FOURTEENTH ANNUAL REPORT

OF THE

# International Association of Dairy and Milk Inspectors

INCLUDING PAPERS READ AT THE ANNUAL CONVENTION IN INDIANAPOLIS, INDIANA OCTOBER 12, 13 AND 14, 1925

*"Men are never so likely to settle a question rightly as when they discuss it freely."*

COMPILED BY
IVAN C. WELD, Secretary-Treasurer
PENNSYLVANIA AVENUE AT 26th STREET
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*Price Two Dollars*

# International Association of Dairy and Milk Inspectors

## CONSTITUTION AND BY-LAWS

## CONSTITUTION

ADOPTED OCTOBER 16, 1911

### NAME

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

### OBJECT

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

### MEMBERSHIP

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

## OFFICERS

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

## AMENDMENTS

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

# BY-LAWS

**ADOPTED OCTOBER 25, 1913**

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ORGANIZATION

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

## ARTICLE 1

MEMBERSHIP

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

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

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

### HONORARY MEMBERS[1]

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

## ARTICLE 2

### OFFICERS

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

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

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

## ARTICLE 3

### DUTIES OF OFFICERS

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

[1]Adopted October 29, 1915.

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

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

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

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

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

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

## ARTICLE 4

### MEETINGS

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

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

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

## ARTICLE 5

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

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Cooley, Dr. R. S...Associate Health Officer in charge Food and Sanitary Inspection .....City Hall, Lakewood, O.
Corlis, Dr. W. S....Veterinary, Meat and Milk Inspector .....Mt. Vernon, N. Y.
Cornehl, Dr. Hugo..Dairy Inspector and Supervisor, Board of Health....Detroit, Mich.
Crisler, Dr. L. H...Milk Inspector .....1346 Scott St., Covington, Ky.

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* Deceased

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| Daley, John P. | Milk Inspector | Beverly, Mass. |
| Daniels, H. O. | | Millbrook Farm, Middletown, Conn. |
| Dinneen, Maurice | Inspector of Milk | Town Hall, Winchester, Mass. |
| Dodson, Fred S. | | Worcester, Mass. |
| Dorian, Dr. Frank P. | Veterinary Inspector, Bureau of Health | Yonkers, N. Y. |
| Dotterrer, W. D. | Bowman Dairy Co. | 140-158 W. Ontario St., Chicago, Ill. |
| Douglas, D. K. | Milk and Dairy Inspector, Department of Health | City Hall, Regina, Saskatchewan, Canada |
| Dugan, Sarah Vance. | Director, Bureau of Foods, Drugs, and Hotels, State Board of Health | Louisville, Ky. |
| Dyer, R. E. | Chief, Dairy Inspection Division, Health Dept. | Boston, Mass. |
| Eddy, Dr. C. W. | Telling-Belle Vernon Co. | Cleveland, O. |
| Estes, Howard R. | Dairy and Food Inspector, Health Department | Flint, Mich. |
| Evans, Dr. Fred. | | Sioux Falls, S. D. |
| Evenson, Oscar L. | Asst. Chemist, U. S. Bureau of Chemistry | Washington, D. C. |
| Fee, Kenneth F. | Director, Bureau of Dairy Products, Department of Farms and Markets | Albany, N. Y. |
| Flanagan, Geo. A. | Food and Milk Inspector | City Hall, Lynn, Mass. |
| Flanagan, Thos. F. | Food and Milk Inspector | 9 Oak Street, Hartford, Conn. |
| Foster, James C. | Dairy Inspector, Colorado State Dairy Commission | Ft. Collins, Colo. |
| Frank, Leslie C. | Sanitary Engineer, Associate in charge, Milk Investigations, U. S. Public Health Service | 519 Dexter Ave., Montgomery, Ala. |
| Frey, Dr. J. J. | Superintendent of Dairy Service, Dept. of Agriculture, State of California | Route 4, Box 954, Sacramento, Cal. |
| Frisbie, W. S. | Chemist in charge of Cooperation, Bureau of Chemistry. | U. S. Department of Agriculture, Washington, D. C. |
| Gamble, Prof. James A. | Western Maryland Dairy | Linden Ave. and Dolphin St., Baltimore, Md. |
| Gauhn, Emmett R. | Supervisor of Food and Sanitation, Health Bureau | Rochester, N. Y. |

Gibbons, John F....Farm Inspector, Dept. of Health .....Room 10, City Hall, New Haven, Conn.

Grapp, Dr. G. H....State Dairy Inspector.....816 Fidelity Building, Baltimore, Md.

Grim, Dr. Geo. W...Milk Control Officer, Board of Health, Lower Merion, Haverford, and Narberth, Pa. .....Ardmore, Pa.

Gruber, Dr. J. T....Milk and Dairy Inspector...Marion, O.

Haines, Ralph A....Dairy Inspector, State Dairy Commission .....1007 Albany Ave., Hartford, Conn.

Hamilton, Jesse H..Dairy Inspector .....Box 424, Sanford, Fla.

Hand, R. R.....Milk Inspector .....Board of Health, Wichita, Kan.

Harding, Dr. H. A..Chief, Dairy Research Division, F. C. Mathews Co....P. O. Box 834, Detroit, Mich.

Hartnett, Daniel P..Inspector of Milk.....City Hall Annex, Holyoke, Mass.

Hay, Dr. E. F.....Health Physician .....5 Illinois St., Chicago Heights, Illinois

Heald, James H....Director of Food Inspection, City Health Department...Winston-Salem, N. C.

Hiscock, Prof. Ira V. Asst. Professor of Public Health, Yale University, School of Medicine..... New Haven, Conn.

Holford, Dr. F. D...Chief Veterinarian, Borden's Farm Products Co.....110 Hudson St., New York City

Hollingworth, Dr. W. G. .....City Veterinarian .....Utica, N. Y.

Hollingsworth, Dr. J. B. .....Chief Food Inspector.....City Hall, Ottawa, Canada

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

Hosteller, C. R.....Milk Inspector of Palmerton and Lehighton .....Palmerton, Pa.

Huffman, R. P.....Food and Dairy Inspector...Wilmington, N. C.

Hulquist, J. A.....Dairy Inspector and Sanitary Inspector .....Jamestown, N. Y.

Irvine, George.....City Milk Inspector.....Ann Arbor, Mich.

Irwin, Ralph E.....Asst. Engineer, State Dept. of Health .....Harrisburg, Pa.

James, J. C.....Director of Laboratory and Food Inspector, Durham County Board of Health...Durham, N. C.

Jennings, J. R.....State Dairy Commissioner...State House, Phoenix, Ariz.

Johnson, E. B.....Executive Officer, Board of Health .....Framingham, Mass.

Jordan, Geo. W....Inspector of Dairies, Health Department .....Detroit, Mich.

Jordan, Prof. James O.....Inspector of Milk.....Room 1104, City Hall Annex, Boston, Mass.

Kelly, Ernest.....Market Milk Specialist, Bureau of Dairying, U. S. Dept. of Agriculture.....Washington, D. C.

Kilbourne, Chas. H..Food and Sanitary Specialist .....1476 Broadway, New York City

Knobel, Dr. Ed.....Inspector of Milk .....Dedham, Mass.

Krause, Dr. C. A...Dairy Inspector .....Portsmouth, Va.

Krehl, E. C.....Detroit Creamery Co.....Detroit, Mich.

Lawrence, Robt. P..Dairy Inspector, Department of Health .....Municipal Building, Montclair, N. J.

Ledbetter, D.....Milk and Dairy Inspector for Biltmore Dairy Farm.....Biltmore, N. C.

Leman, Dr. H.....Agriculture, Dairy and Milk Chemist and Bacteriologist .....Blumenau, Est. S. Catharina, Brazil

Leslie, Dr. Roy F...Chief of Bureau of Food and Dairy Inspection .....127 City Hall, Cleveland, O.

Le Fevre, Peter E...Asst. Market Milk Specialist, Bureau of Dairying, U. S. Dept. of Agriculture .....Washington, D. C.

Lewis, Malcolm.....Asst. Engineer, in charge Milk Sanitation, State Board of Health.....Raleigh, N. C.

Lockwood, Dr. Ralph F.....Health Officer and Milk Inspector .....Lakewood, R. I.

Lockwood, Prof. W. P. B.,.....Managing Director, New England Dairy and Food Council, Inc.....51 Cornhill, Boston, Mass.

Lombard, Alfred W. State Department of Agriculture ..... .....136 State House, Boston, Mass.

Loomis, Frank J....Inspector of Milk and Meat..Watertown, N. Y.

Lyons, Samuel.....Milk Inspector, Board of Health .....Detroit, Mich.

MacBride, C. S.....Milk Specialist, Detroit Creamery Co. ..... .....Detroit, Mich.

McInerney, Prof. T. J. — Milk Inspector and Asst. Professor, Dairy Industry — Dept. of Dairy Industry, Cornell University, Ithaca, N. Y.

Maguire, G. E. — Director, Division of Dairy and Food Inspection — Health Department, Akron, O.

Marcussen, W. H. — Director of Laboratory, Borden's Farm Products Co. — 63 Vesey St., New York City

Marquardt, O. R. — Milk Inspector, Board of Health — Detroit, Mich.

Maughan, M. O. — Secretary, National Dairy Council — 910 S. Michigan Ave., Chicago, Ill.

Melican, Geo. D. — Milk Inspector — Room 6, City Hall, Worcester, Mass.

Menary, Dr. A. R. — City Dairy Inspector — Cedar Rapids, Iowa

Miller, John F. — Inspector of Milk Pasteurizing Plants, State Dept. of Health — Albany, N. Y.

Moe, Norman E. — Dairy and Food Inspector, Natrona County Health Department — Casper, Wyo.

Moellenhoff, F. H. — Asst. City Chemist — Room 9, Municipal Courts Building, St. Louis, Mo.

Moore, Edith L. — Bacteriologist and Chemist — City Hall, Houston, Texas

Murray, R. A. — Chief Milk Inspector — Highland Park, Mich.

Myll, Clifton O. — Milk Inspector — Detroit, Mich.

Oakley, Roger W. — Collector of Milk and Dairy Inspector — City Hall, Brockton, Mass.

Ocker, Harry A. — Meat and Dairy Inspector, Dept. of Health — Cleveland, O.

O'Dea, John F. — City Milk Inspector — Room 10, City Hall, New Haven, Conn.

Osgood, Clayton P. — Asst. State Dairy Inspector — Augusta, Maine

Palmer, Wm. B. — Exe utive Officer, Milk Inspection Association of the Oranges, N. J. — City Hall, Orange, N. J.

Parker, Horatio N. — City Bacteriologist, Health Department — Jacksonville, Fla.

Pearce, Dr. C. D. — Chief Veterinarian, The Borden Company — 350 Madison Ave., New York, N. Y.

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| Pease, Dr. Herbert D. | Director of Pease Laboratories | 39 W. 36th St., New York City |
| Pelton, L. C. | | Seattle, Wash |
| Pilgrim, Dr. S. L. | Chief, Division of Food | Milwaukee, Wis. |
| Plimpton, Geo. E. | Chemist | 534 Boston Ave., West Somerville, Mass. |
| Posson, R. J. | Market Milk Specialist, U. S. Dept. of Agriculture | Washington, D. C. |
| Price, Dr. Wm. H. | Detroit Creamery Co. | Detroit, Mich. |
| Pyper, Dr. S. T. | Chief, Bureau of Food Inspection | Health Department, Dayton, O. |
| Quigley, J. V. | Dairy Adviser, Kansas City Consumers' League | 408 E. 11th St., Kansas City, Mo. |
| Rath, Dr. Floyd C. | Asst. Health Officer, Dairy and Food Inspector | Madison, Wis. |
| Rice, Dr. John L. | Health Officer | City Hall, New Haven, Conn. |
| Richmond, Dr. A. R. B. | Chief of Division of Food Control, Dept. of Public Health | 137 Howland Ave., Toronto, Canada |
| Roadhouse, Prof. C. L. | Professor of Dairy Industry, University of California | University Farm, Davis, Cal. |
| Robinson, Herbert S. | Dairy Inspector, Health Department | Boston, Mass. |
| Rosinek, Ign. Frantisek | In Charge of Bureau for Reorganization and Reconstruction of Sanitary Control of Milk and Milk Products, Ministry of Health | Prague, Vyschrad, Vrahslavova S., Czechoslovakia |
| Rothenberger, Dr. Geo. L. | | Esterly, Pa. |
| Russell, Alfred M. | Agent, Board of Health, and Inspector of Provisions | P. O. Box 56, West Newton, Mass. |
| Schletty, Peter | Dairy and Milk Inspector, State Dairy and Food Department | 461 Ohio St., St. Paul, Minn. |
| Schmeing, J. B. | Sanitary Inspector of Dairies | Covington, Ky. |
| Seaman, Carl O. | Milk Inspector | 14 South St., Manchester, N. H. |

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| Sheffield, M. H. | Chief Milk, Meat, and Food Inspector | Grand Rapids, Mich. |
| Shoults, Dr. W. A. | Director of Food Division, Provincial Board of Health | Winnipeg, Manitoba, Canada |
| Shrader, Dr. J. H. | Director, Bureau of Chemistry and Food, City Health Department | 311 Courtland Street, Baltimore, Md. |
| Shull, Dr. Hubert | Food and Dairy Inspector | 414 W. Third St., Texarkana, Ark. |
| Smisek, M. J. | Milk and Dairy Inspector | St. Paul, Minn. |
| Smith, Dr. C. E. | Commissioner of Health | Dept. of Public Health, Greenville, S. C. |
| Smith, D. R. | Manager, Cloverland Dairy | 1301 High St., Portsmouth, Va. |
| Smith, Edwin J. | Chief Milk Inspector | Detroit, Mich. |
| Smith, Dr. Geo. | Chief Food and Drug Inspector | Division of Health, Toledo, Ohio |
| Smith, Russell S. | Market Milk Specialist, Bureau of Dairying, U. S. Dept. of Agriculture | Washington, D. C. |
| Stahl, C. L. | Dairy Director, Virginia State Dairy and Food Division | Richmond, Va. |
| States, M. V. | Milk Inspector, Dept. of Health | Detroit, Mich. |
| Stevenson, A. F. | | 95 E. Ridgewood Ave., Ridgewood, N. J. |
| Steirett, Dr. C. S. | Inspector of Milk and Provisions | New Bedford, Mass. |
| Strauch, Thomas J. | Chief Dairy Inspector, Bureau of Health | Richmond, Va. |
| Strickland, Franklin N. | Executive Secretary-Chemist, Board of Food and Drug Commissioners | Providence, R. I. |
| Stricklen, Owen E. | Dairy Inspector, City Health Department | Ann Arbor, Mich. |
| Supplee, Dr. G. C. | Director of Research Laboratory, The Dry Milk Co. | Bainbridge, N. Y. |
| Taylor, Geo. B. | Bacteriologist, Chestnut Farms Dairy | Washington, D. C. |
| Terrill, R. M. | Milk Inspector, City of Detroit | Northville, Mich. |
| Tolland, Alexander R. | Dairy Inspector, Health Department | Room 1102, City Hall Annex, Boston, Mass. |

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| Trotter, Dr. A. M. | Chief Veterinary Inspector, Corporation of Glasgow | 60 Hill St. (East), Glasgow, Scotland |
| Vener, Benj. | | 336 Green Ave., Brooklyn, N. Y. |
| Wallis, Wm. H. | Dairy Inspector | City Hall, Somerville, Mass. |
| Walmsley, Dr. F. D. | Borden's Farm Products Company of Illinois | 326 W. Madison Street, Chicago, Ill. |
| Ward, Dr. A. R. | Asst. Chief, Dairy Research Division, F. C. Mathews Co. | Detroit, Mich. |
| Ward, Willard E. | Agent, Board of Health, for Milk and Food Inspection | 14 Town Hall, Brookline, Mass. |
| Warner, W. J. | State Milk Inspector | Route 2, Andover, Conn. |
| Washburn, Prof. R. M. | Director of Laboratories, International Dry Milk Co. | 503 Wilmac Building, Minneapolis, Minn. |
| Way, H. O. | Director, The Agricultural Laboratory | 508 Blackstone Building Cleveland, O. |
| Weed, Ralph E. | Chief Milk Inspector | City Hall, Troy, N. Y. |
| Weld, Ivan C. | Investigator for Chestnut Farms Dairy | Washington, D. C. |
| White, G. T. | Milk Inspector | 1130 Seward Ave., Detroit, Mich. |
| White, W. W. | Assistant, Division of Milk Control, State Dept. of Health | Harrisburg, Pa. |
| Widmayer, Fred J. | Food and Milk Inspector | Scranton, Pa. |
| Wilson, Frank C. | In charge, Milk Laboratory, Food and Drug Department, State Board of Health | 152 State House, Indianapolis, Ind. |
| Wing, Dr. Chas. C. | City Veterinarian and Asst. Health Officer | Room 613, City Hall, Oakland, Cal. |
| Winkler, Dr. J. S. | City Veterinarian and Dairy Inspector | Newport, Ky. |
| Yates, J. W. | General Laboratories | 124 S. Dickenson St., Madison, Wis. |
| Young, Dr. Hulbert. | Manager Walker - Gordon Laboratory | Linden Ave. and Dolphin St., Baltimore, Md. |

# HONORARY MEMBERS

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|---|---|---|
| Evans, Dr. Wm. A. | Health Editor, *Chicago Tribune* | Chicago, Ill. |
| Pearson, Dr. Raymond A. | President, Iowa State College | Ames, Iowa |
| Van Norman, Prof. H. E. | President, American Dry Milk Institute | 160 N. La Salle St., Chicago, Ill. |
| Woodward, Dr. Wm. C. | American Medical Association, Bureau of Legal Medicine and Legislation | 535 N. Dearborn St., Chicago, Ill. |

# Fourteenth Annual Convention

SPINK ARMS HOTEL

INDIANAPOLIS, INDIANA

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WEDNESDAY, OCTOBER 12, 1925

FIRST SESSION

The Fourteenth Annual Convention of the International Association of Dairy and Milk Inspectors was called to order by President T. J. Strauch at 10:15 A.M.

Dr. Wm. F. King, secretary of the Indiana State Board of Health, welcomed the Association to Indianapolis and to Indiana. Dr. G. C. Supplee, First Vice-President, speaking for the Association, expressed its appreciation of the cordial welcome extended by Dr. King.

President Strauch delivered the presidential address, and was followed by Dr. F. D. Holford, of New York City, who read a paper on the subject, "Health Ordinances Pertaining to Milk."

In the absence of Dr. John L. Rice, chairman, the report of the Committee on Communicable Diseases Affecting Man—Their Relation to the Milk Supply and to the Public Health was read by Mr. John F. O'Dea, milk inspector of New Haven.

SECOND SESSION

"A Study of Commercial Pasteurizers in Boston" was the subject of a paper prepared by Mr. Alexander R. Tolland, supervisor of pasteurization of the Health Department, Boston. In Mr. Tolland's absence his paper was read by Mr. C. H. Chilson.

Dr. Wm. H. Price, chairman, reported for the Committee on Pasteurization of Milk and Cream.

A paper on the subject, "Sanitary Efficiency in Country Milk Receiving Stations," by Mr. Russell S. Smith, Market Milk Specialist, Bureau of Dairying, U. S. Department of Agriculture, was read by Mr. Howard R. Estes, of Flint, Mich.

Dr. C. W. Larson, Chief, Bureau of Dairying, U. S. Department of Agriculture, delivered an address on the growth and development of the dairy industry.

### THIRD SESSION

The third session of the convention was called to order by President Strauch at 8 o'clock. Dr. C. D. Pearce, of New York City, chairman, reported for the Committee on Bovine Diseases—Their Relation to the Milk Supply and to the Public Health.

Dr. H. E. Van Norman, of Chicago, delivered an address on the subject, "An Infant in the Dairy Industry."

"The Progress of Tuberculosis Eradication Work" was the subject of a paper by Dr. J. A. Kiernan, Chief of the Tuberculosis Eradication Division, Bureau of Animal Industry, U. S. Department of Agriculture, Washington. This was followed by Mr. M. O. Maughan, secretary of the National Dairy Council, who told of the activities and accomplishments of that Council.

### TUESDAY, OCTOBER 13

The fourth session was called to order by First Vice-President G. C. Supplee, who presided during the session.

In the absence of Mr. Russell S. Smith, chairman, the report of the Committee on Transportation of Milk and Milk Products was read by Edith Moore, of Texas.

Prof. C. L. Roadhouse, of California, read a paper on the subject, "Economic Laboratory Control of Milk Quality by Milk Distributors."

Mr. Ralph E. Irwin, Assistant Engineer, Pennsylvania State Department of Health, chairman, reported for the Committee on Sanitary Control of Ice Cream.

Prof. A. D. Burke, of the Oklahoma Agricultural College, read a paper on the subject, "Veterinarian or Dairyman, Which?"

### FIFTH SESSION

The fifth session of the convention was called to order by President Strauch at 2 o'clock. In the absence of Dr. J. H. Shrader, of Baltimore, chairman of the Committee on Remade Milk, the report of that committee was read by Prof. I. V. Hiscock.

A paper on the subject, "A Detail in the Mojonnier Testing of Ice Cream," was presented by Mr. C. S. MacBride, of Detroit.

Mr. H. O. Way, of Cleveland, O., read a paper entitled, "Some Heat-Resisting Streptococci Found in Market Milk."

A paper on the subject of a proposed control basis for cream supplies, contributed by Dr. J. H. Shrader, of Baltimore, was read by Professor Hiscock.

### SIXTH SESSION

The sixth session of the convention was called to order Tuesday evening at 8 o'clock, President Strauch presiding.

Prof. W. P. B. Lockwood addressed the Association on the subject of serving milk in schools.

Mr. Wm. B. Palmer, executive officer of the Milk Inspection Association of the Oranges, Orange, N. J., read a paper entitled, "The Health Department and the Milk Dealer."

Dr. Wm. H. Price, sanitarian of the Detroit Creamery Company, Detroit, Mich., addressed the Association on the subject, "*B. acidophilus*—Its Therapy and Regulation

from the Point of View of the Food Control Official."

Prof. I. V. Hiscock, Yale University, chairman, presented the report of the Committee on Food Value of Milk and Milk Products.

## Wednesday, October 14

### SEVENTH SESSION

The seventh session of the convention was called to order Wednesday morning by President Strauch. In the absence of Mr. Geo. E. Bolling, chairman, the report of the Committee on Methods of Bacterial Analysis of Milk and Milk Products was presented by Dr. Price.

Prof. W. A. Stocking, of Cornell University, gave an illustrated talk on methods of delivering milk in some European cities.

Mr. Sam H. Greene, secretary-manager of the California Dairy Council, San Francisco, read a paper on "A Welfare and Publicity Department of the Dairy Industry."

Mr. Ernest Kelly, of the Bureau of Dairying, U. S. Department of Agriculture, addressed the convention on the subject, "The Use of Pasteurized Milk in Cities of the United States."

Mr. C. H. Chilson, Director of Dairy and Food Inspection, Board of Health, Detroit, read a paper, "The Methylene Blue Test as an Adjunct to Milk Inspection—Second Year's Report."

### EIGHTH SESSION

The afternoon session was called to order by Vice-President Chilson at 2 o'clock.

Edith Moore, of Houston, Texas, chairman, reported for the Committee on Securing a Satisfactory Supply of Raw Milk for Pasteurization.

Mr. C. S. MacBride, chairman, reported for the Committee on Milk Plants.

Dr. W. A. Shoults, Director of Food Division, Provincial Board of Health, Winnipeg, Manitoba, read a paper on "Certified Milk."

Dr. H. A. Harding, of Detroit, addressed the Association on the subject, "Some Phases of the Methylene Blue Question," and gave a demonstration of the method of testing.

The business session of the Association was called to order by President Strauch on Wednesday afternoon at 4 o'clock.

The auditors reported the accounts of the Secretary-Treasurer had been examined and found correct. The report of the auditors was accepted.

Mr. Ernest Kelly reported for the Committee on Resolutions, and the following resolutions were adopted:

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

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

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

*Resolved,* That when appointed, this committee, possibly in conference with similar committees representing other associations interested in the problem, give special

consideration to the desirability of formulating minimum requirements, or uniform regulations for the production, handling, and distribution of market milk, and present a progress report at the next meeting of this Association.

2. *Resolved,* That the thanks of the Association be extended to the Indiana State Board of Health for its interest in the activities of the Association, as evidenced by the presence of Dr. William F. King and his words of welcome to our members; and be it further

*Resolved,* That the thanks of the Association be extended to Dr. C. W. Larson, Chief, Bureau of Dairying, U. S. Department of Agriculture; Dr. J. A. Kiernan, Chief, Tuberculosis Eradication Division, Bureau of Animal Industry, U. S. Department of Agriculture; Prof. W. A. Stocking, Cornell University; and Mr. Sam H. Greene, secretary-manager of the California Dairy Council, who, not being members of our Association, have given their time to assist us by taking part in our meetings; and be it further

*Resolved,* That the thanks of the Association be expressed to the Convention Bureau of the Indianapolis Chamber of Commerce for its kindness in making provision for the comfort of our members.

3. *Resolved,* That this Association favors the establishment of district and State dairy inspectors' associations; the creation of courses of dairy inspection at our agricultural colleges; and the employment by control authorities of properly trained dairy inspectors; and be it further

*Resolved,* That a committee be appointed in the usual manner to canvass existing conditions along these lines and to report to the Association the results of their findings, together with suggestions for improvements.

4. WHEREAS, Providence has seen fit to remove from our midst Prof. L. H. Cooledge; and

WHEREAS, Our friend and coworker had always been

an earnest and interested friend of our Association; be it

*Resolved,* That we hereby express our sincere sorrow because of his loss to our Association and to the dairy industry; and be it further

*Resolved,* That the Secretary-Treasurer of the Association be instructed to send a copy of this resolution to the members of the family and to the Michigan Agricultural College, and further that it be spread upon the records.

5. WHEREAS, Our Secretary-Treasurer for the past year has so willingly and efficiently served the Association; be it

*Resolved,* That this Association extend to him, by a rising vote, its deep appreciation of his labor and success.

Mr. C. H. Chilson, chairman of the Special Membership Committee, made a brief report. The Association then proceeded to the election of officers, with results as follows:

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

First Vice-President, C. H. Chilson, Detroit, Mich.

Second Vice-President, Dr. W. A. Shoults, Winnipeg, Manitoba.

Third Vice-President, Prof. Ira V. Hiscock, New Haven, Conn.

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

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

The newly elected officers were introduced by President Strauch, and each addressed the Association briefly.

## NINTH SESSION

The ninth session of the convention was called to order by President Strauch Wednesday evening at 8 o'clock. "Cooperative Milk Inspection in the Improvement of Milk and Other Dairy Products" was the subject of a paper read by Dr. Roy F. Leslie, of Cleveland, O.

Dr. C. A. Krause, of Portsmouth, Va., had as the subject of his paper, "Field Notes." Mr. J. V. Quigley, Dairy Adviser, Kansas City Consumers' League, Kansas City, presented a paper on "The Essential Element of Milk Improvement Work."

Dr. F. C. Rath, Dairy and Food Inspector, Madison, Wis., read a paper, "A Municipal Milk Supply from Tuberculin-Tested Cows."

## ADDRESS OF WELCOME

DR. WM. F. KING, *Secretary,*
Indiana State Board of Health, Indianapolis, Ind.

It is a very great pleasure, I assure you, to welcome you to Indiana and to Indianapolis for the fourteenth annual convention of your Association. Not being the mayor of the city, I cannot offer you any city keys, nor can I promise you protection in case you should run past a stop signal or attempt to indulge in overtime parking. I can assure you, however, that we Hoosiers are glad to have you with us and glad to extend to you our Hoosier hospitality, than which there is none more friendly nor sincere.

Indianapolis is proud at this time to be host to the National Dairy Exposition, that wonderful ten-million-dollar show, built up around and glorifying the American cow. A few weeks ago, Indianapolis was host to a ten-billion-dollar show when some twelve hundred Indiana babies were brought together in a state-wide baby contest to be examined and judged by experts in order to determine the highest-scoring babies physically in the different classes. This state-wide baby contest has become part of the Indiana State Fair and a vital factor in the education of mothers and of our citizenship generally in the importance of baby care and protection. The people of Indiana are vitally interested in babies, and the people of Indiana are tremendously interested in cows, dairies, and milk, because the future of the State is all wrapped up in its babies, and the strength of its babies is all wrapped up in the purity and wholesomeness of its milk supply. We are deeply interested in you and in your work, because in your official responsibility you

constitute the first line of defense in the protection of our babies and children and consequently the first line of defense in safeguarding the future of the State. In the final analysis the State will be known, not for its clanging furnaces nor for its broad and productive acres, nor even for the magnificent chaos of its cities, but for the health and strength and beauty of its children.

Health has been defined as "the highest degree of efficiency prolonged over the greatest period of time." In other words, health is the quality of life that renders the individual fit to live most and serve best. Your Association is a health organization because you have to do with the safety of a vital food for which there is no substitute. You are the connecting link between the ten-million-dollar cow and the ten-billion-dollar baby. You are a partner in every health department and a coworker with every child welfare agency. As such, we give you "Hail and Welcome," with the earnest hope that your stay in Indianapolis will be pleasant and your meeting together be helpful and inspiring.

Over the entrance doorway to one of the old castles in England there is an inscription which breathes the very spirit of Hoosier friendship and good will. It is this little couplet:

*"This is the message I have to tell:*
*Ye are well come; ye are come well."*

## RESPONSE TO ADDRESS OF WELCOME

DR. G. C. SUPPLEE, *First Vice-President,*

Bainbridge, N. Y.

It is a pleasure for me to accept in behalf of the Association the cordial hospitality of Indiana and Indianapolis as extended by Dr. King. I am sure the words of welcome express the true conviction of the speaker, whose daily activities have an objective much the same as ours. It is a curious fact that those who have common aims for the betterment of human welfare instinctively express sentiments of common accord. Perhaps the reason would not be difficult to find if we examined the motivating force which prompts the voluntary coming together of this Association.

The International Association of Dairy and Milk Inspectors is a voluntary organization which exists for the purpose of promoting those measures and policies which shall insure to the population of our cities and to our children a safe and wholesome milk supply. I believe that its achievements as an organization and the part played by its individual members have been a real force in protecting the public health and in fostering supervisory policies which are acceptable to the industry and which are effective in purpose.

The arbitrary fiat of the milk inspector is a method of other days. Cooperation between producers, dealers, and inspectors is more in evidence now than in the past, and the results are bound to be more satisfactory and more enduring than those gained by punitive means. Mutual appreciation of the intricate problems of the dairy industry has done much to eliminate misunderstanding. Simplification of regulations and supervisory methods can fur-

ther enhance the effectiveness of control efforts, but in order that there may be no retrogressive trend as a result of hasty decision or ill-advised policies, due reliance must be placed upon the methods of the patient investigator; conservative judgment accruing from varied experiences must be exercised and close observation of the working mechanism of the vast dairy industry must be made. It is believed that all these elements have contributed and will continue to contribute to simplification and direct action in matters pertaining to supervision of the milk supply. Already we have adequate illustration of the progress which has been made. The general adoption of pasteurization, simplification of bacteriological procedures, tuberculosis eradication activities, and other instances might be cited as examples of simple, direct, and efficient methods of assuring a wholesome milk supply.

In this Association we are fortunate in having among its members representatives of the various groups who are intimately concerned with different phases of the dairy industry. The exchange of experiences and opinions cannot but help to unify and stabilize the regulatory policies pertaining to this industry with which we are concerned.

*"The greater a man's knowledge of what has been done, the greater his power of knowing what to do."*

# PRESIDENTIAL ADDRESS

T. J. STRAUCH, Richmond, Va.

Another year of peace and prosperity, of progress and good, constructive work has rolled around, and we are gathered to transact the business of our fourteenth annual convention. I cannot tell you how very happy it makes me to stand on this platform and look into the faces of old friends, seen year after year at these wonderfully instructive meetings, and to meet the eyes of new friends whose friendships will surely ripen into the full and perfect things which the old ones have grown to be. But, after all, I need not tell you because each of you has also experienced that exhilarating, satisfying feeling of meeting old friends again and making new ones at these annual conventions.

May I point, with the pardonable pride which each of us feels in the tremendous accomplishments of so young an organization, to the progressive history of this Association? May I remind you, before I urge your cooperation in plans which shall make the future as filled with useful, constructive deeds as the past, of the very great achievements which have come, in fourteen years, from an organization starting with a mere handful of men?

The history of the International Association of Dairy and Milk Inspectors, from year to year, has been one of definite and steady progress. Past presidents have stressed, in their annual messages, the wonderful growth of the Association, both in the number of members, in the breadth and quality of the programs of work undertaken and successfully carried through, and in the pleasing attitude of the public mind, which has come to consider the Association a necessary link in the vital work of sanitation and public health. All of these things your

past presidents have told you in their annual messages, each president so adding a chapter of worth-while undertakings to the big book of scientific expansion which the International Association of Dairy and Milk Inspectors is writing in the life of the American people.

And, in this summing up of the achievements of the Association, as a whole, it has been the privilege of your presidents to point with enthusiastic pride to the individual accomplishments of some of the members of the Association. Numbered among our members are the authors of books dealing with the subject of milk in its many phases, and the important question of safeguarding the public health by applying rigid inspection and scientific methods to one of the chief food supplies. Other members, recognized as leaders in their various lines, have written valuable papers on the phases of the milk question with which they are most familiar, and have been honored by being asked to read their profound and lucid thoughts upon those subjects before prominent organizations.

I think we all know how greatly the success of this Association has depended on the foresight, energy, enthusiasm, and good, hard, honest work of the former officers. We know how they and the chairmen and members of various committees have given unsparingly of their time and thought for the success of this Association. Our secretary, who has held that position since the Association was organized, devotes a great deal of his time to the work of the organization. His one task of compiling the annual report is a stupendous thing, and yet he receives no compensation for this. It is entirely a labor of love.

I am not going to enumerate the achievements of the Association in the past year, and the splendid work which the various officers and committee chairmen have done. You will see and hear all those things through the reports

of your other officers and the standing committees, for no matter how modest they may be, it is impossible to hide completely their hard work and successful efforts in the interest of this Association. I am not even going to take your time to speak, at any great length, of the splendid cooperation which I have received this year from individual members as well as those entrusted with the administration of our Association, other than to say that without this enthusiastic interest and willing cooperation it would have been impossible to write in the annals of the Association the accomplishments of the past year.

I am going to take your time, however, to strike a note which I sincerely hope every member will adopt as his attitude toward this Association. I am speaking now of loyalty.

We should realize that all the great things of this world have been accomplished through the loyalty of men and women. Without loyalty we would have no permanence, no great United States, no safe and comfortable homes, no civilization. Our success in business depends, to a large extent, on the loyalty of those who work under us, and the success of the men higher up depends, too, on our loyalty. If we consider the question of loyalty for any length of time, we begin to realize how definitely, how conclusively the progress of the world depends on the loyalty of men and women to the right things.

It is not possible for an association of this sort to grow and prosper—nay, even to exist—without the loyalty of its members. It is hardly fair to apply the old saying, "A chain is never stronger than its weakest link," to this Association, because all of us know that the Association can still go forward and do great things if it has not the loyalty and support of one, or two, or even three members; for the loyalty and devoted service of those other hundreds of members must mean something. However, we all know, too, that no association can ever reach its fullest

growth and prosperity until it has the loyalty of every single one of its members.

But let us consider this question of loyalty to the Association and to our work from a purely selfish standpoint. The days of the old giants in stature have passed. Today we do not have men who, by their physical strength alone, can move mountains. But we do have, instead, great combinations of men who, by their united efforts and through their united brains, can do more than move mountains; they can prevent loss of life, improve living conditions, give pure food to the people, and so build up a healthier, saner, happier population. Isn't it something of a privilege and an honor to be a part of this great giant, and to have a part in such tremendous undertakings and achievements?

Every member should feel it his privilege and duty to do everything possible to help build up our organization, and so continue its shining achievements. That, of course, includes more active work as individuals and as chairman or members of committees, as well as such seemingly little things as paying dues promptly, thereby making it unnecessary for the secretary to spend his time and the Association's money writing three or four letters for our year's dues. This Association can grow and prosper without the support of any one individual; but there is no one individual in this line of work who cannot grow, increase his knowledge, widen his acquaintance, and add to his reputation for usefulness by being an interested, active, and loyal member of the International Association of Dairy and Milk Inspectors.

*"The public health movement may be broadly defined as a social effort to prevent disease, to lengthen the life and usefulness of every member of society, and to afford opportunities for a normal physical and mental development of society."*

# HEALTH ORDINANCES PERTAINING TO MILK

## Their Lack of Uniformity and the Problems of the Milk Dealers in Complying with Different Regulations

DR. F. D. HOLFORD, *Chief Veterinarian,*
Borden's Farm Products Company, Inc.,
New York City

The classification of food products in definite grades is today considered of vital importance in improving marketing conditions. Products properly graded can be more economically marketed and the consumer can choose the desired food with greater certainty of getting what he wants. It would seem to be important that all market milk should be sold according to generally accepted standard grades.

Many municipalities supervise their milk supply and provide grades under which it may be sold by ordinance and in making a survey of ordinances one finds great variation in requirements. The nearest approach to a uniform standard grade is found for certified milk, and this is due to the fact that most municipalities accept the rules and regulations of the American Association of Medical Milk Commissions.

It is very difficult for a producer or dealer to dispense his product in more than one municipality when other municipalities served by him have regulations not only different but in many cases in direct conflict. It is certain that prevention of fraud and sanitary control of milk supplies are logical responsibilities of health authorities. It is equally certain that in attempting such control, health authorities should employ such methods as will prevent fraud, promote cleanliness in production and handling, and at the same time run parallel with and not interrupt

normal practices of production and distribution, to the end that such supplies may be maintained.

In many of the smaller municipalities, little attention is paid to the milk supply. Frequently there is no milk ordinance, and the grades of milk sold are determined entirely by those engaged in producing and distributing the milk. With uniform milk regulations a system of control could be developed whereby each municipality would secure the same quality of product. A trial of this on a small scale is being undertaken at the present time by the Dairy Inspection Association of the Oranges in the State of New Jersey. There are several municipalities in this locality that have adopted the same rules and regulations for the production of their milk supply, and each of these municipalities has a representative in the Milk Inspection Association, of which Mr. Wm. B. Palmer, a member of this Association, is executive officer. Each of these municipalities pays its share toward the maintenance of the Milk Inspection Association and its activities. Uniformity in requirements is likely to result in uniformity in the product, and any consumer in these municipalities may obtain the quality desired.

Many municipalities do not have sufficient finances to allow them to properly inspect and control their milk supply, but with uniform requirements it would be convenient for them to accept the work of other muncipalities which could afford an inspection system. Then again, a dairyman or distributor would know that his product would be eligible for sale in any municipality.

The interests of the producer, the distributor, the health officials, and the consumer do not differ. If one loses confidence in the other, all suffer the consequences. The relationship between these is sometimes complicated and strained at times by too many vague requirements, too much evasion, too much law, and too little honest

effort to work together fairly and helpfully in the interest of all.

The principle of cooperation is a well-established one in this day and age, and the fundamentals which govern honest movements of this kind are substantially a step in the right direction. We know the hygienic qualities of milk depend very largely upon the conditions existing at the source of supply, and an inspection at the dairy farm seems to be the most logical means of securing this information. In order to obtain the best results, we should have a uniform dairy score card, and above all, uniformity in the *interpretation* of the same. The health officials can be of great assistance to the dealer in checking dairy conditions, and both should have the confidence of the dairymen. It is true that we have the power to disqualify a dairyman's shipment, and when this is done we do not receive his product, though this dairyman can generally get his premises again in condition to receive our approval; but for each day that we are present at his place, there are many days that we are not there. The average dairyman is trying to produce a good product, and while he is very susceptible to encouragement, he is sometimes more easily discouraged. He has to be educated by patient endeavor, and when properly approached he will usually respond to suggestions.

We must aim to develop a real desire on the part of the dairyman to produce the very best article, and in order to do this we should be able not only to point out to him where he is wrong, but, more important, how to make the wrong right. The human element is present in dairy inspection, and it rests largely with the dairy inspector whether real progress is made, which will be reflected in an everyday effort, or whether improved conditions are gained by special efforts to meet an inspection at certain times. This is a field for real cooperation, because when

all is said and done it rests wholly with the individual dairyman whether we are to achieve success or not.

In certain sections of the country, dairymen are paid a premium according to the bacterial content of the raw milk as it is delivered to the factories. This method gives the dealer a constant check upon the methods employed at the dairy and also keeps the dairyman interested and active to retain this premium. We believe a plan which recognizes and rewards dairymen who are willing to comply with the rigid requirements in the production of a clean product is one of the best known methods to improve a market milk supply. The dairyman receives pay for the quality of product he produces, and the extra expense is passed on the consumer, who is willing to pay for the better quality product.

During the latter part of April of the present year, the Association of Food and Drug Officials of the Central Atlantic States appointed a committee to report on minimum requirements for the production of milk. Dr. H. W. Redfield, of the Bureau of Chemistry, U. S. Department of Agriculture, acted as chairman of the committee, which drew up minimum rules and regulations for the production and distribution of three grades of milk; namely, certified milk and two grades of pasteurized milk. These recommendations were adopted by the Association and its members were urged to get the States and municipalities represented to adopt these requirements.

It must be realized that to secure uniform control, it is first necessary to secure uniformity in administrative procedure, which, in turn, is largely dependent on uniform rules and regulations. I would suggest that in order to secure uniformity or at least make a start towards it, it would be advisable for this Association to appoint a committee to meet with other committees representing other associations interested in this problem, and to formulate minimum requirements for the production, hand-

ling, and distribution of the different grades of market milk. The committee should submit a report at our next meeting. There should be at the general committee meeting representatives of other associations interested in a movement of this kind. If this Association should not care to go so far at the beginning, our committee could formulate rules and regulations and submit them for criticism to such interested associations and authorities.

We all undoubtedly realize there are many health officials who are generally well informed and somewhat more progressive than the average, who have evolved a code of rules and regulations which they consider nearly perfect and of paramount importance for the proper production of safe milk. There is no disposition to question the good intentions or the ability of this type of official, but I feel that all officials should be willing to sacrifice, if need be, for the time being, certain of their special requirements in order to bring all rules and regulations into conformity with the judgment of the majority. I should like to point out in this connection the analogy between uniform administrative procedure and standard analysis. Most of us agree upon standard methods of analysis, both chemically and bacteriologically, and if we were to make any changes in these methods it would soon lead to confusion. I feel that it is just as desirable for administrative officials to adopt a uniform mode of procedure as it is for the official analyst.

## Conclusion

1. Uniform requirements would be more economical.
2. Uniform requirements would encourage smaller municipalities, which have no control at the present time, to adopt such methods.
3. Uniform requirements would create a better understanding between States and municipalities.
4. Uniform requirements would create a better under-

standing between health officials and individual dairymen.

5. Uniform requirements would be of great assistance to producers and dealers in dispensing their product.

6. Uniform requirements would result in a better control and a more uniform and safer product.

In closing, I would like to emphasize again the importance of such a movement, and I sincerely believe that this Association should take immediate steps to start a campaign toward uniformity of requirements for the production and distribution of safe milk.

## DISCUSSION

MR. KELLY: Greater uniformity in sanitary inspection is much to be desired. Chemical standards are now more uniform than previously. We should encourage more uniformity in inspection in the various States.

MR. WM. B. PALMER: I believe fruitful results can be secured in working for uniformity of regulations. The regulations for the production of certified milk come near to uniformity. I am in accord with Dr. Holford's suggestions looking toward uniformity of regulations.

DR. HARDING: I wish to emphasize that in our attempts to secure uniform standards we must consider that different sections of the country have conditions of production that are quite different.

MR. MAGUIRE: Our Northern Ohio Association of Dairy and Milk Inspectors, having 161 members, proposed to work for and if possible secure uniform inspection, not only in northern Ohio but throughout the State.

*"All free governments are managed by the combined wisdom and folly of the people."*

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

DR. JOHN L. RICE, *Chairman*

During the year 1924, there were over fifty billion pounds of milk used for household purposes in the United States. Besides this enough more milk was consumed as milk products to bring the total figure well above the hundred billion mark. A hundred billion pounds of milk is a quantity so large that the figure makes but little impression on the mind, but if one thinks of it in terms of quart bottles of milk, it is easier to comprehend. The milk from a hundred billion pounds would make enough quart bottles to form 1,052 rows, a width of 350 feet, touching each other from Boston to San Francisco, or would make 126 rows around the world at the equator.

If it were possible to calculate the number of individuals who come in contact with a year's production of milk, from the hired men on the farms to the cooks and housewives in the kitchen, it would be found to be a high figure. Milk is capable, not only of acting as a vehicle in transferring disease germs from one person to another, but is a medium in which a few germs introduced may increase to millions. Besides this, it is without doubt possible that certain germ diseases of cows, such as bovine tuberculosis, may be transferred to human beings through milk.

With the ability of milk to broadcast disease, and with potential foci of infection in man and animal linked with milk handling, it is almost beyond belief that there are comparatively so few known or suspected milk-borne

outbreaks. During the year 1924 definite and indefinite outbreaks of milk-borne disease probably concern only a few thousand quarts of milk, perhaps enough to form a row of quart milk bottles one half a mile long. With this state of affairs existing, one of two facts must be true: either a failure is being made of properly placing the responsibility of diseases or epidemcs on milk, or else the methods now in general use are controlling the situation in a majority of instances. It will probably be conceded that this latter fact is true.

There are three distinct lines of defense which without doubt have had a large influence in bringing about these results. These three safeguards are pasteurization, cleanly methods of production and distribution, and the tuberculin testing of cattle. Each year with the developing and spreading out of these three procedures, the hazards in milk consumption are decreasing. A closer study of the present milk situation and these three safeguards more than suggests that pasteurization has played and is still playing the chief part.

Even though there was no report from the Committee on Communicable Diseases Affecting Man last year, the ground was well covered by Dr. Price in his admirable report for the Committee on Pasteurization of Milk and Cream. Dr. Price, in the section of his report dealing with communicable diseases transmitted through raw milk supplies, reviews all the milk-borne outbreaks up to the summer of 1924. The following brief summary of these outbreaks is included to bring the report of this Committee up to date.

1. An outbreak of typhoid fever of 41 cases, in Iowa, in December, 1923, from raw milk.
2. An outbreak of typhoid fever of 26 cases, in Portland, Oregon, in March, 1924, from raw milk.
3. An outbreak of typhoid fever of 50 cases, in

Bath, Michigan, in May, 1917, from cheese cured but a short time.

4. An outbreak of paratyphoid B fever, of 50 cases, in New Rochelle, N. Y., in March, 1924, from certified milk.

5. Sixty-one milk-borne outbreaks of communicable disease from 1918 to 1923 are tabulated in the *Public Health Reports* for August 26, 1924. Forty of these outbreaks were from raw milk, four from pasteurized milk, and in seventeen instances the kind of milk was not stated. Dr. Price's investigation of the reported four instances of pasteurized milk indicated that the pasteurization, if attempted, was faulty.

6. Sixteen outbreaks of communicable diseases, supposedly due to pasteurized milk, were investigated and reported by Dr. Godfrey. In all cases evidence was lacking warranting the conclusion that infection survives proper pasteurization.

The report of this committee covers outbreaks of typhoid and scarlet fever occurring during the past year. It also refers to a new modification of a method for detecting typhoid carriers and the resulting frequency with which carriers have been found. Besides this a summary is given of a recent statistical study, which indicates a decrease in the dissemination of bovine tuberculosis following the use of pasteurized milk.

If the reports of milk-borne outbreaks of communicable diseases that have come to the attention of this Committee are an indication of the general situation during the past year, it can safely be said that it has been the best year on record. The outbreaks to be recorded at this time are few in number. There is a detailed report of one scarlet fever epidemic and one of typhoid fever. Besides

this, there are short indefinite reports of several other milk-borne outbreaks to be noted.

## Scarlet Fever

In April, 1924, there occurred an outbreak of 38 cases of scarlet fever at Helena, Montana, in which raw milk was reported to be the vehicle of infection. Arthur Jordan, Health Officer of Lewis and Clark County, Montana, reports this outbreak in *Public Health Reports* of October 17, 1924. Mr. Jordan's investigation concluded that the source of infection was a milker on the dairy farm, who had a severe sore throat ten days before the outbreak. A more or less definite variety of streptococcus hemolyticus was isolated from the milk in large numbers and also from the throats of the cases. The dairy concerned distributed about fifty gallons of raw milk a day to about 160 persons. Besides the 38 original cases of scarlet fever in this epidemic, there were seventeen contact cases.

## Typhoid Fever

In the *Public Health Reports* for June 19, 1925, Dr. L. L. Lumsden gives a detailed report of an outbreak of typhoid fever occurring in January and February, 1924, at Lincoln Memorial University at Herrogate, Tenn. During this explosive milk-borne typhoid outbreak, there were at least a hundred cases with eight deaths among a student enrollment of 430. Dr. Lumsden's study of this epidemic is so thorough that it is considered advisable to quote liberally from it.

"*Milk.* As one possible factor after another was eliminated in the course of investigation, the evidence continued to point to milk as the major vector of the infection.

"The explosive character of the outbreak, the high case incidence among the exposed, the large proportion of

cases with sudden onsets of pronounced and severe symptoms, the clinical course of the cases, and the relatively low degree of resistance furnished by recent anti-typhoid vaccination—all were suggestive of heavy dosage infection such as may come from milk into which typhoid bacilli, introduced through contamination with (perhaps) highly diluted or very minute quantities of human excreta, have had time to multiply before the milk is ingested.

"Raw milk was one of the staple articles of diet in the mess halls. Therefore it was entirely possible for infection in milk to reach most of the resident students.

"Of the 28 students furnishing the cases investigated in detail, all stated that for the four weeks or more prior to the onset of their illness they had partaken freely of the milk served in the mess halls—25 having used it regularly as a beverage, two having used it in cereals regularly and also as a beverage occasionally, and one having used it in cereals only.

"The milk supply of the university during the period of causation of the outbreak was obtained from four different sources and in amounts as follows: (1) The university herd, 40 gallons a day; (2) farm of W., 16 gallons a day; (3) farm of S., 20 gallons a day; and (4) dairy of C., 8 gallons of cream a week.

"*Supplies from farms of W. and S.* Milk from these farms was delivered to the university creamery in the morning, the deliveries including the night milk of the day before and the morning milk of that day. Some of these parts of the supply were separated, the cream being stored for butter making, but all of the milk, whether skim or whole, from both of these outside farms was distributed to and consumed in the mess halls. It was understood from the statement of the dairy manager in our first interview with him that all the butter made from the cream derived from the farms of W. and S. went to the mess halls, but later on, after we had learned that oleomargarine instead of butter was used in the mess halls, he said that there had been a misunderstanding and that the butter made from those creams was distributed as was that made from the college herd cream. It appeared certain that only a small proportion of the butter supply was made from cream separated from the milk bought

from farmers W. and S., and it is quite probable that on some days none of the cream from either of these sources went into the butter-making supply. All the statements obtained were definitely to the effect that none of the milk received from farmer W. or S. was distributed to any place except the student mess halls. Whatever cream from these sources was used for butter making was "ripened" for four to eight days before being churned.

"The university creamery was fairly well equipped and appeared to be operated in a cleanly manner. The water running through the cooling room where the cans of milk were stored was exposed to contamination from near-by sewers, cesspools, and privies. There were two grossly insanitary open-surface privies on the side of the hill within 60 feet of the dairy. These would constitute a definite source of danger in the warmer weather seasons, because flies could readily make the trip from the exposed excreta to the milk in the dairy.

"If the infection causing the outbreak had been introduced into the milk—including that from the university herd—at the dairy, there would have been no reason for the outbreak to have been confined to those who took their meals at the mess halls. Therefore it appeared that if the infection was milk-borne, the vector must have been the milk obtained from farmer W. or farmer S. or both. These sources of milk were visited and inspected on the morning of March 17. The conditions surrounding the dairying business of W. were found appallingly insanitary. The residence was located in a gulch. The milk house was about 40 feet from the residence and was over a small stream fed by a near-by spring and several other springs up the gulch. No privy was provided for the use of the family. Recent deposits of human excreta were observed between the residence and the milk house. The water in the stream over which the milk house was built and in which the cans of milk were set for cooling was exposed to gross pollution from several open-surface privies and stables within a hundred yards or so up the gulch. Presumably the obviously contaminated water from W.'s spring or from the stream fed by this spring was used for washing the milk cans. The stable yard, located about 50 yards down gulch from the residence,

was dirty. The cows were dirty. Incidentally it may be stated that these cows had never been tuberculin tested All the conditions surrounding the dairying were such as to make certain the introduction, from time to time, of human excreta into the milk sent from this farm to the university. A typhoid-fever patient or a human carrier of typhoid bacilli on this place, or at any of the several homes within the immediate vicinity up the gulch, would complete the chain of circumstances necessary to the introduction of infectious matter into the milk. There were a good many visitors to this settlement between December 1, 1923, and January 1, 1924. Upon inquiring about illness in the neighborhood, we learned that Mr. W. himself, who had most to do with the handling of the milk, became indisposed about December 10. By Christmas Day he had become ill enough to give up and go to bed. After remaining in bed for about a week, he returned to work but felt "poorly" for two or three weeks afterwards. He was not attended by a physician and his case was not diagnosed during his illness. Mr. W. was not at home at the time of our visit. Specimens of feces, urine, and blood were obtained from him a few days later and sent to the State Health Department for examination. The feces and urine were reported negative for typhoid but the blood in high dilution gave a positive Widal reaction. It seems highly probable that Mr. W.'s case was one of mild typhoid fever, and that either Mr. W. or some visitor from whom he contracted the disease was the source and the milk from his farm the vector of the infection causing the outbreak at the university.

"The conditions surrounding the dairying of farmer S. were also grossly insanitary, but not so pronounced as those at the place of farmer W. No history was obtained of recent illness suggesting typhoid in the household or immediate neighborhood of farmer S.

"There was no way of ascertaining the proportion in which the milk received from W. was distributed to each of the mess halls involved. It is quite possible that most of it went to Norton Hall mess. This seems to offer the most probable explanation of the apparent disproportion of cases among the students who took their meals at that mess.

"If the butter was made from cream separated from

milk received from both W. and S. and was sent to the faculty households and the extra university trade, the explanation of the entire escape from the outbreak by the consumers of that butter might be found in one of the following hypotheses:

"(1) The organisms of the strain causing the outbreak were not sufficiently virulent to cause disease unless ingested in large number.

"(2) None of the cans of milk containing the infection (and it is quite reasonable to believe that the milk was not uniformly infected so as to have typhoid bacilli in every 5-gallon lot) was drawn upon for cream used in the butter making.

"(3) The typhoid bacilli of the strain operative were not sufficiently vigorous to survive in the souring cream."

The report of this investigation emphasizes the outcome to be expected from a grossly neglected dairy, a typhoid carrier, and no pasteurization.

Besides these two well-investigated and reported epidemics, there are occasional notes or notices of milk-borne outbreaks, of which the following are samples.

In the *Journal of the American Medical Association* for October 3, 1925, under Ohio news, appears the following:

"*Sandusky Typhoid a Milk Epidemic.* It is reported that the State Director of Health, Dr. J. E. Munger, recently returned from an investigation of the typhoid epidemic at Sandusky, where he found that sixty cases had been reported, all of which had been using milk from the same dairy. The dairy owner was directed to pasteurize his milk supply and prevented from delivering milk until that had been done."

The Health Officer of the Oranges, N. J., Wm. B. Palmer, writes:

"From 1914, the time of the organization of this Association, until 1919, there were five epidemics of scarlet fever in the Oranges. All of these outbreaks were controlled by pasteurization of the milk supplies.

Investigations in each case revealed the sources of infection. In 1918 about 20 cases of mastitis occurred in one of our certified dairy herds and the entire milk supply was pasteurized under the supervision of the Medical Milk Commission and the local health departments during the time of the veterinary and laboratory investigations and until the outbreak was controlled."

Dr. M. F. Haygood, Health Officer of Knoxville, Tenn., writes:

"Since taking charge of the Bureau of Health of this city, on May 21, 1924, we have had three small, but definite outbreaks of typhoid fever, traceable to contaminated milk. Two of these have occurred since February 1, 1925. In this case a small dairyman, supplying only ten gallons of milk a day, had six cases of typhoid fever occur among his small number of customers. These six cases constituted exactly 50 per cent of all the typhoid in the city during the time these cases were developing. His milk supply was suspended, he was requested to sell his milk to a pasteurizing plant, and did so, while we undertook a search for a typhoid carrier among his milk handlers. This we succeeded in doing on an examination of the three specimens submitted by these workers.

"At the present time we have 15 cases of typhoid fever, 13 of which are active, using milk from another dairy supplying about 125 gallons of raw milk each day. This milk has just been denied a place on our retail market, and has been sent to a pasteurizing plant, while we undertake a search for the offending person in this case.

"I might say that since January 1, there have developed in our city 30 cases of typhoid fever, 21, or 70 per cent, of which used milk from the two dairies mentioned above, and this milk constituted only 2.25 per cent of our total milk supply."

Without doubt there are a good many outbreaks of this

character, but the reports are meager and the conclusions to be drawn are not to be relied on.

### Typhoid Carriers

A report published in the *Journal of the American Medical Association* for October 3, 1925, by Dr. Welch, *et al.*, of Alabama, describes a new modification of a laboratory method for the isolation of the typhoid organism from feces and urine. A brilliant green bile medium is put up in one-ounce large-mouth bottles and taken to the individual and inoculated rather than having the specimen sent to the laboratory and then transferred to the medium. This method and brilliant green bile medium "prevents in considerable degree the rapid death of the typhoid bacillus in the feces; promotes, on the other hand, its multiplication and prevents in most specimens the rapid overgrowth of *B. coli.*" Dr. Welch has made a survey including 1,076 healthy persons employed in the dairy industry of Alabama. An average of 2.3 examinations of the feces and urine of each person was made, resulting in the finding of 39 typhoid and 16 paratyphoid carriers, or a total percentage of carriers in this group of 5.1. "The examination of the general population for typhoid carriers in various localities in the past has disclosed an incidence of from 0.3 to 0.8 per cent." The result of this investigation suggests that a rather high percentage of typhoid carriers escape detection by the commonly used method. It also brings up for consideration the question as to why, with such a high percentage of carriers, so few milk-borne outbreaks can be charged to them. It is hinted that it may be possible that there is a nonvirulent typhoid organism as there is a nonvirulent diphtheria bacillus.

### Tuberculosis

In the *American Review of Tuberculosis* for October, 1924, there is published a statistical study of tuberculosis

mortality in relation to pasteurization, by C.-E. A. Winslow and Cora E. Gray. It is found, according to these observers, that among the group of children of the milk-consuming age, one to four years, in cities where a high percentage of the milk consumed is pasteurized, there is a death rate from nonpulmonary tuberculosis of about 75 per 100,000 population, as contrasted with a pulmonary rate of about 25 per 100,000. On the other hand, in cities where there has been but little efficient pasteurization there is an increase in the nonpulmonary rate to 100 per 100,000, where the pulmonary rate remains about the same.

As nonpulmonary tuberculosis is the type associated with milk consumption and not pulmonary, and as the death rate from this cause is lower in cities where milk is effectively pasteurized, this study emphasizes once more one of the values of pasteurized milk.

*"From ignorance of what is good and what is bad the life of men is greatly perplexed."*

# A STUDY OF COMMERCIAL PASTEURIZERS IN BOSTON

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Pasteurization is defined by this Association as the process by which every portion of the milk is heated to a temperature of approximately 145 degrees F., never lower than 142 degrees F., held at that temperature for a period of 30 minutes, and then cooled to a temperature below 50 degrees F. Massachusetts defines pasteurization as the process of heating milk to a temperature not above 145 degrees F. or below 140 degrees F., holding for 30 minutes and cooling to a temperature of 50 degrees F. or below. Our pasteurizing regulations conform to the State requirements and call for a final bacteriological count of not more than 100,000 bacteria per c.c. This standard is very lenient, as practically all our pasteurized product runs much below 50,000 bacteria per c.c.

Milk was first pasteurized in Boston in 1904. At that time the flash method was used. Milk was heated to 158 to 162 degrees F. and momentarily passed over heated cone surfaces, and then cooled and bottled. This method was in use in some of our plants up to the year 1922. Later some of our large dealers used a heater and pocket holders. The small dealers inclined to coil vats. Later on the continuous-flow type, glass-lined vats and spray vats came into use.

In 1922 we practically eliminated all flash pasteurization; and while we had always advocated pasteurization, this was the beginning of our drive for pasteurizing all but certified milk. At present one dealer is pasteurizing certified milk and claims quite a demand for it. Papers

read at our thirteenth convention regarding Boston's milk supply told you what strides had been made in influencing raw-milk dealers to pasteurize their product, and at that time 96.72 per cent of our milk supply was pasteurized. Since then, three dealers selling raw milk from accredited herds have installed pasteurizing equipment, thereby changing slightly over 1,200 quarts from raw to pasteurized milk, and in a short time the other dealers now selling raw milk from accredited herds will pasteurize their milk.

When samples of milk taken from dealers show counts above our regulations, the dealer is notified, and this Department uses all its resources to aid him in locating the cause of the high count and in applying a remedy for it. Should we be unable to find the cause of the trouble by an examination of equipment, processing, cooling, storing, and so forth, it becomes necessary to take check samples, the number, of course, depending on the equipment. Samples are usually taken as follows:

Raw milk, after clarifying, after heating, after holding period, top and bottom of cooler, filler, and bottled milk; also samples of washed bottles and bottle caps. The four counts consisting of top and bottom of cooler, filler, and bottled milk are averaged and on chart are headed "Average of counts on cooler, top and bottom, filler, and bottle." The charts used in this paper are the results obtained in the making of these investigations.

Properly designed and constructed equipment with first-class operation of the same is extremely essential in the elimination of bacteria, and should show an efficiency of 95 per cent. The table will give an idea of actual conditions which may be compared with the ideal. We can also see how efficient the various types and systems of bottle washing are and what effect the bottle caps have on the final count.

| Pasteurizer | | Heated to (Degrees F.) | Minutes held | Cooled to (Degrees F.) | Raw Milk (Bacteria per c.c.) | After Clarifying (Bacteria per c.c.) | After Holding (Bacteria per c.c.) | After Filtering (Bacteria per c.c.) | Av. of Counts Cooler, Filler and Bottle | Elimination (per cent) | Bottle Washer | Av. of Bottle Counts (Bacteria per c.c.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Final Container | 1 | 146 | 31 | 46 | 600,000 | | | | 6,000 | 99.00 | Soaker type | 60 |
| Glass-Lined Vats | 1 | 145 | 30 | 39 | 1,200,000 | | 24,000 | | 14,000 | 98.83 | Hydraulic | 800 |
| | 2 | 145 | 30 | 40 | 800,000 | | 18,000 | | 16,000 | 98.00 | Hydraluic | 220 |
| | 3 | 145 | 30 | 30 | 1,800,000 | | 48,000 | | 42,000 | 97.66 | Hydraulic | 760 |
| | 4 | 144 | 30 | 45 | 900,000 | | 48,000 | | 43,000 | 96.33 | Hydraulic | 420 |
| | 5 | 145 | 30 | 40 | 2,300,000 | 2,600,000 | 80,000 | | 64,000 | 97.30 | Soaker type | 80 |
| Spray Vats | 1 | 145 | 30 | 41 | 1,000,000 | | 16,000 | | 14,000 | 98.60 | B. & 1-case ster.* | 450 |
| | 2 | 143 | 30 | 38 | 2,500,000 | | 40,000 | | 44,000 | 98.24 | B. & 1-case ster. | 3800 |
| | 3 | 143 | 30 | 44 | 220,000 | | 16,000 | | 12,000 | 94.54 | B. & 1-case ster. | 3400 |
| | 4 | 142 | 30 | 41 | 600,000 | | 26,000 | 24,000 | 29,000 | 95.16 | Hand-fed Hydr. | 590 |
| | 5 | 145 | 30 | 44 | 140,000 | | 16,000 | | 14,000 | 90.00 | B. & 1-case ster. | 1150 |
| Pocket Holders | 1 | 142 | 30 | 43 | 600,000 | | 24,000 | | 22,000 | 96.33 | B. & 1-case ster. | 85 |
| | 2 | 145 | 30 | 42 | 1,100,000 | 1,200,000 | 20,000 | | 32,000 | 97.09 | Hydraulic | 560 |
| | 3 | 145 | 30 | 46 | 280,000 | | 20,000 | | 12,000 | 95.71 | B. & 1-case ster. | 2800 |
| | 4 | 145 | 30 | 40 | 800,000 | 1,000,000 | 40,000 | | 38,000 | 95.25 | Soaker type | 60 |
| | 5 | 145 | 30 | 46 | 900,000 | | 32,000 | | 28,000 | 96.88 | Hydraulic | 600 |
| Coil Vats | 1 | 143 | 30 | 40 | 1,400,000 | | 12,000 | 14,000 | 12,000 | 99.15 | Hand-fed Hydr. | 390 |
| | 2 | 143 | 30 | 42 | 800,000 | | 12,000 | 12,000 | 10,000 | 98.75 | Hand-fed Hydr. | 280 |
| | 3 | 143 | 30 | 42 | 1,200,000 | | 16,000 | 18,000 | 16,000 | 98.66 | Hydraulic | 600 |
| | 4 | 143 | 30 | 47 | 800,000 | | 14,000 | 20,000 | 14,000 | 98.25 | Hydraulic | 190 |
| | 5 | 143 | 30 | 44 | 1,600,000 | | 400,000 | 114,000 | 29,500 | 98.15 | Hand-fed Hydr. | 1400 |
| | 6 | 143 | 30 | 31 | 800,000 | | 20,000 | 20,000 | 18,000 | 97,75 | Hand-fed Hydr. | 60 |
| | 7 | 141 | 30 | 47 | 800,000 | | 20,000 | 18,000 | 18,000 | 97.74 | Hydraulic | 760 |
| | 8 | 142 | 30 | 46 | 880,000 | | 20,000 | 24,000 | 20,000 | 97.74 | Hydraulic | 360 |
| | 9 | 145 | 30 | 42 | 600,000 | 720,000 | 14,000 | 16,000 | 14,000 | 97.66 | Hydraulic | 800 |
| | 10 | 146 | 30 | 50 | 800,000 | | 24,000 | | 20,000 | 97.50 | B. & 1-case ster. | 470 |
| | 11 | 140 | 30 | 47 | 1,200,000 | | 16,000 | | 21,000 | 98.25 | Hand-fed Hydr. | 210 |
| | 12 | 145 | 30 | 44 | 1,200,000 | 1,400,000 | 30,000 | | 30,000 | 97.50 | High-pressure H. | 280 |
| | 13 | 142 | 30 | 44 | 10,000,000 | | 184,000 | 130,000 | 256,000 | 97.44 | Hydraulic | 1340 |
| | 14 | 143 | 30 | 50 | 1,400,000 | | 48,000 | 34,000 | 40,000 | 97.14 | Hand-fed Hydr. | 480 |
| | 15 | 143 | 30 | 38 | 240,000 | | 11,000 | 18,000 | 17,000 | 97.06 | Hand-fed Hydr. | 1410 |
| | 16 | 144 | 30 | 48 | 600,000 | | 16,000 | 18,000 | 17,500 | 97.08 | Hand-fed Hydr. | 380 |
| | 17 | 140 | 30 | 40 | 800,000 | | 14,000 | | 14,500 | 98.12 | Hand-fed Hydr. | 180 |
| | 18 | 143 | 30 | 46 | 900,000 | | 20,000 | 22,000 | 28,000 | 96.88 | Hydraulic | 1200 |
| | 19 | 144 | 30 | 42 | 2,000,000 | | 36,000 | 36,000 | 84,000 | 95.80 | Hand-fed Hydr. | 300 |
| | 20 | 145 | 30 | 44 | 1,400,000 | | 120,000 | 116,000 | 110,000 | 95.71 | Hand-fed Hydr. | 1110 |
| | 21 | 144 | 30 | 46 | 1,400,000 | | 40,000 | 38,000 | 48,000 | 96.57 | Hydraulic | 220 |
| | 22 | 145 | 30 | 45 | 600,000 | | 30,000 | | 32,000 | 94.66 | Hydraulic | 1600 |
| | 23 | 142 | 30 | 49 | 2,000,000 | | 40,000 | | 124,000 | 94.00 | Hydraulic | 1300 |
| | 24 | 145 | 30 | 46 | 1,600,000 | | 128,000 | | 104,000 | 93.50 | B. & 1-case ster. | 630 |
| | 25 | 142 | 30 | 43 | 400,000 | | 30,000 | | 26,000 | 93.50 | Hydraulic | 1360 |

* Turbine brush and one-case sterilizer.

| Pasteurizer | | Heated to (Degrees F.) | Minutes held | Cooled to (Degrees F.) | Raw Milk (Bacteria per c.c.) | After Clarifying (Bacteria per c.c.) | After Holding (Bacteria per c.c.) | After Filtering (Bacteria per c.c.) | Av. of Counts Cooler, Filler and Bottle | Elimination (per cent) | Bottle Washer | Av. of Bottle Counts (Bacteria per c.c.) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Coil Vats | 26 | 145 | 30 | 44 | 600,000 | | 32,000 | | 40,000 | 93.33 | Hydraulic | 120 |
| | 27 | 144 | 30 | 40 | 2,000,000 | | 180,000 | 160,000 | 138,000 | 93.10 | Hydraulic | 1000 |
| | 28 | 145 | 30 | 50 | 1,200,000 | | 18,000 | | 37,000 | 96.91 | B. & 1-case ster.* | 3000 |
| | 29 | 144 | 30 | 44 | 460,000 | | 18,000 | 16,000 | 21,000 | 95.43 | Hydraulic | 280 |
| | 30 | 144 | 30 | 42 | 320,000 | | 14,000 | | 16,000 | 95.12 | B. & 1-case ster. | 2400 |
| | 31 | 143 | 30 | 46 | 1,200,000 | | 100,000 | | 120,000 | 90.00 | Hand-fed Hydr. | 1200 |
| | 32 | 145 | 30 | 48 | 2,000,000 | | 9,300 | | 210,000 | 89.50 | B. & 1-case ster. | 2030 |
| | 33 | 145 | 30 | 44 | 2,000,000 | | 200,000 | | 244,000 | 87.80 | Hydraulic | 160 |
| | 34 | 143 | 30 | 48 | 800,000 | | 94,000 | | 102,000 | 87.25 | B. & 1-case ster. | 270 |
| | 35 | 142 | 30 | 40 | 600,000 | | 52,000 | 80,000 | 80,000 | 86.66 | Hand-fed Hydr. | 420 |
| | 36 | 141 | 30 | 40 | 360,000 | | 60,000 | | 56,000 | 84.44 | B. & 1-case ster. | 1200 |
| | 37 | 140 | 26 | 49 | 900,000 | | 200,000 | | 240,000 | 73.33 | B. & 1-case ster. | 1200 |
| | 38 | 141 | 30 | 44 | 1,000,000 | | 18,000 | | 16,000 | 98.40 | B. & 1-case ster. | 4000 |
| Continuous Flow | 1 | 145 | 30 | 40 | 1,400,000 | 1,600,000 | 20,000 | | 15,000 | 98.85 | Hydraulic | 1700 |
| | 2 | 145 | 30 | 38 | 1,200,000 | 1,300,000 | 14,000 | | 12,000 | 99.00 | Soaker type | 70 |
| | 3 | 144 | 30 | 42 | 1,400,000 | 1,600,000 | 14,000 | | 16,000 | 98.85 | Hydraulic | 800 |
| | 4 | 145 | 30 | 44 | 1,100,000 | 1,200,000 | 28,000 | | 16,000 | 98.54 | Hydraulic | 250 |
| | 5 | 145 | 30 | 43 | 800,000 | 860,000 | 16,000 | | 12,000 | 98.50 | Hydraulic | 280 |
| | 6 | 145 | 30 | 42 | 2,000,000 | 3,600,000 | 40,000 | | 38,000 | 98.10 | Hydraulic | 800 |
| | 7 | 143 | 30 | 41 | 2,000,000 | | 34,000 | | 40,000 | 98.00 | Hand-fed Hydr. | 170 |
| | 8 | 145 | 30 | 40 | 3,000,000 | 3,400,000 | 100,000 | | 70,000 | 97.66 | Soaker type | 70 |
| | 9 | 144 | 30 | 49 | 900,000 | 1,100,000 | 26,000 | | 22,000 | 97.55 | Hydraulic | 3000 |
| | 10 | 143 | 30 | 42 | 440,000 | 460,000 | 14,000 | | 12,000 | 97.27 | Hydraulic | 360 |
| | 11 | 145 | 30 | 46 | 1,000,000 | 1,180,000 | 42,000 | | 30,000 | 97.00 | Hydraulic | 450 |
| | 12 | 143 | 30 | 48 | 400,000 | | 100,000 | | 108,000 | 92.28 | B. & 1-case ster. | 230 |
| | 13 | 145 | 30 | 46 | 360,000 | | 20,000 | | 18,000 | 95.00 | Hydraulic | 1950 |
| | 14 | 143 | 30 | 50 | 1,400,000 | | 130,000 | | 108,000 | 92.28 | B. & 1-case ster. | 1300 |
| | 15 | 146 | 30 | 40 | 1,600,000 | 1,800,000 | 156,000 | | 132,000 | 91.75 | Hydraulic | 1590 |
| | 16 | 145 | 30 | 42 | 100,000 | | 14,000 | | 12,000 | 91.46 | Hydraulic | 320 |
| | 17 | 144 | 30 | 42 | 320,000 | | 44,000 | 40,000 | 41,000 | 87.18 | Soaker type, Jr. | 90 |
| | 18 | 143 | 30 | 41 | 1,100,000 | | 212,000 | | 210,000 | 80.90 | Hand-fed Hydr. | 170 |
| | 19 | 141 | 24 | 47 | 2,000,000 | | 740,000 | 700,000 | 440,000 | 70.08 | Hand-fed Hydr. | 230 |
| | 20 | 143 | 27 | 46 | 800,000 | | 200,000 | | 182,000 | 77.25 | Soaker type, Jr. | 110 |

* Turbine brush and one-case sterilizer.

We have 74 processing plants supplying Boston, many of them supplying smaller dealers with bottled pasteurized milk. We find the small dealer problem more easily solved when one large plant will bottle for a number of them. The table shows an average count in raw milk of 1,170,540 bacteria per c.c., and a final count of 47,430 bacteria per c.c. It shows an average elimination of 95.94 per cent. The raw milk ranged from 140,000 to 10,000,000 bacteria per c.c., and the finished pasteurized product ranged from 10,000 to 256,000 bacteria per c.c. The average distance raw milk is transported is approximately 170 miles. Carload lots closed at the creamery and shipped direct to Boston are iced by the dealer and usually well iced. Less than carload lots load at a number of stations. The car is iced and cared for by the railroad and ice is not always plentiful on these cars.

The sixteen plants clarifying show an average increase of 261,250 bacteria per c.c. after clarification, or 20.06 per cent, and the average elimination on plants clarifying was 97.37 per cent. Clarification does not increase final counts. The breaking up of colonies makes organisms easier to kill. Colonies of large surface areas, such as yeasts, molds, *B. coli,* etc., are thrown out in the slime, leaving behind types more easily killed.

The twenty-three plants filtering show an average decrease after filtering of 15,910 bacteria per c.c., or 17.67 per cent, and the average elimination on these plants was 95.77 per cent. Filters help to decrease counts. Carelessness in changing filter cloths or in allowing filter bags to break results in more harm than good.

The table given below shows the average elimination of bacteria by types of pasteurizing equipment used.

The continuous-flow tubular holder type showed an elimination of 98 per cent, and the cylindrical holders and equalizer type showed an elimination of 99 per cent.

The reasons for most high bacterial counts are as

| Type of equipment | Average Elimination (per cent) | No. plants |
|---|---|---|
| Final container | 99.00 | 1 |
| Glass-lined vats | 97.62 | 5 |
| Pocket holders | 96.25 | 5 |
| Spray vats | 95.31 | 5 |
| Coil vats | 94.62 | 38 |
| Continuous-flow type | 93.27 | 20 |

follows: Inefficient or careless operators, poor arrangement, lack of balanced equipment, contaminated equipment, and high initial count in milk. Inefficient operators will not check controls, charts, and thermometers and will neglect to run the plant on rated capacity. Poor arrangements may include outfits with pockets which leave milk in them at incubating temperatures. Lack of balanced equipment means pasteurizer and filler are not of the same capacity. As an instance of contaminated equipment, a processing outfit may show an elimination of 99 per cent after the holding period, but unclean coolers, pipes, pumps, and so forth, can destroy the effect of this work. Small plants find it difficult to kill organisms of a high thermal death point and the elimination is decreased. This condition is found more often in a plant using the milk from one herd than from a plant using milk from several herds. A high count in raw milk often results in a high count in the pasteurized product.

Pasteurizing in the final container seems to be the ideal process, but the cost of equipment and low capacity make it prohibitive for most dealers. Glass-lined vats will do satisfactory work, but cooked milk on sides must be washed off between runs.

Pocket holders operated properly will hold for full time, but there is a danger of by-passing from valves. Spray vats will hold and are easily cleaned. Coil vats will hold for full period. Clean coils are essential for low count milk. Continuous-flow types will not always hold for the full time and there is a mixing of hot and cold milk.

They can be designed to operate close to the vat system in efficiency.

The table given below shows the average bottle counts on the various types and systems of bottle washing.

| Type of Equipment | No. plants | Bacteria per c. c. | No. bottles |
|---|---|---|---|
| Soaker type | 7 | 77 | 19 |
| High-pressure hydraulic | 1 | 288 | 7 |
| Hand-fed hydraulic | 17 | 524 | 50 |
| Hydraulic | 32 | 817 | 148 |
| Turbine brush and one-case sterilizer | 17 | 1,671 | 105 |

Operation and care of washing machines are most important. Hand-washed bottles show the highest counts, bringing to our attention the human element, possibly an undue haste to complete work which the use of automatic washers makes impossible. Bottle counts ranged from 20 to 16,000 bacteria per c.c. The average count on 208 bottle caps was 571 bacteria per c.c.

## Conclusions

Properly designed and constructed equipment will give the maximum efficiency, provided it is operated by interested and intelligent help. The plant operator is a vital factor in the quality of milk. Positive holding shows the highest elimination. At least 95 per cent of bacteria should be eliminated after pasteurization. With proper care of coolers, fillers, and bottles, this percentage should stand. Soaker-type washers turn out bottles as near to sterility as possible. Ordinarily bacteria in washed bottles do not affect the count of the finished product. The same is true of bottle caps.

There should be no let up on field work, all of which tends to secure production of milk with a low bacteria count. Dairy inspection, country creamery inspection, plant inspection, the taking of temperatures, sediment tests, acidity tests, direct microscopic work, and reductase

tests should be carried on with renewed vigor, as processing outfits will eliminate only a certain percentage of bacteria. Usually the low-count raw milk results in a low-count finished product.

## DISCUSSION

MEMBER: What is the number of bacteria allowed in Boston for raw milk previous to pasteurization?

PROFESSOR JORDAN: There is no requirement for raw milk. The number that may be present in pasteurized milk is limited to 100,000 per cubic centimeter.

MR. PALMER: The mere reduction of bacteria does not indicate the efficiency of the pasteurization. So-called "flash" pasteurization may reduce the number of bacteria, but the flash method is not approved.

*"Good reasons must perforce give place to better."*

# SANITARY EFFICIENCY IN COUNTRY MILK RECEIVING STATIONS

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The increased demand of the larger urban centers of population for an adequate milk supply has made necessary the establishment of country milk stations in rural districts located farther and farther from the large cities.

The primary function of a milk station is to serve as a place where milk may be received and either prepared for shipment to market or manufactured into milk products. Country stations which formerly functioned as creameries and cheese factories have, in many instances, been converted into milk shipping stations. The increased use of such stations by milk producers and by milk dealers has followed the increased demand for market milk.

There is a growing tendency to convert country bottling plants within forty or fifty miles of large cities into receiving stations and transport the milk in bulk to city dairies and bottling plants. Insulated tanks mounted on motor trucks or on railway cars are used for this purpose, and their use is increasing. The principal reasons for this change in the country bottling plants are the relatively high rail rates on cases of bottled milk and the development of new highways which make possible the use of motor transport, thus allowing bulk shipments in tanks.

In the Chicago area about twelve country bottling stations have been converted into receiving stations, and the number of tanks for bulk shipments by motor trucks has increased from about four to 20.

In preparing milk for market it is important that a high degree of sanitation be maintained, and this is possible only when the receiving station is properly located, constructed, equipped, and operated.

## Location

Milk dealers in many large cities have established country receiving stations in milk-producing areas where the dairy farms are within short distances. These stations are usually located near railroads, so that the milk can be shipped to the city by rail. Development of adequate highway systems and the increased use of motor equipment have allowed milk dealers to locate new milk receiving stations in producing areas farther away from railroads. This development has also influenced the growth of milk-producing areas which heretofore have been inaccessible and undeveloped. The preferable location for a milk receiving station would be in an area where abundant milk is available with twice-a-day delivery of milk from the farms.

Shipping facilities by the railroad should be adequate and train schedules should be adapted to the business. When motor trucks are to be used for hauling milk in cans or metal tanks, the condition of the roads as regards surface and grades is an influencing factor. In case of breakdowns of motor equipment the proximity to the railroad or electric line should be considered. Especially would this be of advantage if no supplemental motor equipment were available.

Whenever possible, country milk receiving stations should be located so that the product can be loaded directly to cars, trucks, or tanks for shipping and the empty cans, cases, bottles, and supplies conveniently unloaded. Such locations are more economical and insure a better product because of the elimination of delays.

The location of a receiving station with reference to an

adequate water supply and sewage disposal is an important factor to consider. Water for cooling purposes need not necessarily be of as good quality as that which is used for washing, but it should be cold. In general, the water supply for washing should be of a quality suitable for drinking purposes and it should be available in adequate quantities. In disposing of sewage or drainage from the milk receiving station, a close proximity to a flowing stream of water is highly desirable. The nearness to the distributing center is a strong influencing factor in determining the location of milk receiving stations. Many dealers who have built their receiving stations as close to the city as possible have learned that in times of shortage of milk, small city dealers raid the nearby areas for a supply of milk, offering exorbitant prices for it in order to supply their trade. As cities grow, the nearby farms of producers are sometimes sold to real estate dealers and dairying, therefore, becomes supplanted with other enterprises. For these reasons milk dealers have considered the far-out location for receiving stations as best because such areas have a chance to grow with the growth of the city and the milk business.

## Construction

Milk receiving stations should be constructed for convenience of operation and for the highest degree of sanitation. A frame building with adequate ventilation, light, screens, and drainage serves every purpose. Well-drained floors of concrete with concrete walls extended at least three feet above the floor facilitate cleaning. A raised receiving deck or platform for the inside and outside of the building facilitates handling the milk. A small shed adjoining the building is usually built for the boiler and for coal storage. A movable platform is sometimes built for conveying the cans of milk outside the building for loading to the railway cars. This facilitates handling and

allows the milk to remain protected from the sun, inside the receiving station, until just previous to the time the train arrives. This is of particular advantage, when trains are late, as exposure to the sun might cause the milk to deteriorate in quality.

## Equipment

A study of the handling of milk at different country stations receiving milk from 2,135 producers and shipping it to the city supplies facts which are of pertinence in considering establishing and equipping a new milk shipping station. (See Tables 1 and 2.) It is not enough to know the number of producers, but the quantity of milk which each producer will bring must be taken into account. If the total quantity of milk can be ascertained, the number of producers from whom it will come is of minor importance.

The method of conveying milk from the shipping station to the railroad car must be considered, as protection from the sun during this stage of the journey is important in summer.

Equipment adequate for handling approximately two thousand gallons or less daily should include scales for weighing milk, a two-compartment weigh can, a receiving vat, a sanitary milk pump, an inclosed milk cooler, a holding vat (storage), a cooling system capable of cooling milk below 40 degrees F., a water heater or steam boiler, a can washer and sterilizer. This equipment should be in good working condition and easy to operate by the average man. Contact surfaces should be thoroughly cleaned and sterilized after each use. It would be of considerable advantage for large companies to standardize the equipment of their receiving stations, as such a system facilitates interchange and replacement of equipment in case of breakdowns.

Refrigeration of milk in a receiving station is a pri-

TABLE 1.

MILK RECEIVED AT COUNTRY RECEIVING STATIONS.

| Station | Quantity of milk received daily | Number of producers | Number of producers to 100 gallons of milk | Distance from farms to receiving station | Distance between receiving station and railroad | Method of conveying milk from receiving station to railroad |
|---|---|---|---|---|---|---|
| | Gallons | | | Miles | Feet | |
| 1 | 200 | 11 | 5.5 | 1/16 to 5 | 50 | Movable platform on track. |
| 2 | 360 | 20 | 5.5 | ⅛ to 2½ | 15 | do. |
| 3 | 440 | 33 | 7.3 | ⅛ to 5 | 200 | do. |
| 4 | 460 | 44 | 9.5 | 1/16 to 8 | 100 | do. |
| 5 | 470 | 38 | 8.0 | ½ to 6 | 200 | Hand truck. |
| 6 | 470 | 50 | 10.6 | ¼ to 9 | 15 | Movable platform on track. |
| 7 | 530 | 61 | 11.5 | ¼ to 7 | 50 | do. |
| 8 | 550 | 37 | 6.7 | ⅛ to 6 | 25 | do. |
| 9 | 560 | 41 | 7.3 | ⅛ to 4 | 25 | do. |
| 10 | 600 | 37 | 6.2 | ⅛ to 6 | 25 | do. |
| 11 | 600 | 52 | 8.7 | ½ to 7 | 15 | do. |
| 12 | 600 | 72 | 12.0 | ⅛ to 7 | 50 | do. |
| 13 | 600 | 85 | 14.2 | 1/16 to 12 | 30 | do. |
| 14 | 730 | 62 | 8.5 | ⅛ to 7 | 50 | do. |
| 15 | 750 | 58 | 7.7 | 1/16 to 6 | 200 | Wagon. |
| 16 | 750 | 62 | 8.3 | ¼ to 15 | 15 | Movable platform on track. |
| 17 | 850 | 72 | 8.5 | 1/16 to 9 | 50 | do. |
| 18 | 900 | 58 | 6.3 | ½ to 7 | 20 | do. |
| 19 | 920 | 92 | 10.0 | ¼ to 8 | 50 | do. |
| 20 | 925 | 41 | 4.4 | ¼ to 4½ | 40 | do. |
| 21 | 1,000 | 88 | 8.8 | 1 to 5 | 40 | do. |
| 22 | 1,110 | 52 | 4.7 | 1/16 to 6 | 40 | do. |
| 23 | 1,200 | 96 | 8.0 | 1/16 to 6 | 20 | do. |
| 24 | 1,300 | 60 | 4.6 | ¼ to 6 | 40 | do. |
| 25 | 1,500 | 112 | 7.5 | ¼ to 7 | 30 | do. |
| 26 | 1,500 | 139 | 9.2 | ⅛ to 28 | 20 | do. |
| 27 | 1,620 | 99 | 6.1 | 1 to 6 | 200 | Wagon. |
| 28 | 1,820 | 111 | 6.1 | ⅛ to 6 | 30 | Movable platform on track. |

TABLE 2.

AVERAGE NUMBER OF PRODUCERS PER 100 GALLONS OF MILK DELIVERED TO RECEIVING STATIONS HANDLING VARYING QUANTITIES OF MILK.

| Quantity of milk handled. Gallons. | Average number of producers per 100 gallons. |
|---|---|
| 200 to 400 | 5.5 |
| 400 to 500 | 8.8 |
| 500 to 600 | 8.5 |
| 600 to 700 | 10.3 |
| 700 to 800 | 8.2 |
| 800 to 900 | 8.5 |
| 900 to 1,000 | 7.4 |
| 1,000 to 1,200 | 6.7 |
| 1,200 to 1,500 | 6.3 |
| 1,500 to 1,800 | 7.1 |

mary function and the chief reason for its existence. When natural ice is used, it is necessary to store it in a well-constructed ice house and to wash off the sawdust or other foreign matter before using. Mechanical refrigeration is more convenient and sanitary, requires less labor, and the milk may be cooled quicker and to a lower temperature.

It has been estimated[1] that "in case two hundred and fifty or more cans of milk are handled daily, mechanical refrigeration is believed to be more economical than the use of natural ice."

Steam for the sterilization of equipment is an essential at milk receiving stations. In some of the larger stations, both steam and electric power are developed, especially where mechanical refrigeration is in effect. A separate power room is always desirable for sanitary reasons.

## OPERATION

There is a very close relation between the time of year when plants receive their supply of milk and the type of business conducted. Plants doing a city retail business need nearly as much milk in winter as in summer, and over a period of years prices tend to become adjusted so that a sufficient supply of winter milk can be secured. During 1922 in New York State[2] 48 plants of this type

secured 48 per cent of their yearly supply during the six months from October to March, inclusive. This is about the proportion of winter milk required for the city trade. One hundred fifty-one plants which shipped as fluid milk all which they secured from farmers received 47 per cent of their yearly supply during the colder half of the year. This was partially because most plants of this type were located where agricultural conditions permit the production of winter milk and partially because the production of winter milk is encouraged by the market provided by these plants.

Daily receipts of milk usually do not vary over a wide range except when weather conditions prevent hauling or drought lowers production.

Train schedules are not always suitable for milk transportation to cities from receiving stations. It often happens that producers have to adjust their morning work in order to deliver the milk to the receiving station ahead of train time. The introduction of daylight-saving time, with a corresponding change of time schedule for the trains hauling milk, has not always met the approval of milk producers. Delivery of milk after train time necessitates storage at the receiving station, sometimes until the following day.

Milk storage facilities were present at 23 stations in the Middle West out of 29 studied. At 11 of these shipping stations 6,578 gallons of milk were stored till the next day because the milk was received after train time and hence could not be sent to the city on the morning when it was received. Table 3 shows what occurred on a typical day at nine of these stations.

TABLE 3.

COMPARATIVE TIME OF MILK DELIVERY AND TRAIN DEPARTURE.

| Time milk train left | Time milk was received at station | Milk received after train time | Proportion of total received after train time |
|---|---|---|---|
| A.M. | A.M. | Gallons | Per cent |
| 6.42 | 8.30 to 11.00 | 750 | 100 |
| 7.10 | 7.30 to 9.30 | 600 | 100 |
| 7.30 | 7.00 to 10.00 | 850 | 96.6 |
| 7.35 | 7.15 to 10.00 | 500 | 80.3 |
| 7.40 | 7.00 to 11.30 | 1,620 | 100 |
| 8.25 | 7.00 to 10.00 | 400 | 44 |
| 8.55 | 6.30 to 12.00 | 900 | 60 |
| 9.13 | 7.45 to 10.45 | 500 | 54.3 |
| 9.15 | 7.00 to 11.00 | 250 | 20 |

This illustrates how train schedules are not always adapted to milk shipping. It shows also the effect of lateness on the part of the producer in delivering milk for shipment. While many producers deliver their milk before train time, others fail to do so because they neglect to arrange their schedule of morning work so that they can arrive early at the railroad station. When bad, muddy roads or breakdowns are met with, the quantity of milk arriving late and having to be stored is greater; but Table 3 represents ordinary conditions in good weather. The distance of the farmers from the railroad is seen in Table 2.

On arriving at the receiving station, the milk from each producer is usually dumped into a weigh tank and then allowed to run into a receiving vat, from which it runs by gravity or is forced by a pump over a cooler. It is then run into cans or into metal transportation tanks for shipping to the city.

A study of the handling facilities (see page 73 for adequate equipment) at 29 country receiving stations (including those in Table 1) showed that 24 obtained their water supply from wells, three had city water, and two had water from ponds. The water was used for both cooling milk and cleaning utensils.

The weigh tanks at two stations were covered, four were partially covered, and at 23 stations no covering was provided.

The receiving vats at 12 stations were covered, while at four stations there was no covering. At 11 stations the weigh tank was the only receiving tank in use, and at two stations a 10-gallon can on a platform scale constituted the receiving apparatus.

Cheesecloth strainers were in use at 13 stations, canton flannel at one station, wire strainers at six stations, and at nine stations the milk was not strained.

Pumps for elevating the milk over a cooler were in use at 14 of the stations. At nine stations refrigerating machines with brine circulation for milk cooling were present; at ten stations ice water was used as a cooling medium; and at five stations well water was used for cooling. At two stations cooling facilities were present but not in use, and at four stations new coolers were present but not installed. Surface coolers at all stations were uncovered. An average milk-cooling temperature of 48 degrees was recorded at 20 stations.

At 20 stations the milk remained on the loading truck within the shipping station until just previous to the arrival of the train. At two stations a canvas covering was used over the cans of milk.

Milk of variable quality and at various temperatures is usually received at country milk receiving stations. When the object is to weigh, cool, and place milk in cans or tanks for shipping, it must be remembered that milk is susceptible to inoculation from all contact surfaces and from contaminated air. Every precaution should therefore be taken to prevent inoculation from any source.

Samples of milk were secured from milk delivered by producers to country receiving stations. A summary of the bacterial content (Table 4) and the temperature (Table 5) of this milk shows what is no doubt a typical condition of milk received in this manner by many receiving stations.

## TABLE 4.

BACTERIA COUNT OF 314 SAMPLES OF MILK DELIVERED BY PRODUCERS AT COUNTRY STATIONS.

| Bacteria per c.c. | Morning's milk | | Evening's milk | | Mixed milk | | All samples | |
|---|---|---|---|---|---|---|---|---|
| | Number of samples | Proportion of total | Number of samples | Proportion of total | Number of samples | Proportion of total | Number of samples | Proportion of total |
| 10,000 and under ..... | 15 | 13.8 | 4 | 3.2 | 3 | 3.6 | 22 | 7.1 |
| 10,000 to 50,000 ..... | 38 | 35.2 | 29 | 23.6 | 24 | 28.9 | 91 | 28.9 |
| 50,000 to 100,000 ..... | 18 | 16.7 | 21 | 17.1 | 15 | 18.1 | 54 | 17.2 |
| 100,000 to 500,000 .... | 26 | 24.1 | 29 | 23.6 | 15 | 18.1 | 70 | 22.3 |
| 500,000 to 1,000,000 ... | 3 | 2.8 | 10 | 8.1 | 7 | 8.4 | 20 | 6.4 |
| 1,000,000 and over .... | 8 | 7.4 | 30 | 24.4 | 19 | 22.9 | 57 | 18.1 |
| Totals ..... | 108 | 100.0 | 123 | 100.0 | 83 | 100.0 | 314 | 100.0 |



## TABLE 5.

TEMPERATURE OF 314 SAMPLES OF MILK DELIVERED BY PRODUCERS AT COUNTRY STATIONS.

| Range of temperature | Morning's Milk | | Evening's milk | | Mixed milk | | All samples | |
|---|---|---|---|---|---|---|---|---|
| °F | Number of samples | Proportion of total | Number of samples | Proportion of total | Number of samples | Proportion of total | Number of samples | Proportion of total |
| 50° and under ..... | 4 | 3.7 | 47 | 38.2 | 13 | 15.7 | 64 | 20.3 |
| 51° to 55° ..... | 6 | 5.6 | 12 | 9.8 | 8 | 9.7 | 26 | 8.2 |
| 56° to 60° ..... | 30 | 27.7 | 31 | 25.1 | 25 | 30.1 | 86 | 27.5 |
| 61° to 65° ..... | 31 | 28.8 | 24 | 19.6 | 22 | 26.5 | 77 | 24.5 |
| 66° to 70° ..... | 20 | 18.5 | 9 | 7.3 | 11 | 13.2 | 40 | 12.8 |
| 71° and over ..... | 17 | 15.7 | 0 | 0 | 4 | 4.8 | 21 | 6.7 |
| Totals ..... | 108 | 100.0 | 123 | 100.0 | 83 | 100.0 | 314 | 100.0 |

## Quality Tests

It is hardly possible for a receiving station to make complete bacteriological and chemical tests of the mlik from all producers each day. However, some tests are usually made of milk as it is received and the special tests of milk are only made periodically from a limited number of producers, but at the end of several months or a year all milk has received all the tests and it is then possible to concentrate on those producers who habitually have milk of poor quality. The daily tests usually include butterfat tests. Each day a sample is taken and placed in a numbered bottle containing preservative. At the end of the week the composite sample is tested for butterfat and this, with the total weight of milk received, determines the amount paid to the producer if butterfat content is the basis of payment.

Tests for quality are sometimes made at the time the milk is received, and these are sometimes used to determine a basis for payment or for premiums. The quickest and perhaps the best test for market milk is the smelling and tasting of the milk by an experienced man at the weigh can. Off flavors and odors and otherwise undesirable milk for the consumer can be immediately rejected. Such milk might possibly pass the most sensitive chemical tests and might be low in bacteria and free from sediment, and still be undesirable to the consumer. A keen milk tester will detect undesirable flavors and odors in milk.

When milk is purchased on a quality basis as well as on the butterfat content, the tests which determine quality usually include sediment tests. It is a common practice to send sediment disks, containing sediment from a pint of the producer's milk, back to the producer. This visible evidence at once tends to cause improvement, as a producer does not desire to be in constant receipt of this evidence of neglect on his part.

Quick or rapid tests for quality, other than the taste,

odor, and sediment tests, are usually chemical or bacteriological, and require some laboratory preparation either of the material used or for a prolongation of the test.

The alcohol test is sometimes made at condenseries as an indication of what will happen to the milk when heated. It is rapid and quite reliable, but hardly serves its purpose when applied to milk intended for market milk.

Testing milk for acidity by titration, using an alkaline solution in the presence of an indicator, is a common method. A quantity of the solution with indicator can be prepared so that a certain degree of acidity will be noted. Usually milk with a 0.2 per cent acidity is rejected.

It is interesting to quote[3] some of the comments on rapid tests for milk quality made by those using the tests in milk-product plants and city milk plants.

*Methylene blue.* Fails to differentiate below 30,000 bacteria per c.c. Not entirely reliable and takes time. Requires little extra labor and checks very favorably with the Breed test. Detects poor quality quicker than any other test.

*Sediment.* Influences better straining, but does not improve quality. Good when used in territory not heretofore developed. Enables plant to show farmer direct result. Does not give check on cooling and handling on the farms.

*Hydrogen-ion.* Takes too much time and equipment. Very little more value than sediment test. Does not differentiate on good quality.

*Acidity.* Uncertain test at night. Is an indicator of keeping quality of milk. Good test in new territory where little attention has been paid to quality. Gives only titratable acidity.

*Direct microscopic.* High counts can frequently be determined from the types of organisms. Takes too much time and eye-strain.

*Frost, or little-plate.* Tests completed at inconvenient time. In pasteurized milk develops colonies which have no sanitary significance.

*Alcohol.* Does not detect spore-formers. Of value only on very poor milk. Uncertain.

*Curd.* Should be used in connection with other tests.

*Temperature.* More a control measure. Very effective.

Altogether 25 different combinations of tests were indicated; of those, 11 were combinations of two tests, ten of three tests, and four of four tests.

A method of determining the hydrogen-ion concentration of milk was devised in 1919 by Cooledge and Wyant[4] of the Michigan Agricultural College Experiment Station. This method measures the activity of certain bacterial types of importance in the souring of milk. The method consists of adding 0.1 cubic centimeter of the milk to be tested to a tube of broth containing the indicator brom thymol blue and incubating at 37 degrees C. for eight hours. pH readings are made hourly, and the condition of the milk is judged by the rate of change. Results are thus obtained in from one to eight hours.

The reductase or methylene blue reduction test[5] is now used by a large number of cheese factories and milk plants in an effort to eliminate undesirable milk. An incubation period for the sample is required, and that makes it of little benefit in grading the milk the day it arrives unless the milk is held pending the results of tests.

Hastings and Davenport,[6] in a comparison of the relative value of the methylene blue reduction test, the brom thymol blue test, and the brom cresol purple test, arrived at the following conclusions: "In comparison of the three tests, methylene blue reduction, brom thymol blue, and brom cresol purple, for the determination of the keeping quality of milk, it is shown that methylene blue reduction test is preferable because of its greater sensitive-

ness to biological differences in milks; because it measures the number of bacteria rather than the by-products of their growth; and because of its simplicity and practical advantages."

Baker and Van Slyke[7] devised a method for determining the keeping quality of milk, in which brom cresol purple is added to the whole milk to be tested and the color noted at room temperature after 24 hours.

It can be seen that all of these so-called quick or rapid tests for milk quality require an incubation period for the sample and are of little value during the day on which the milk is received.

A rapid test for hydrogen-ion concentration in milk and other liquids was described in 1924 in a paper[8] by Dr. J. Howard Brown, of Baltimore, Md. It consists of a color comparison of known solutions with a solution to which milk is added; the entire comparison being carried out on a direct reading pH scale. The Lamotte outfit with which the tests are made is compact and complete and can be operated with but little practice. Renewal of indicators and buffer solutions from time to time is necessary. This method has been observed by the writer, and it was noted that the hydrogen-ion reading for milk could be made in from one to two minutes with a high degree of accuracy. A large number of samples can be tested as fast as milk arrives at a receiving station. As an indication of the actual acidity or alkalinity of the milk at the time of its arrival at the receiving station there seems to be no test which is quicker or more accurate. No incubation period is required for the sample, and if the result is not favorable the milk can be rejected at once.

## Milk Cooling

It is possible to present in Table 6 comparative tests on milk from one farm before and after it passes through a country receiving station. The milk was cooled at the

farm by setting the cans in well water and stirring the milk. It was transported in sterile cans a distance of one mile to the milk receiving station, where it was poured into the weigh tank and from there passed by gravity over the cooler into the shipping cans for transportation in baggage cars to the city.

TABLE 6.

TEMPERATURE AND BACTERIAL CHANGES IN MILK AT DIFFERENT POINTS.

| | At farm | | | | At receiving station | | | |
|---|---|---|---|---|---|---|---|---|
| | Fresh | | Stored over night | | In weigh tank | | After cooling | |
| Sample number | Temperature | Bacterial count | Temperature | Bacterial count | Temperature | Bacterial count | Temperature | Bacterial count |
| | Deg. F. | Per c.c. | Deg. F. | Per c.c. | Deg. F. | Per c.c. | Deg. F. | Per c.c. |
| 1 | 97 | 67,000 | | | 83 | 310,000 | | |
| 2 | 95 | 43,000 | | | 84 | 125,000 | | |
| 3 | 96 | 100,000 | | | 85 | 110,000 | | |
| 4 | 96 | 277,000 | | | 83 | 2,860,000 | 58 | 1,460,000 |
| 5 | 96 | 19,000 | | | 90 | 48,000 | 54 | 2,720,000 |
| 6 | 95 | 62,000 | | | 84 | 88,000 | 63 | 334,000 |
| 8 | 96 | 180,000 | | | 85 | 180,000 | 58 | 1,240,000 |
| 9 | 98 | 8,900 | 67 | 360,000 | 70 | 522,000 | | |
| 10 | 98 | 18,000 | 69 | 7,500,000 | 71 | 36,000,000 | | |
| 11 | 96 | 9,700 | 66 | 1,660,000 | 68 | 5,400,000 | | |
| 12 | 98 | 23,000 | 68 | 8,880,000 | 72 | 8,000,000 | 56 | 7,400,000 |
| 13 | 98 | 3,000 | 70 | 4,350,000 | 72 | 5,700,000 | 52 | 34,000,000 |
| 14 | 96 | 9,700 | 66 | 1,460,000 | 68 | 2,500,000 | 54 | 4,700,000 |
| 15 | 98 | 83,000 | 64 | 500,000 | 68 | 5,400,000 | 56 | 12,300,000 |

Samples 1 to 8 represent morning's milk which was stored in cans at the farm for about one hour before being transported to the receiving station a mile away. Samples 9 to 15 represent evening's milk stored over night at the farm.

Over-night storage at the temperatures indicated permits a material development of bacteria before the milk reaches the receiving station. Twice-a-day delivery of the milk, or more efficient cooling at the farm, would have been a remedy for this.

An increase in bacteria was noted in all except two sam-

ples after the milk passed over the cooler in the receiving station. This was no doubt due to previous contamination from other milk as well as the general condition of the surface of the cooler. Greater care in cleanliness at this point in the milk's journey to the city consumer is essential.

### Washing and Sterilizing

One of the principal sources of inoculation is the milk can used by the producer and also the shipping can used by the dealer. Facilities for can washing and steaming are usually provided at milk receiving stations, but in many instances the cans are not washed either by the operator or by the producer.

At 25 milk receiving stations out of 29 studied which had such facilities, it was observed that in only 11 did the producers use them. If producers' milk cans were washed and sterilized at all milk receiving stations, a material improvement in the milk would no doubt result.

As milk from the cooler is usually drawn into shipping cans, it is important that these cans be as nearly sterile as possible. It was observed that at 24 out of 29 stations the shipping cans were used as received from the city plants. One station steamed the cans and four stations rinsed them prior to filling with milk. Therefore, 28 out of 29 of the stations depended upon the city plants to wash and sterilize the shipping cans. Further observations revealed the fact that at only five of the city plants receiving this milk were the returned cans sterilized and dried properly, and only six plants were equipped with machine washers and steamers. The remainder of the 35 city plants receiving the milk from 29 receiving stations used a sink and steam jet. Bacteriological examination at 21 of these country stations of shipping cans sent from the 35 city plants for transporting raw milk back to the city showed an inoculation of over 1,000 bacteria per cubic centimeter of milk.

In a study of milk can washing and sterilizing it was concluded[9] that "it is possible and thoroughly practicable to secure a comparatively low initial inoculation in milk cans when the proper equipment is installed and in constant daily use."

Inoculation from cans varies with the efficiency of washing, steaming, and drying and the length of time between the washing process and filling the cans with milk. It is important that only recently washed and sterilized cans be used for milk containers and that receiving stations be equipped for this work.

When milk is shipped in bulk in transportation tanks, it is important to thoroughly scrub and sterilize the inside of the tanks before filling with milk. In a study[10] of the use of tanks for transporting milk, the following conclusions relative to the care of tanks were made: "Special attention should be given to cooling the milk to a low temperature before it enters the transportation tank, as the condition of the milk when it arrives at its destination depends largely upon its condition and temperature at the starting point. Proper cleaning and sterilization of transportation tanks after each shipment is essential."

The change which occurs during the different stages through which raw milk passes from farm to the city through 24 country milk receiving stations is brought out in the following summaries, which represent the condition of milk received from producers, after milk is cooled and placed in cans for shipping, and upon its arrival at 35 city pasteurizing plants.

TABLE 7.

BACTERIAL CHANGE IN MILK DURING HANDLING AND SHIPPING THROUGH 29 MILK RECEIVING STATIONS.

| Bacteria per c.c. | Delivered by producers. (Per cent of 314 samples) | In shipping cans at country stations (Per cent of 134 samples)* | At city plants (Per cent of 134 samples)* |
|---|---|---|---|
| 1,000,000 and over | 18.1 | 29.9 | 54.5 |
| 500,000 to 1,000,000 | 26.4 | 15.7 | 13.4 |
| 100,000 to 500,000 | 22.3 | 41.0 | 22.4 |
| Under 100,000 | 53.2 | 13.4 | 9.7 |
| | 100.0 | 100.0 | 100.0 |

*Same milk.

A summary of temperature changes in the same samples is given in the following table:

TABLE 8.

TEMPERATURE CHANGE IN MILK DURING HANDLING AND SHIPPING THROUGH 29 MILK RECEIVING STATIONS.

| Temperature (Degrees F.) | Delivered by producers (Per cent of 314 samples) | In shipping cans at country stations (Per cent of 134 samples)* | At city plants (Per cent of 134 samples)* |
|---|---|---|---|
| 65 and over | 19.5 | 3.7 | 9.7 |
| 60 to 65 | 24.5 | 7.5 | 5.2 |
| 55 to 60 | 27.5 | 17.9 | 11.2 |
| 50 to 55 | 8.2 | 17.2 | 39.6 |
| 50 and under | 20.3 | 53.7 | 34.3 |

*Same milk.

It will be noted that while the milk is cooled considerably lower by its passage through the cooling stations, the bacterial content invariably increases. The tables show that 53.2 per cent of 314 samples received at 29 country receiving stations had less than 100,000 bacteria per c.c., but after milk at these stations was ready for shipment only 13.4 per cent of 134 samples contained less than 100,000 bacteria. When the same milk reached the city plant, only 9.7 per cent of the samples were in that class.

While the milk cooler and milk cans no doubt are the principal sources of inoculation, other equipment, such as the weigh tank, strainers, milk pump and pipes may contribute if they are not carefully washed and steamed after each use. Leaky cans should be watched for and when-

ever milk is spilled into the water in storage tanks, the tank should be drained. Sometimes storage tank water contains dirt from unclean ice or has a bad odor from some other cause. At these times the tank should be drained and thoroughly cleaned and steamed. The use of chlorin disinfectants is sometimes recommended, but it should be remembered that chlorin is not effective when organic matter is present. Thorough cleanliness is a preëssential to the use of any chemical disinfectant.

## Inspection

It is sometimes difficult for a milk inspector to give proper advice, from a sanitary standpoint, to milk station operators. The same routine is usually followed from day to day and usually the city pasteurizing plants have their bacteriologist to send out to their receiving station to make tests whenever necessary. However, some record should be made which will enable the health department or milk inspection force to know what is being done. Any system of rating, scoring, or recording should be uniform, simple, and well understood. New inspectors should be able to interpret records of former inspectors. A criticism which is sometimes made of numerical scoring is that credit is often given on score cards for apparatus which is not actually being used regularly and that too much is left to the judgment of the inspector.

A system in which a record is made of the facilities which are present and also states whether or not they are in use would seem to give the desirable information. Following this plan, a record card for receiving stations was devised for the use of inspectors in a large midwestern city. It has been in use for about two years and the health department deems it quite satisfactory for its purposes. Some sanitary inspection record of country milk receiving stations should be on file at city health depart-

ments and the following record card is suggested for that purpose.

**CITY OF.....**

**Division of Health.**

**Milk Inspection Department.**

Date ..... Receiving Station ..... Owned by .....

Ships to .....City ..... State .....

Quantity received daily ..... Gallons Source of supply.

Quantity shipped daily ..... " Number of producers.....

Quantity held over daily ..... " Other receiving stations.....

Quantity for later shipment..... " Producers' range of distance.....

Quantity for Mfg. cond. milk..... " Time of delivery.....

Quantity for Mfg. cheese ..... " Type of containers.....

Quantity for Mfg. butter ..... " Covering for cans.....

Quantity for Mfg. mk. powder..... "

Source of water supply..... Result of laboratory tests.....

| *Surroundings* | Yes | No | Remarks |
|---|---|---|---|
| Well drained ..... | | | |
| Stables or vaults etc., near..... | | | |
| *Employees* Number | | | |
| Present or recent illness.. | | | |
| (Nature of illness) | | | |
| Appearance neat and clean..... | | | |
| *Construction and arrangement* | | | |
| Separate receiving room.. | | | |
| Separate cooling room.... | | | |
| Separate boiler room.... | | | |
| Well lighted and ventilated..... | | | |
| Well screened..... | | | |
| Good floors (trap drain).. | | | |
| Gravity flow over cooler.... | | | |
| Storage after cooling.... | | | |
| Ice storage house..... | | | |
| *Equipment and methods* | | | |
| Toilet facilities..... | | | |
| Weigh tank..... | | | |
| Receiving vat..... | | | |
| Clarifier. Separator..... | | | |
| Strainer ..... | | | |
| Milk pump..... | | | |
| Milk cooler ..... | | | |
| Refrigerating machine.... | | | |
| Ice water. Brine..... | | | |
| Boiler ..... | | | |
| Can washing and steaming facilities ..... | | | |
| Milk storage facilities..... | | | |

Temperature of milk

Before cooling..... degrees F. How is milk shipped.....

After cooling..... " " Condition of cans.....

During storage..... " " Tests made on milk.....

**How often are tests made.....**

**Basis of payment.....**

**Inspector .....**

## Summary

Country milk receiving stations are necessary and of growing importance in securing an adequate and sanitary milk supply for large cities.

Sanitation in the highest degree is necessary at milk receiving stations.

The preferable location for a milk receiving station

would be in an area where abundant milk is available and where the milk can be delivered twice a day from the farms. Such location should allow the product to be loaded directly to railway cars, car tanks, or motor tanks or trucks for shipping to the city.

Adequate and safe water supply and proper waste disposal are factors influencing location.

Adequate light, ventilation, screens, and drainage should be considered in construction. An arrangement whereby milk is received at a higher level allows gravity flow and this is desirable. Well-drained floors of concrete, with trap drains and concrete walls extending at least three feet above the floor, are desirable.

Steam and refrigeration are necessary at milk receiving stations.

All equipment having possible contact with the milk in milk receiving stations should be so constructed and arranged as to facilitate prompt and sanitary handling of milk.

Schedules of trains hauling milk are not always suitable. Sometimes a considerable portion of milk has to be stored at the receiving station until the following morning, necessitating proper storage facilities and extra care, especially during hot weather.

Tests for butterfat and for quality usually form a basis for payment to the producer. Quality tests tend to encourage improvement when a premium is paid for better milk. Most of the tests for quality require time and therefore do not permit the immediate rejection of undesirable milk. However, progress is being made along this line, as indicated by the rapid method of hydrogen-ion determination in milk by using the Lamotte outfit.

The primary function of milk receiving stations is to cool milk properly and thus prevent spoilage. In the process of cooling, great care and cleanliness are essential.

Proper cleaning and sterilization of milk contact surfaces in milk stations and of milk cans or milk tanks used for shipping is essential. Washing and sterilizing the farmers' milk cans is an important function and it should be carried out by receiving stations. Steam sterilization of milk cans is preferable to chemical sterilization, as the latter method is not effective when organic matter is present or when it is not preceded by thorough cleanliness.

Some sanitary inspection record of country milk receiving stations should be on file at city health departments. Such record should show what facilities are present and also whether or not they are in daily use. Other conditions from a sanitary standpoint should be checked up frequently.

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*"In science, read by preference the newest works."*

# THE RELATION OF ECONOMY OF MILK PRODUCTION TO DAIRY SANITATION

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There is, I believe, a definite relation between economy of production of milk and progress in milk sanitation. The foundation of our industry needs attention now. The average gross income from each cow in the United States last year was only $100. Out of this must be paid the feed, housing and care, and milking of the cow, and if there is anything left, that is the profit. Of course, many of the herds supplying milk, in which you are particularly concerned, are above the average, and yet in every community there are cows and herds that are unsatisfactory, and until we raise the production of our cows the business of producing milk will not be on a sound basis.

When we realize that the average cow of this country produces only about four thousand six hundred pounds of milk a year, and that it is easily possible to develop herds with cows that give twice this quantity, we wonder why improvement is so slow. It requires the same barn space, the same work in feeding and for cleaning the barn, the same general overhead, and the same amount of labor for milking a cow that produces 4,600 pounds of milk as it requires for one that produces twice that much. The only difference is the slight additional amount of feed required to produce the extra amount of milk, and that is not great. Upon the amount of production, more than any other factor, depends the cost of production. In other words, the efficiency of the dairy largely depends upon the amount of production of the individual cow.

Many of you know that it is not difficult and does not require a very long time, through proper selection and breeding, to develop the kind of cows we ought to have on our farms, but we are not using the best means we have of doing this, and that is through the use of good bulls. It is rather a startling fact that even today it is necessary to visit as many as ten, and in many cases, twenty farms in the communities in which there are creameries to find one purebred bull. Good bulls are not expensive; they cost no more to keep than poor ones; without this one step our progress will be greatly retarded.

Of course, selection can not be very intelligently done without some sort of testing to determine the good cows. About one per cent of the cows in the United States are now in cow-testing associations, and although these associations have been in existence only a few years, the average cow in these associations produces about sixty per cent more than the average cow in the United States. The tabulation of 20,000 yearly individual records of cow-testing-association cows not only showed that the income climbs fast in proportion to increased production, but this study of the records actually measured this rate of increase and gave it to us in terms of dollars. For cows having an average butterfat production of 150 pounds, the income above feed cost was $26; at 300 pounds the income above feed cost was $74; and at 450 pounds the income above feed cost was $122. In other words, by increasing average production per cow three times, the average income over cost of feed was increased almost five times. This was accomplished with the same stable room, and by feeding and milking the same number of cows. To be sure it took more feed to support the high producers, but the figures just given show that the high producers bring in a greater net income over cost of feed.

In the study of cow-testing association records in our bureau we are also comparing the records of the daugh-

ters of purebred bulls with the records of the dams of the daughters. The results are startling. In some cases every daughter of the sire excelled a high-producing dam in production of milk and butterfat. In other cases every daughter of the sire produced less milk and butterfat than was produced by a medium to low-producing dam.

What are we going to do about it? Are we going to continue to use bulls, good, bad, and indifferent? I say no. We must get rid of the inferior and mediocre sires and use to the limit the sires that improve our herds. To put this work over in a big way we must all pull together. We need your help. Now we have the facts in the case. Using these facts as our weapons let us move forward and we can easily double the average production of our dairy cows. The lesson from this is to select profitable cows to breed and to use good, purebred bulls. In this way we can soon build up a more satisfactory foundation to this industry.

It is easy to increase production of our average cows when we use purebred bulls of reasonably good breeding and with ancestry of satisfactory production, and when we succeed in getting our average cow up to 300 pounds of butterfat a year other problems will confront us. But our need now is to get cows that average 300 pounds or more. In a study of more than 2,000 records of dams and daughters in cow-testing associations it was found that the average bull did not increase the production of cows that produced 384 pounds of fat per year.

The investigators and field men of our Bureau, cooperating with the dairy extension field men of the various States, are now at work to bring increased production through better breeding, and judging from the way they are going about it they will succeed. They are not stopping with the figures that show production of dams and daughters, but are carrying those figures right into the field and using them to defend or to condemn the sires. The bull will

not be condemned on his appearance nor on the appearance of his calves, but if he must be condemned it will be on the actual yearly production records of his daughters. The cow-testing association has already eliminated guesswork from the selection of our dairy cows. It is just beginning to eliminate guesswork from the selection of our dairy bulls.

The dairy feeding programs of many of our communities are not satisfactory. Too often the practice is to feed the dairy cows whatever happens to be available. If there is some hay that can not be marketed, or some other feeds, and pasture, they are often depended upon to feed the cows. There are certain best feeds for every community, and I will say at this point that experience and experimentation have shown that pasture and roughage should have the greatest consideration in working out a feeding program. There are some best crops for each community. If alfalfa or sweet clover or other crop is the best legume, plan to have as many acres planted as will fully feed the herd even in the poor years. Silage and other crops should be planted in the same way. In fact, on some of the Government farms we are feeding our herds on pasture and roughage alone and are getting splendid results, both in quantity of milk and profitableness of production. To do this, however, requires good pasture and good roughage. Alfalfa, sweet clover, and other legumes, also silage or other succulent feed, seem essential for economical production. For highest production, and under most conditions, for cheapest production, the cows must be fed concentrates according to the amount of milk they give.

The facts, therefore, about economical production and our present situation, so far as our dairy herds are concerned, are, first, that the average cow is not good enough. It is easily possible by selection and breeding to double the production of the average cow, and when

this is done her profitableness is many times increased and the farmers' interest in dairying stimulated. The second need is that of good bulls. On a large percentage of our dairy farms we are not using good bulls and could do so to our very great advantage. The third need is for a feeding program in each community.

Now this discussion is not entered into to form a basis for you, as inspectors, to take the place of specialists in dairy extension, or even to suggest that you devote any part of your time to bringing these things about, but this is a big and important job in the development of our industry and we need the support and encouragement of every group of people interested in the industry. My purpose in bringing this before you is to ask your support, encouragement, and cooperation with the agencies in your State and communities that are working to bring this improvement about, and I believe that where more economical production can be brought about better conditions and sanitation will easily follow.

There seems to be an impression that there is danger of overproduction of milk in this country. It is not my purpose today to discuss this point at length, except to say that the recent trend in production and consumption is not such as to indicate that we shall overproduce in the near future. Consumption is increasing in this country more rapidly than production.

The consumption of milk in all its forms has increased about twenty-five per cent, or from 834 pounds in 1918 to 1,020 pounds per capita in 1924. The consumption of all dairy products, including milk, butter, cheese, ice cream, condensed and evaporated milk, has increased. Consideration, of course, must be taken of the fact that the consumption of butter and cheese was lower in 1918 than it had been for some years before, due to the propaganda against the use of these two products in order to have available increasing amounts for our soldiers and our

allies during the war. By consideration I mean that it may be assumed that it is easier to make progress towards a practice that once existed than to change to an entirely new mode of living. With some other products, however, it has been noticed that they have remained at the restricted consumption of the war period.

The knowledge of the worth of dairy products, it seems to me, has as a whole taken a very noticeable place in the minds of the American people. In some communities, through educational work, the knowledge of the importance of milk has become widespread, chiefly to the advantage of the consumers themselves, but incidentally this increased consumption has had a very desirable effect upon the development and progress of the dairy industry. Experience, however, has shown that such educational work must be continuous and that there are still many millions of people to be reached.

The most noticeable increase is the consumption of milk itself, which amounts, since 1918, to 25 per cent. Consumption of butter has likewise increased a little over twenty per cent, namely, from 14 to 17¼ pounds per capita; cheese consumption shows an increase of 40 per cent over 1918, but during the latter year consumption was very low, and the consumption even now is relatively low compared with that of other countries. Practically all the increase that has taken place in consumption of cheese since the war has been for imported cheese and not for American made. The use of ice cream has made a rather steady increase since 1918, but does not compare with the increase before the war. There was a slight setback in 1921, due perhaps to the industrial depression, and another in 1924, due perhaps partly to lower buying power, but more particularly to the cool season throughout the large ice-cream-consuming centers. The consumption of condensed and evaporated milk has also increased.

## Per Capita Consumption of Dairy Products

1918-1924

| | 1918 | 1919 | 1920 | 1921 | 1922 | 1923 | 1924 |
|---|---|---|---|---|---|---|---|
| Milk for all products..(lbs.) | 834 | 831 | 841 | 923 | 950 | 998 | 1020 |
| Milk, household use....(gals.) | 43.0 | 43.0 | 43.0 | 49.0 | 50.0 | 53.0 | 54.75 |
| Butter .....(lbs.) | 14.0 | 14.8 | 14.7 | 16.1 | 16.5 | 17.0 | 17.25 |
| Cheese .....(lbs.) | 3.0 | 3.5 | 3.5 | 3.5 | 3.7 | 3.9 | 4.2 |
| Ice Cream .....(gals.) | 2.14 | 2.49 | 2.46 | 2.28 | 2.43 | 2.68 | 2.5 |
| Cond. and Evap. Milk.(lbs.) | 12.5 | 12.3 | 10.17 | 11.4 | 12.69 | 13.25 | 14.05 |

It may be interesting in this connection to record what this change has meant to the dairy industry, partly through increase in population, but more to increased per capita consumption. There was consumed in the United States in 1924, 114 billion pounds of milk, either as milk or milk products, as compared with 86 billion in 1918. This means an increased consumption of 28 billion pounds of milk, and to produce this would require 6½ million of our average cows. In that time we have increased our cows a little more than two million, so that the increased consumption in the last seven years is greater by three times than the increase in cow population that would be required to produce it. This enormous increase in the amount of milk, however, has been supplied through an average production of 500 pounds of milk more per cow than in 1918, partly because of the relatively advantageous price last year as compared with 1918. Cows were fed more liberally and general improvement in the milk-producing ability of our cattle has been brought about through better breeding. In 1918 we exported the equivalent of 2¼ billion pounds of milk, while last year we imported one-quarter billion, thus adding 2½ billion pounds to our available supply for consumption, and the difference of product on hand in 1918 as compared with 1924 adds another three-quarter billion.

These altogether account for the source of most of the 28 billion pounds of milk and milk products consumed in 1924 above 1918. In the case of butter we have an increased consumption due to this increased per capita of 3¼ pounds, plus the increase in population of almost nine million in that period, requiring now over 450 million pounds more per year to supply the butter needs of the people of the United States than was used in 1918. To supply the increase in consumption of butter alone since 1918 requires more than twice as many cows as we have added to our herds in that same time.

The average consumer in the United States uses about one thousand pounds of milk a year, either in milk or its products. The average cow produces a little over four thousand pounds, which means that for each increase of four in population one cow—of the average kind—is needed. Our population is increasing at the rate of one million and a half a year, so that it will be seen that at the rate we are going 375,000 new cows are needed each year to simply maintain the present per capita consumption and take care of the new population each year. There have been only one or two years in the last ten that we have increased our herds by this number, and the average falls far below it.

But whether we overproduce or not, the point that seems more important to me is that we produce our product more economically, and this can be done by methods we now know. Our average production can be doubled and it is in this way that we, it seems to me, have the greatest opportunity for meeting the growing need for milk. We need not add a single cow to our numbers in the next 50 years, and we should add none, but meet the increased population and increasing appreciation of milk through the development of better cows, and better feeding programs, and in this way benefit not only the dairymen, but all mankind.

*"The greatest rewards of mankind are obtained by those who earnestly and conscientiously work."*

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

DR. C. D. PEARCE, *Chairman*

There is very little for this committee to report, as there have been no great epidemics of disease among cattle since our last meeting. The quality of our milk supplies as a rule is constantly improving, although the menace of disease transmission from animal to animal or from animal to man demands constant vigilance if these ills of man and beast are to be controlled and kept at a minimum.

The question of bovine diseases as it applies to cattle is largely economic. Through death or by rendering dairy animals unfit for milk production these diseases take their yearly toll. There is a loss not only of the cattle themselves, but of the milk they would have produced had they remained healthy. Some idea of the losses from specific bovine diseases may be obtained from the estimate furnished by the U. S. Department of Agriculture. They estimate that the losses from this cause during the past year amounted from one hundred million dollars to one hundred and thirty million dollars. This does not take into consideration losses from parasites, exposure, accidents, etc., which would increase this estimate materially. These figures include all cattle, as estimates for dairy cattle alone have not been made available.

As we are a part of the great dairy industry and as these diseases materially affect our milk supplies, some of our efforts may well be put forth toward educating the producers of milk to eliminate some of these losses. In other words, we should aid in conserving our live-stock interests by practising preventive medicine.

In considering the question of bovine diseases and their relation to the public health, it is difficult to obtain definite data. As the report of this committee is limited to bovine diseases, milk-borne epidemics such as typhoid, diphtheria, scarlet fever, etc., will not be discussed. These diseases are of human origin and bovine animals are apparently immune and not carriers of them. The organisms causing these diseases, however, sometimes find their way into milk supplies and may cause serious impairment of public health.

At our meeting last year there was considerable discussion of the outbreak of foot-and-mouth disease that occurred in California. You will no doubt be interested in the report sent in by one of the members of our committee, Dr. J. J. Frey. The report is as follows:

"The opportunity for studying the relationship of foot-and-mouth disease to the milk supply and public health was afforded in California during the past year. In a period of five months there were 23,086 head of dairy cattle condemned and slaughtered on account of this disease. The milk supply of some of the largest cities in the State was involved. However, through the application of stringent veterinary police measures, with the prompt disposal of infected herds, together with close supervision of all market milk and cream establishments, no cases of the disease were reported in the human and no transmission occurred through the medium of dairy plant operations. In the infected areas daily veterinary inspection of dairy herds was exercised. All market milk and cream was required to be pasteurized between 140° and 145° F. for thirty minutes. The option was given of distributing raw milk under constant ranch inspection. In all dairy or milk plant operations special attention was paid to the sterilization of all equipment, particularly the cans which may be shifted from one ranch to another, and including the disinfection of milk trucks. It was required that all milk from the ranches be

collected at the roadside, no admission to the dairy premises being permitted under any circumstances.

"The constant inspection in milk plants necessitated a corps of over three hundred inspectors. The cost of maintaining this supervision was paid by the plants with practically no opposition or complaint. The dairy industry of the State deserves high commendation for its part in promoting eradication work.

"The occurrence of foot-and-mouth disease in the foothill districts was followed by limited infection among the deer in the mountains of Tuolumne County. An entirely different problem was encountered in eliminating the disease among the deer owing to the inability of placing the animals under close confinement and due to the topography of the mountain districts which offered considerable resistance in carrying out routine inspections."

An outbreak of foot-and-mouth disease also occurred in Texas the latter part of September, 1924. This was discovered on a ranch 20 miles southeast of Houston, and before the disease was apparently stamped out 148 herds in Harris and Galveston Counties, Texas, were slaughtered. This year in the latter part of July, foot-and-mouth disease was found on the same premises where the 1924 outbreak began, and it is thought that the infection has been carried over from the previous outbreak. Ninety-six head of cattle were slaughtered and a quarantine placed on a large portion of Harris County. On August 5, another infected herd was discovered within the quarantined area.

Thanks to the activity of the Bureau of Animal Industry and State authorities, foot-and-mouth disease has never really gained a foothold in this country and we pray it never will. Although it is only rarely transmitted to man, it causes tremendous economic losses to live stock in countries where it occurs year after year.

The bovine diseases that are likely to affect public health

through milk are those involving the udder or the region in close proximity to that organ.

One of these, tuberculosis, is still receiving a great deal of attention. The various States and communities are cooperating with the Federal Bureau through the accredited herd plan to control this scourge, not only on account of its being transmissible to man, but because of the losses to the live-stock interests. These are estimated to be many million dollars a year. This work of tuberculosis eradication has gone steadily forward during the past year. More money has been appropriated by various States, with the result that more herds have been tested and more herds have been accredited.

In addition to Federal activities an ever-growing number of cities is demanding that all raw milk sold within their borders must be produced from tuberculin-tested cows and that all other market milk sold must be pasteurized. Most of these cities are actually supervising the tuberculin testing and pasteurization operations.

California has passed laws that all cows producing raw market milk must be tuberculin-tested by veterinarians in the full employ of the State and that all other market milk must be pasteurized under special supervision. If this proves a success in California, other States no doubt will adopt similar legislation.

There are also many communities demanding tuberculin testing of cows producing milk consumed locally. These are generally smaller municipalities where no milk is pasteurized. This is a step in the right direction, but many authorities believe that when this is the only supervision given a market milk supply, such places are resting under false security due to the fact that the tuberculin test is applied, in many cases, no oftener than once a year, with little or no attention paid to the sanitary production of the milk itself. While this test may give protection against

tuberculosis, there is no protection against other diseases that may be transmitted through milk.

Where the tuberculin testing of dairies supplying raw market milk is carefully carried out and all other market milk is properly pasteurized, tuberculosis is rapidly disappearing as one of the milk-borne diseases.

The various inflammations and diseased conditions of the udder are grouped under the general name of mastitis. In bovine mastitis changes generally take place in the tissues of the udder as well as in the milk. Pus-producing organisms are generally found and abscess formations are not infrequent. It goes without saying that milk should not be used that comes from an udder where either an acute or chronic inflammation is present. This does not mean that all cows suffering from mastitis should be condemned. They should, however, be quarantined and the milk withheld until there is no further danger. In cases of chronic mastitis, or where recovery is improbable, cows should be disposed of. The number of cows throughout the country that have lost one or more quarters of the udder are a mute testimony to the prevalence of mastitis among cows. Many of these, however, are no longer a menace to health as the one or more quarters involved have been completely destroyed.

In order to have some control over this condition, a physical examination by competent veterinarians is of prime importance as a means of educating dairymen in disease prevention and in disposing of undesirable cows. If the first few streams of milk from each quarter are drawn upon a fine, wire-mesh strainer, abnormal milk is readily seen and many obscure cases of mastitis are discovered. A utensil containing such wire-mesh strainer cloth is called a strip cup, and has been used to advantage by milkers on certified farms, by veterinarians when making physical examinations, and by dairy inspectors.

One of the specific diseases involving both men and bovines is septic sore throat. The streptococcus causing this disease in man is also capable of causing mastitis in cows. It is a disputed question, however, as to whether or not this disease originates with man. This need not enter into this discussion. The fact remains that year after year there are outbreaks of this disease in some section of the country, many times resulting in death. The evidence points to its spread through milk and investigators have proved that in many cases the disease came from cows with diseased udders. This fact alone calls for a careful consideration of udder conditions.

Besides disease-producing organisms that may be transmitted through milk, there are numerous other bacteria that find milk a convenient medium for their propagation. As some of these are capable of making changes in the milk, its quality may be materially affected. A poor quality of milk, in turn, may have a decided effect on public health, as the cow has become the foster mother of the vast majority of babies born in this country. Milk forms an important part of the dietary for the first few years of life and as the digestive tract of the young is delicate, a poor quality of milk may become a contributory cause to diarrheal and other digestive disturbances. As our babies will become the men and women of tomorrow, our milk supplies should be so supervised as to give them the best and safest milk obtainable.

Investigators have proved that proper pasteurization destroys disease-producing organisms sometimes found in milk. In cities where milk has been so treated there have been few, if any, outbreaks of disease traced to milk properly pasteurized. This would appear to be the control measure that will eventually solve the problem of disease transmission through milk.

Therefore, your committee believes that bovine diseases

and their relation to the milk supply and to the public health may be controlled by maintaining clean, healthy herds; by producing clean, wholesome milk through careful milking and handling; and by proper pasteurization that will destroy disease-producing organisms which sometimes find their way into our market milk supplies.

*"We do not need more cows so much as we need better cows."*

# AN INFANT IN THE DAIRY INDUSTRY

DR. H. E. VAN NORMAN, *President,*
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Early in the middle of the last century, efforts to concentrate milk were successful as evidenced by the production of condensed milk on a commercial scale in the early '50's.

This process consisted of placing the milk in vacuum pans and, under vacuum, boiling off the water till the milk was sufficiently concentrated. In order to preserve it successfully, cane sugar was added, and today technically in the market, "condensed milk" refers to milk which has been concentrated and preserved with sugar.

In the middle '80's, milk condensed in vacuum was sterilized in the retail container, and this has developed a market under the name "evaporated milk."

By the condensing process, milk is concentrated so that it has twice the amount of milk solids per quart that it does in its natural state.

As far back as the '50's, men were not satisfied with this partial concentration and history records persisted attempts to carry this concentration on to the point of dryness. It was not until about 1905 or 1906 that methods were so perfected as to make the drying of milk a commercial success.

While the method of drying was so perfected as to make a thoroughly marketable product, the presence of the fat made it very difficult to preserve indefinitely the dry or powdered whole milk, so difficult, in fact, that the industry of drying whole milk has grown rather slowly until very recently. However, under the stimulus of a demand for a market for skim milk, and lacking the difficulties in-

cident to preserving whole milk, the industry of drying skim milk has grown by leaps and bounds. Government figures report a production of 16,000,000 pounds of dry skim milk in 1916, while only nine years later, the 1924 production attained the total of 69,000,000 pounds, with indications of steady growth in demand and supply. The annual increase plotted in a curve makes an almost straight line from 1916 to 1924 except for the years 1921 and 1922, in both of which the production was less than in 1920, but the production in 1923 was very much greater than in 1920 and in 1924 still greater.

The fractional products of milk are all exceptionally high-grade human foods. Each has its character and particular usefulness. Milk is commonly separated into "cream" and "skim milk." On the farm and in the factory, this is done by centrifugal force; in the home, left to stand, the cream rises. In city homes, mother "pours the top" of the bottle off for coffee, while the "bottom" or "skim" milk is given to the children to drink, put on the cereal, or used in cooking. Again, cream, by churning, is separated into butter and buttermilk, both of which are highly esteemed foods. And finally, we may take the skim milk and separate its food solids from its water by application of heat and evaporation of the water, leaving "dry skim milk" (powder or flake, spray or roller).

It is doubtful if there has ever been a time when the food value, not only of milk, but of the various parts of milk, was as highly esteemed as at the present time.

Scientific research in late years has corrected our inappreciation and misapprehension as to the value of various milk products. Cream was always good, but better if richer in fat. But skim milk—white, even blue-white—has been a neglected product in many homes and on many farms, and yet it contains, under ordinary conditions, three-fourths of all the food value of the original milk. Farmer and

housewife alike, while belittling the value of skim milk, have not hesitated to feed it to calves, pigs, chicks, and even their babies, have even claimed that "it was good for them," and our agricultural literature is rich in reports of feeding experiments which testify to the correctness of this claim. We are not so fortunate in the volume of scientific data and literature substantiating the claims of high food value in skim milk for growing children, but the evidence is rapidly accumulating.

Commercial dry skim milk, spray or roller, powder or flake, is made usually by one of three processes: (1) The liquid, or partially condensed, milk is sprayed into an air chamber where hot air carries off the moisture, leaving a dry product which is bolted or sifted, giving it the common name of "powder." (2) Partially condensed, it is spread on steam-heated rollers in a film so thin that all moisture is driven off before the roller completes one revolution. A knife scrapes this film off. This product is ground and sifted or bolted to make roller-process powdered milk. (3) Partially condensed milk is spread on a wire-mesh belt, passed through a drying chamber, and the resulting product left in a flake or granular form.

Irrespective of the process—spray, roller, or belt—or the form—"powder" or "flake"—dry skim milk must be made from the best grade of milk, since concentrating the solids also concentrates and makes more evident the faults, if any prevail, in the original milk. Most dry skim milk is made by concerns having an outlet for the highest grade of butter or cream. They must buy the whole milk to secure quality and quantity, or they want to increase the return to the farmer and stimulate dairy development by making a more remunerative market for the cow owners' product.

Starting with the best of raw material close to source of production, delivered from farm to factory daily, and in some cases twice daily, the process of drying automatically

stops bacterial growth, even destroys most of that present and puts the product in a form to prevent, through lack of moisture, any further development of the bacteria which may survive the drying process or gain accidental access.

Fluid milk is seven-eighths water, one-eighth food solids —ideal combination for bacterial growth, a perfect food, in fact. Three-quarters of these solids are the skim-milk solids, containing, when dry, practically all the calcium and other minerals which make milk so perfect for growing children, the protein, most valuable of all proteins (animal or vegetable), and the milk sugar (lactose), which recent discoveries suggest has a higher dietetic value than has yet been understood.

The most important use for dry skim milk is doubtless in the bakery, particularly for bread where, added to the dough at the rate of about five pounds for each one hundred pounds of flour, it supplements the high qualities of white bread by adding four or five times as much mineral, largely calcium, as the bread naturally contains. It supplements the wheat protein by an even more valuable milk protein and carries the milk sugar, the value of which we are just beginning to appreciate. The resulting loaf is more attractive to look at, and has better color, better texture, improved flavor, in addition to its greater nutritive value and better keeping quality. It is also used in many of the other articles of bakery manufacture.

The ice cream manufacturer can meet his fluctuating demand by a reserve supply of dry skim milk and unsalted butter, each in condition to stand holding or storage longer than any other form. With these at his command, he has quality, convenience, economy and assured supply.

The candy manufacturers and the makers of prepared flours are also generous users of dry skim milk in their goods. It is even reported that manufacturers of cosmetics

find that dry skim milk is a desirable ingredient of their beauty-producing goods.

Inspectors who come in contact with the milk producer will doubtless find an increasing use of dry skim milk among those more progressive breeders who are learning that only by breeding their best cows and saving the heifer calves can they hope to increase the average production of their herds. When he can sell his whole milk solids at twenty to thirty cents a pound, as many are doing, and can buy skim milk solids dried for ten to fifteen cents, it is good economy to raise some calves.

While outside of the inspector's field, it may be interesting to know that the poultryman, especially the raiser of baby chickens, is finding that the addition of dry skim milk to their mixtures does something for the chicks which no other feed does. It lowers the death losses, reduces the number of culls, increases the rapidity of growth.

Even the producers of laboratory animals for research work have found skim milk powder a desirable and essential part of their standard mixtures for producing animals of uniform growth and health.

Ignorance of the intrinsic value of the methods of production and distribution of some of the fractional dairy products has been responsible in the past for local prohibitions which, in the light of science, can only be explained by misunderstanding, to state it mildly. It is not necessary to prohibit the use of any milk product merely to prevent a limited amount of abuse. In the early days of the milk industry, we did not padlock the pump because its product sometimes found its way into vessels where it did not belong. We have passed the time when skim milk should be forbidden to the public because somebody surreptitiously sold it for what it was not.

We now know that containing, as it does, three-fourths

of all the food value of the original milk, it is a desirable food product.

Relieved of its water, nine tenths of the shipping weight has been eliminated; thus dry skim milk produced in the valleys of the Pacific Coast is shipped through the Panama Canal for consumption in the great industrial centers of the East at a price less than fluid skim milk can profitably be shipped a hundred miles.

It is the growing appreciation of its high intrinsic food value that is bringing this article into the limelight of public recognition.

*"Today is yesterday's pupil."*

# THE PROGRESS OF TUBERCULOSIS ERADICATION WORK

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Gratifying progress was made during the year in the cooperative work of eradicating animal tuberculosis. The cooperation existing between the respective State, county, municipal and Federal officials was further cemented and improved. On account of increased appropriations, improved State laws, and a better understanding on the part of the live stock owners, more complete plans looking to the absolute eradication of the disease were formulated. In a number of States these plans are now so complete as to enable a rather definite prognosis as to just when the complete eradication of the disease may be expected in these States. These plans, naturally, are based upon the furtherance of the area plan of eradication, which is now recognized generally as the only method to be pursued on an intensive basis.

Tuberculosis of live stock is losing its foothold in North America. Our esteemed neighbor of the North has been waging a vigorous campaign against the disease, and our people in the United States have shown a determination that knows no compromise, to stamp out, not only tuberculosis, but also other maladies that sap the vitality and profit out of our animals. We have a very good illustration in the attitude demonstrated by a number of States when recent injunctions were granted in Texas restraining officials from destroying animals affected with foot-and-mouth disease. The quarantines issued by the various States against the introduction of live stock, hay, straw, hides, and

many of the principal commodities from the Lone Star State, are a warning that interstate commerce in general may be greatly interfered with when trifling methods are employed to frustrate the honest endeavor of a State to suppress outbreaks of infectious diseases which, if not controlled, may mean their rapid spread throughout the United States, causing chaos to the industry. The State quarantines against Texas had hardly been issued when the injunctions were dissolved. I am happy to say that the cleaning up of foot-and-mouth disease in Texas is now proceeding in the usual way employed in its eradication.

The people as a whole, and the live stock owners in general, have declared, most emphatically, that tuberculosis shall be suppressed. They have instructed their legislators, State and Federal, to make funds available so that the work may keep pace with the demand for it; and yet the demand increases and outstrips the organizations built up to carry on the work. The legislatures of upwards of forty States met during the past winter and increased their total appropriations from about six million dollars for the payment of indemnity to almost twelve million dollars; and yet there are indications now that in a number of the States the appropriations will be inadequate to carry on the work at the present pace for the biennial for which funds were provided. There is no doubt, however, that so long as the work is carried on in a systematic and thorough manner, the people will support it and will find ways and means to keep it going until the disease is entirely under control, if not entirely suppressed.

## Accredited Tuberculosis-Free Herds

Despite the preference given to the area project, the tuberculin testing under the accredited herd plan was conducted in all States. The conclusion of August showed a total of 76,155 fully accredited herds, containing 1,327,457

cattle; once-tested-free herds in process of becoming accredited, 980,383, containing 8,463,011 cattle; total herds under supervision, 1,191,874, containing 12,868,513 cattle. As an indication of the interest displayed by live stock owners, at the end of August there were on the waiting list 393,812 herds, containing 3,474,811 cattle.

In establishing this large number of accredited herds, and also in the course of the area eradication work (reported under another heading), the tuberculin test was applied to 66,429 herds, containing 676,856 cattle, of which 19,066 cattle, or 2.8 per cent, were condemned as diseased.

The following table shows by years the number of cattle tested annually, the number of reactors obtained, and the accredited and once-tested-free herds:

PROGRESS OF WORK OF ESTABLISHING ACCREDITED HERDS FREE OF TUBERCULOSIS

| Fiscal Year | Cattle * tested | Number reactors | Per cent reactors | Accredited Herds | Accredited Cattle | Passed one test Herds | Passed one test Cattle |
|---|---|---|---|---|---|---|---|
| 1918 | 134,143 | 6,544 | 4.9 | 204 | 6,945 | 883 | 22,212 |
| 1919 | 329,878 | 13,528 | 4.1 | 782 | 19,021 | 6,535 | 117,243 |
| 1920 | 700,670 | 28,709 | 4.1 | 3,370 | 82,986 | 16,599 | 197,577 |
| 1921 | 1,366,358 | 53,768 | 3.9 | 8,201 | 193,620 | 49,814 | 643,233 |
| 1922 | 2,384,236 | 82,569 | 3.5 | 16,216 | 363,902 | 161,533 | 1,548,183 |
| 1923 | 3,460,849 | 113,844 | 3.3 | 28,526 | 615,156 | 312,281 | 2,724,497 |
| 1924 | 5,312,364 | 171,559 | 3.2 | 48,273 | 920,370 | 529,018 | 4,772,836 |
| 1925 | 7,000,028 | 214,491 | 3.1 | 72,383 | 1,275,063 | 921,758 | 8,047,540 |

*Includes testing under area plan.

It will be noted that the total number of cattle tested during the period from 1918 to 1925, inclusive, is 20,688,526, with 685,012 reactors, or 3.3 per cent.

## ERADICATION OF TUBERCULOSIS FROM AREAS

Amazing progress was made in the eradication of tuberculosis from cattle under the circumscribed area plan, the county usually being used as the unit of territory to be freed from disease. The rapid growth of this project again fully demonstrates the value and efficiency of the plan. At the close of the fiscal year there were 591 counties in the United States which were either classified as modified accredited areas, had completed one or more tests of all

cattle, or were intensively conducting tuberculosis eradication work. This is an increase over the 318 reported as having been engaged at the close of the previous fiscal year, an increase of approximately 86 per cent. Of these 591 counties, 89 were classed as modified accredited, in comparison with 38 for 1924. Counties reported as having completed one test of all the cattle, including modified counties, totaled 185. Those reported as intensively engaged but not yet completed were 396.

### Accredited Herd Failures

Recently the statement was made regarding a number of successfully accredited herds not remaining on the list. A summary of this statement covering the period of from July 1, 1924, to April 30, 1925, is as follows:

Accredited herds tested..... 18,795
Herds removed from list..... 984 (5.2 per cent)

One of the main reasons for herds being taken off the list is the addition of cattle from herds not under supervision. It is rather surprising the number of owners who are willing to take a chance by introducing cattle into herds not knowing the health status of such cattle. The fact that cattle from accredited herds sell at a premium has been used by some persons at times to represent animals they have for sale or to make statements that certain animals are from accredited herds, when, as a matter of fact, they were not. We have investigated the origin of a number of cattle shipped interstate as accredited which at destination reacted to the tuberculin test. In several instances it was found that the animals were sold out of accredited herds several months prior to the time they were shipped interstate, and had been traded a number of times during the interim. Such practices bring discredit on the Plan. It, therefore, behooves everyone connected with the work in an official capacity to be mighty careful about issuing interstate certificates cover-

ing interstate shipments of cattle which are alleged to be from accredited herds. As a matter of fact, they should know that the animals shipped are those covered by the certificate. Owners can be of great assistance in keeping up the efficiency of the Accredited Herd Plan, if they will notify the State whenever they sell an accredited animal. They agree to do this when they sign the joint agreement placing their herds under supervision. Just now we are investigating a rather suspicious transaction involving the sale of a large number of cattle represented as having come from an accredited herd. I often wonder if we did not make a mistake in changing the original plan, which provided for the accrediting of purebred cattle. You will recall, after the plan was in operation one year, it was modified so as to permit the accreditation of herds solely constituted of grade cattle. There is so much trading of cattle in certain localities, and so many owners fail to exercise the necessary precaution to safeguard their accredited herds. Of course this danger of reinfection becomes less as areas are cleaned up, but until that is accomplished every herd that is accredited, or reaccredited, should be carefully checked to see that it is as represented.

## Tuberculosis Impartial

The question is frequently asked: "Are not certain breeds of cattle more susceptible to tuberculosis than others?" As far as can be determined tuberculosis plays no favorites. This is proved by the following report, which covers the period from July 1, 1921, to April 1, 1924.

| BREEDS | Number of Cattle tested | | Number of Reactors found | | Per cent Reactors | |
|---|---|---|---|---|---|---|
| | Pure Bred | Grade | Pure Bred | Grade | Pure Bred | Grade |
| Aberdeen-Angus | 43,193 | 32,866 | 2,119 | 1,570 | 4.9 | 4.8 |
| Ayrshire | 31,230 | 31,850 | 1,299 | 2,427 | 4.16 | 7.62 |
| Brown Swiss | 11,542 | 10,397 | 442 | 640 | 3.83 | 6.16 |
| Devon | 728 | 274 | 5 | 43 | .7 | 15.7 |
| Dexter | 14 | 1 | 0 | 0 | | |
| Dutch Belted | 535 | 413 | 26 | 11 | 4.9 | 2.66 |
| Galloway | 761 | 760 | 93 | 22 | 12.2 | 2.9 |
| Guernsey | 138,544 | 268,612 | 3,376 | 12,330 | 2.44 | 4.59 |
| Hereford | 89,103 | 102,982 | 835 | 1,349 | .94 | 1.31 |
| Holstein-Friesian | 592,925 | 1,525,765 | 39,962 | 106,755 | 6.74 | 7.0 |
| Jersey | 224,429 | 1,125,163 | 4,797 | 23,415 | 2.14 | 2.8 |
| Milking Shorthorn | 3,270 | 5,600 | 230 | 290 | 7.0 | 5.18 |
| Polled Shorthorn | 8,694 | 2,733 | 140 | 35 | 1.61 | 1.28 |
| Red Polled | 14,452 | 9,325 | 438 | 345 | 3.3 | 3.7 |
| Shorthorn | 264,882 | 683,616 | 13,662 | 23,293 | 5.16 | 3.4 |
| Nondescript | | 656,084 | | 43,597 | | 6.6 |
| Total | 1,424,302 | 4,456,439 | 67,424 | 216,122 | 4.7 | 4.8 |

| | |
|---|---|
| Total cattle tested | 5,880,741 |
| Total reactors found | 283,546 |
| Per cent reactors | 4.8 |

## How Reliable is Tuberculin?

From the very inception of the use of tuberculin as a diagnostic agent its reliability has been questioned, more especially by those who are not thoroughly familiar with its use and accomplishment. Much has been written on the subject, but still it is maintained by some people that this biologic is not to be relied upon, because when it is introduced into cattle it condemns some that are not tuberculous and fails to produce reaction in tuberculous cattle.

The Bureau, in order to obtain some up-to-date statistics along this line, addressed letters to field representatives in nine States, asking them to submit reports of tests on herds where the entire herd reacted and post-mortem

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Statistics Showing
Accuracy of the Tuberculin Test

| State | Herds | Cattle | Reactors: Lesions | Reactors: No Lesions |
|---|---|---|---|---|
| **Intradermic** | | | | |
| Connecticut | 11 | 256 | 243 | 13 |
| Indiana | 1 | 25 | 25 | 0 |
| Massachusetts | 36 | 751 | 738 | 13 |
| Michigan | 58 | 574 | 558 | 16 |
| New Jersey | 1 | 23 | 23 | 0 |
| New York | 3 | 51 | 44 | 7 |
| Ohio | 13 | 178 | 168 | 10 |
| Vermont | 16 | 425 | 414 | 11 |
| Wisconsin | 18 | 287 | 271 | 16 |
| Total | 157 | 2,570 | 2,484 | 86 (3.3%) |
| **Subcutaneous** | | | | |
| Massachusetts | 2 | 66 | 66 | 0 |
| New York | 11 | 268 | 258 | 10 |
| Total | 13 | 334 | 324 | 10 (3.0%) |
| **Subcutaneous-Ophthalmic** | | | | |
| New Jersey | 5 | 38 | 38 | 0 |
| **Intradermic-Ophthalmic** | | | | |
| Connecticut | 1 | 26 | 26 | 0 |
| New York | 328 | 3,946 | 3,740 | 206 |
| Ohio | 3 | 22 | 20 | 2 |
| Vermont | 1 | 9 | 9 | 0 |
| Total | 333 | 4,003 | 3,795 | 208 (5.2%) |

reports were made on same. From the nine States information was received which leaves no doubt as to the reliability of the test. The following statistics indicate the most extraordinary degree of efficiency. It will be noted that of the 2,570 cattle that reacted to the intradermic test alone, lesions were found in 2,484 and no lesions reported in 86 cattle. Remember that these 86 no-lesion cases came out of herds where 100 per cent of the cattle reacted. It is unnecessary to make any argument because it is almost a foregone conclusion that at least the great majority of the 86 cattle were tuberculous. The lesions were not revealed, but in all probability the balance of the 86 were infected with the tubercle organism and the reaction was a true reaction to the infection.

## No-Lesion Cases

During the month of August, 1925, there were destroyed on account of tuberculosis 19,872 cattle, all of which represented reactors condemned by cooperating veterinarians engaged in the eradication campaign.

The number of no-lesion cases among the above mentioned cattle amounted to 1,174, or 5.9 per cent. This is the lowest percentage of no-lesion cases that has been found during any month since the cooperation campaign was inaugurated. It speaks very highly for the skill of the veterinarians and for the splendid cooperation furnished by the meat inspection forces, State and Federal, who conduct the post-mortem work. It is hoped that the no-lesion cases may be maintained at least at this low level, because we all appreciate the fact that when the live stock owner receives a report of a high percentage of his cattle showing no lesions of the disease, it is not only discouraging to him, but to all his neighbors as well. While we all feel great confidence in the reliability of tuberculin, we must not put the full responsibility on that biologic, but should resolve to make a

full study of each herd and of the results obtained from each test.

## Disposition of Reactors

The original Act of Congress creating the Bureau of Animal Industry prescribes in Section 6 that no animals affected with contagious, infectious and communicable diseases may move interstate. Until a few years ago it was impossible to move known tuberculous cattle interstate, but as cooperative work increased, it was found absolutely necessary to amend the law so as to permit reactors to be shipped interstate for immediate slaughter. It was believed at that time that sufficient safeguards were employed to make it highly improbable that unscrupulous persons would violate the law by diverting tuberculous cattle for purposes other than slaughter. However, as with many other laws, there are those who will violate even a law the object of which is largely the preservation of human life. Within the past few months a few contemptible persons have been found to have removed ear tags from the ears of tuberculous cattle and had attempted to obliterate the brand "T" on the left jaw in order that they might sell those cattle for dairy purposes, and thus perhaps feed children tuberculous milk. I do not know what the penalty is for such violations, but if it be short of capital punishment it would seem inadequate. A person who will perpetrate such a nefarious act is capable of committing the most heinous of crimes. Such occurrences remind us, however, of how necessary it is to employ eternal vigilance to prevent recurrences of such nature. Most of the group referred to are languishing in the county jail at Cortland, Cortland County, New York.

Several years ago criticisms reached the Bureau from societies for the prevention of cruelty to animals. From one of the States came the plea against branding cattle, to which the reply was made that, of the choice of two evils,

the Bureau was firmly of the opinion that it was much less barbarous to instantly, and I believe without undue pain, brand an animal than to permit a known tuberculous animal to be bartered in trade. It is again urged that any animal that reacts to the tuberculin test be branded immediately upon condemnation. The horse thief endeavored for years without much success to find ways of obliterating brands. Most of you know the penalty meted out to such culprits, and the person who attempts in this way to mutilate a brand on a tuberculous cow will have about as much mercy shown him as was shown the cattle rustler in the pioneer days on the plains.

## Organization

There are evidences in many communities that the organizations maintained in some of the States are entirely too small to carry on the work as it should be carried on. It has been much easier to obtain funds for the payment of indemnity than for operating expenses. Both the State legislature and Congress take the attitude that the personnel must not be increased. In consequence of this a number of the States have organizations not much larger than when the total indemnity fund was one fourth less than at the present day. We do not favor the building up of large permanent organizations to be a drain upon the State and Federal treasuries, but we do recommend that a sufficient number of veterinarians be available to carry on the work in conformity with the demand. There are counties in practically every State that are required to wait months and sometimes years before the eradication organization is available to start testing. This is not inconsistent with the statement that the indemnity funds are not large enough. There are in practically every State a number of counties where the disease is not extensive and where, if funds were available, the work could be carried on without depleting the

indemnity fund. While I believe in eradicating tuberculosis wherever the disease exists, I also favor getting over as much territory as possible; getting it out of the way, then concentrating on the remainder. This is a problem, however, for each State to work out. It is recognized that conditions vary in different parts of the country. The organizations, therefore, should be built up to meet the particular needs of each Commonwealth.

## Program of Work

The campaign has reached the stage in most States where it is advisable to map out a program for the future. I have in mind one State in which the following program has been figured out: The number of townships that will be completely tested in 1925; the number of counties wherein the first test or the second test will be completed in 1925; the number of counties that will be modified in 1925. The same sort of program has been planned for 1926 and 1927. Now that may be difficult to arrange in some States, but the idea of having a definite plan of operation seems to be desirable. There are a number of States now wherein the work is being carried on in more than fifty per cent of the area, and a few States wherein the officials have practically arranged to put the work on a State-wide basis. This also is a matter that is dependent upon local conditions. It seems, however, that if a definite plan could be worked out and a map prepared showing what it proposed to do, then presented to the legislature, the approximate cost of carrying out the work in an area as outlined could be estimated. It would have, if veterinarians were secured, the salutary effect of permitting the work to go on continuously without the irritating interruptions that are encountered every year about the time the legislature meets. In some of the States they have agreed upon a program, and I feel sure that it will work out satisfactorily.

## Conclusion

The work on the whole is so far advanced, and proceeding so well, that it is believed nothing can prevent its ultimate accomplishment except the breaking down of the general morale and efficiency. So long as the work is performed satisfactorily there is no doubt as to the ability to free herds of the infection and to maintain them in a healthy state. This applies to the individual herd and to any group of herds, no matter how large. It is freely admitted that occasionally badly infected herds are encountered where every effort, short of the total destruction of the herd, fails to eradicate the disease. Such herds are those in which the infection is of long standing; and it is no reflection on the campaign when the ordinary methods that accomplish successful results in the vast majority of herds, fail in these.

It is expected that within a very few years the campaign will have reached its peak, and from then on the cost of operation will gradually decrease as the infection diminishes. It is not unreasonable, therefore, to expect that within the next ten years tuberculosis will be so well under control in the United States that it will cause no apprehension regarding its absolute suppression, or reduction to the irreducible minimum. There should be no let-up, however, in our vigorous campaign against it; instead we should work with increased determination to conquer this enemy which, for a time, threatened the future of our live stock industry, but which now, while admitting it to be a formidable foe, is one that we feel sanguine will be overcome. Let us hope victory will be forthcoming in the not-too-far distant future.

## DISCUSSION

Question: What is the prospect for the eradication of tuberculosis from flocks and farm animals other than cattle?

DR. KIERNAN: In some places poultry have been found to be infected to a slight degree. In some places it may be advisable to conduct campaigns for the eradication of tuberculosis in swine and in poultry. A practical plan may be to eliminate the disease in poultry by culling out flocks where the disease exists and depend on pullets for egg supply. So far as I know, avian tuberculosis is not transferable to the human race. In poultry it is, therefore, an economic rather than a public health problem.

*"There is a keen sense of satisfaction in doing your work so well that others may benefit from it."*

# WHAT THE DAIRY COUNCILS ARE DOING

M. O. MAUGHAN, *Secretary,*
National Dairy Council, Chicago, Ill.

Every great movement has a slow beginning. There are those who at the outset say it can't be done, and many are the followers in this group; but there are always a few who can see clearly into the future, who say it can be done and then proceed to do it.

You will remember the story of the old man who had lived pretty much to himself, had never read very much, or kept up to date on developments in this great world. One day he saw an engine, a big one, standing idly on the railroad tracks. He heard someone say it would be started soon, but he laughed and said, "No, you can't start it, you can't start it." But as he looked on, it did start, right before his very eyes, and as it moved on, it gained speed and before it was out of sight, and as it rounded a curve at high speed, he turned to those about him, and said, "You can't stop it, you can't stop it."

Such is the history of the National Dairy Council in the past ten years. There were a few dairy leaders who said, "It *can* be done," and they got busy, and today the National Dairy Council stands as a great monument to these men, prominent among whom were Mr. George Haskell, of the Beatrice Creamery Company, and Dr. Favill, the first president of the National Dairy Council.

Because it has been a policy of the National Dairy Council to do its work in a quiet, unspectacular way, many possibly feel that the work is not very extensive as yet; but glance at the map of the United States, and the locations of the regional Dairy Councils will show that Dairy Council work now covers a large portion of this great country.

There are now 12 Dairy Council units in action. The oldest of the twelve is Boston, which has been active for about five years. Professor Lockwood is doing splendid work down there. And by the way, Professor Lockwood is the man responsible for the splendid Dairy Council exhibit at the National Dairy Exposition in this city.

Other Dairy Council units include Philadelphia, Baltimore, Pittsburgh, Connecticut, Detroit, Ohio, Indianapolis, St. Louis, Iowa, California, and Oregon.

In the large cities, where Dairy Council work is being conducted on an intensive scale, the farmers usually pay one cent for each one hundred pounds of milk which they sell and the milk dealers pay a like amount. To give you an idea of what this one cent from the farmer and one cent from the dealer mean, I might mention the latest Dairy Council organized, in Detroit. We will have a budget of about $60,000 a year to begin with. The other branches of the industry pay proportionately, and you will be glad to know that every branch of the dairy industry is now financially supporting the Dairy Council, some, of course, stronger than others. It is our aim to get as nearly 100 per cent membership as possible from all branches.

During the year 1925, the Dairy Councils will spend approximately three quarters of a million dollars in educational work.

There are approximately one hundred and forty Dairy Council workers, all being specialists in their particular line. Some of them are especially trained in dramatics, others in nutrition work, and so on. Some of the Dairy Councils, especially those in Pittsburgh and Philadelphia, devote a part of their time to quality control work with the farmers, helping them produce a higher quality of milk. We recognize full well that improved quality and educational work together make a complete and highly effective program. In the Dairy Council territories where we do not

have quality control activities, it is because this important work is being handled in a very efficient way by the health department of the city or by the milk dealers.

The health program of the National Dairy Council is a very broad one, and emphasizes eight important health rules, featuring not only milk and milk products, but fruits, vegetables, drinking water, brushing the teeth, playing part of every day out of doors, sleeping many hours with the windows open, and bathing oftener than once a week.

Because the Council has been broad and highly serviceable in its work, the public has rallied around the Council to a remarkable degree, and we are now considered as one of the leading health organizations of America.

No one who knows the work of the Council thinks of it as a commercial organization. We are teaching health. Our aim is to sell health, and as a result of this, the industry gains, because health cannot be taught without the consumption of milk and milk products being increased to a great degree.

Dairy Council work is conducted through ten different channels. Our most fertile field and the field from which we receive most calls for our program of health is the schools. The school officials, when they become acquainted with Dairy Council work, recognize that we are after no selfish gain. As a result, they are anxious for our workers to come into the schools and weigh and measure the children, put on demonstrations, tell stories, put on health and milk plays, conduct poster contests, and numerous other things, including the conducting of many health games of various descriptions.

Our second channel through which we work consists of women's clubs, including the Parent-Teacher Associations, which are growing stronger each day throughout the country, and which are keenly interested in the welfare of the children, the teacher, and the community life in general.

In various women's clubs, we give our demonstrations, we put on our plays, we show our motion-picture films, we conduct food budget classes, supper clubs, and numerous other projects.

Our third channel of publicity is through the newspapers. We do very little advertising, and we therefore buy very little space. We do, however, cooperate with the editors and the health department of the newspaper staff, giving them information and articles for publication on foods, etc.

Various contests are conducted in cooperation with newspapers, such as newsboys' contests and limerick contests.

Our fourth channel of publicity consists of work in factories. Here our workers demonstrate and tell of the importance of dairy products, leafy vegetables, and fruit in the daily diet. It is truly wonderful how the men engaged in factory work, as well as various other industrial pursuits, are turning toward the drinking of milk.

The fifth channel of publicity consists of work in the playgrounds.

The sixth way in which our work is conducted is by means of the radio. We broadcast over various stations throughout the country, and oftimes educational literature is offered the listeners-in.

The seventh way our work is conducted is by means of the movies; the eighth, by means of window displays; the ninth, by quality improvement work; and the tenth through miscellaneous avenues.

Now for the results of Council work. It cannot be measured exactly, but we can look about us and see what is happening along the very same lines which we are working, and then we can truthfully say we helped to do it. In general, I would say the results of Dairy Council work are five-fold: First, improved health; second, increased consumption; third, improved quality; fourth, closer relationship between producer and dealer; fifth, a greater public

appreciation regarding relative low price of dairy products.

With respect to increased consumption, let me cite the following figures. During the past four years, milk consumption has gone from 43 to 55 gallons per person per year. This is an increase of over 27 per cent per person.

Butter consumption in four years has gone from 14.7 pounds to 17.25 pounds per person, which is over 17 per cent increase.

Cheese consumption in four years has gone from 3.51 pounds to 4.2 pounds, which is approximately 20 per cent increase per person.

Ice cream in four years has gone from 2.46 gallons to 2.56 gallons per person. This is only 4 per cent, but is accounted for by considering the low consumption last year due to a cold summer. Leaving out last year's figure, and considering the three previous years only, the increase was 9 per cent, which is at the rate of 3 per cent per year.

With the health wave continuing and gaining momentum each year, with this industry having the most healthful food available to mankind as its basis, and with this food being the most economical food available, there is evidently a great future. The cow is a most efficient producer of human food, utilizing feed approximately seven times more efficiently than the beef animal, and fitting into the scheme of American agriculture in a most admirable manner. She keeps up the fertility of the soil, and affords constant employment for the farmer, increasing his net income tremendously. There is a great future for the cow and her products. And more and more each day, the farmer is recognizing that he cannot make a living by working only three or six months each year. He must find employment for twelve months, either going into factory work in the winter or arranging his type of farming so as to keep *profitably* busy the year around, and the dairy cow will fit in here unusually well.

So our cow is right and our product—milk—is right. Why isn't there a future? And when the scientific world says, "Drink more milk, shift your food bills so that there will be 44 per cent rather than 20 per cent expended for dairy products," there are surely better times ahead.

In ten years, or by 1935, milk consumption should be 75 gallons per person, instead of 55; butter consumption should be 25 pounds, instead of 17; cheese consumption should be ten pounds and maybe 20 pounds per person, instead of four pounds; and ice cream consumption should be ten gallons instead of less than three gallons per person. These figures should not be looked upon as fantastic dreams, for they are being realized in some countries even today. For example, milk consumption in Sweden is 70 gallons per person; butter consumption in Canada is 27 pounds, and cheese consumption in Switzerland is 26 pounds. Uncle Sam, by the way, sits at the end of the table and when the cheese is served he scarcely gets enough to be recognized.

So let us increase the consumption of dairy products and promote the growth of the dairy industry until it finally occupies its rightful position among the industries. An increased use of dairy products, together with a greater consumption of fruits and leafy vegetables, together with a close observance of the other health rules set forth by the Dairy Council, will result in a healthier American race and a more efficient American race, all of which means individual development and achievement, and greater national security.

## DISCUSSION

MR. BULMER: It would seem that some cities are not entitled to support a milk campaign because of the low quality of milk distributed. In one city a campaign for the increased consumption of milk was put on in advance of providing safe milk. Shortly after the campaign, about one

hundred cases of typhoid developed, due to a contaminated supply. Where safe milk is distributed, milk campaigns are fine, and in Birmingham we have increased consumption materially and now feel we are ready for a real campaign to increase milk consumption.

MR. MAUGHAN: We will not go into any territory where safe milk is not available. We now organize permanently rather than for a brief campaign.

MR. YATES: I believe at least ten per cent of the children in our public schools are undernourished. Doubtless more children suffer for want of milk than as a result of bad milk.

*"The strength of a nation depends upon the health and strength of its individual members. It matters not how wealthy a nation may become, how large its cities, how vast its armies and navies, if the health of its people is on the decline, it will rapidly perish and decay."*

*—Disraeli.*

# REPORT OF COMMITTEE ON TRANSPORTATION OF MILK AND MILK PRODUCTS

RUSSELL S. SMITH, *Chairman*

The high degree of perfection which has been obtained in methods of transportation and distribution of milk and milk products is a distinct credit to the dairy industry. There should be no relaxation in effort to improve conditions and practices, as there is considerable wastage and spoilage of milk and milk products in spite of the degree of perfection reached.

## ECONOMIC WASTE

Some of the points brought to the attention of the President's Agricultural Committee by Secretary Hoover in his discussion of the wastes that cause costly losses no doubt apply to the dairy industry and are cited below:

1. Waste from speculation, relaxation of effort and extravagance of booms, with the infinite waste from unemployment and bankruptcy which comes with the inevitable slump.

2. Waste from excessive seasonal character of production and distribution.

3. Waste caused through lack of information as to national stocks, of production and consumption with its attendant risk and speculation.

4. Waste from lack of standards of quality and grades.

5. Waste from unnecessary multiplication of terms, sizes, varieties.

6. Waste from lack of uniformity of business practices in terms and documents, with resultant misunderstandings, frauds, and disputes.

7. Wastes due to deterioration of commodities.

8. Waste due to inadequate transportation and terminals, to inefficient loading and shipping and unnecessary haulage.

9. Waste due to disorderly marketing, particularly of perishables, with its attendant gluts and famines.

10. Waste due to too many links in the distribution chain and too many chains in the system.

11. Waste due to bad credits.

12. Waste due to destructive competition of people who are in fact exhausting their capital through little understanding of the fundamentals of business in which they are engaged.

13. Waste due to enormous expenditure of effort and money in advertising and sales promotion effort, without adequate basic information on which to base sales production.

14. Waste due to unfair practices of a small minority.

15. A multitude of wastes in use of materials, in unnecessary fire destruction, in traffic accidents and many other directions.

Changes in methods of transporting milk have occurred in recent years and a resume of the extent of some of these changes may be of value to the members of this association.

## Tank Car Installations

Insulated, glass enamel-lined metal tanks placed in insulated cars form a type of conveyance for bulk shipments of milk which is gradually being used to greater extent in some cities. These tanks are mounted on special cradles which are anchored to the needle-beam of the car, thus making a solidity of installation which is necessary in volume transport of liquids. The cars are mounted on pas-

senger service trucks and have special buffers to offset the effects of impacts.

Since the first installation of tank cars in Boston, Mass., in 1907, the number has increased, the increase being rapid in the past two years, until in January, 1925, there were approximately eighty tank cars in use, these being principally in the cities of Pittsburgh, Philadelphia, and Chicago.

This form of bulk transportation is suitable for country receiving stations and city plants which are located on sidings so that the cars can be shunted adjacent to both. The ideal method of filling and emptying the tanks would be a gravity system; however, it is a common practice to pump the milk into and out of the tanks. Railway tank cars do not constitute a system as flexible or as economical generally as do the trucks mounted on semitrailers or removable cradles. A smaller investment is usually required for tank truck installations than for tank car installations and service where circumstances and facilities permit a choice of either system. Trucks can complete the round trip between country receiving station and city plants on their own schedule and tanks on trailers can be added when required. On the other hand, if tank cars are used there is usually at least one extra car required in order to make the service continuous. Minimum rates for tank car shipments are for 40,000 pounds, and it is plain that unless the minimum load is hauled the service becomes uneconomical. The use of tank trucks with semitrailers constitutes a more economical system for handling variable shipments from country receiving stations than do the tank cars where conditions allow a choice of system.

Tank trucks are usually owned by city distributors, although in some cities hauling contractors own large numbers of tank trucks and make a regular business of transporting milk in this manner. At least one large railroad car company is now making tank cars which they lease to dairy

companies who desire a tank car service. Such a leasing system may be desirable because of the large initial cost of railroad cars equipped with insulated tanks. The inability of dairies to make large investments in such equipment has no doubt curtailed to some extent the use of tank cars, but now that such cars can be leased from the builders this type of service will no doubt increase wherever conditions are adapted for their use.

The use of transportation tanks on railroad cars for so-called pick-up shipments of milk, where milk is poured into the tank from farmers' cans at different stations along the route, is not to be recommended. A railroad hauling milk into New York City has made extensive experiments with a type of flat car specially constructed to receive unit tanks. The plan provides for a series of five or six separate glass enamel-lined, insulated tanks, enclosed in heavy wood and steel rectangular case, each tank with a capacity of 825 gallons. These tank containers are to be lifted from the flat cars in the railroad terminal by derrick; swung onto a motor truck; and, on arrival at the pasteurizing plant, lifted off the truck into the plant; the milk pumped out; the tank sterilized; and the unit returned to the railroad car. This method offers many favorable considerations and possibly some economy, especially on shipments between country receiving stations and city plants. The principal objection seems to be that neither city nor country plants are now equipped for handling milk in this manner. This was revealed when, on the first trial shipment, the derrick used for hoisting broke under the weight of the tank filled with milk.

In an experimental shipment of 253 miles in New York State in 1924, it was found that the cream rose to the top of the milk in the tank to such an extent as to make a top sample test 15 per cent in butterfat. This fact caused the

shippers to consider some method of agitating the milk during transit to prevent the rising of the cream.

## Motor-Truck Tanks

Metal tanks mounted on motor trucks and trailers for the transportation of milk are a comparatively recent development. Their use has no doubt been influenced by the development of motor transportation and better roads, which make possible the establishment of receiving stations in milk-producing territory inaccessible by rail.

Since the first installation of metal tanks mounted on motor trucks about the year 1912 the number has increased, more rapidly in the last few years than before, until in January, 1925, it was known that approximately two hundred and thirty metal tanks were in use for transporting milk.

There is a growing tendency to convert country bottling plants within forty or fifty miles of large cities into receiving stations and transport the milk in bulk to city dairies and bottling plants. Insulated tanks mounted on motor trucks or on railway cars are used for this purpose and their use is increasing where conditions are adapted for their use. The principal reasons for this change in the country bottling plants are the relatively high rail rates on cases of bottled milk and the development of new highways which make possible the use of motor truck transport, thus allowing bulk shipments in tanks.

In the Chicago area about twelve country bottling stations have been converted into bulk receiving stations for the foregoing reasons in the past two years, and during the same period the number of tanks for bulk shipments by motor have increased from about four to 20.

Capacities of steel, glass enamel-lined tanks mounted on motor trucks vary from 300 to 1,500 gallons, and when filled full as they should be at the start, the total weight of both tank and milk will vary from 3,765 to 17,074 pounds.

Copper tanks used for milk transportation by motor truck have a capacity varying from 450 to 1,500 gallons, and when filled with milk have a total weight varying from 4,345 to 14,200 pounds.

It has been found advisable to distribute the load by mounting average-sized tanks on semitrailers, as sometimes if the larger tanks are full they exceed the maximum weight limits permitted in some States.

Installations of tanks on motor trucks have been halted in some instances when it was found that the motor unit would have to remain idle when milk was not being hauled. Tanks mounted on cradles, which allow the entire tank to be removed from the truck body, have been observed. In these instances the motor truck is used for other purposes, but this would not have been possible if the tank mounting had been permanent. It should be understood that such economies in the use of the motor unit are only practical when the entire time is not required in hauling milk. Both the semitrailer and the removable cradle installations allow for flexibility and expansion of milk hauling as well as for economies in the use of the motor unit; all of which is of considerable value to the industry.

## Refrigerated Trucks

New uses for mechanical refrigeration are being discovered almost daily. One of the latest, which we believe will be of interest to the members, is the application of a mechanical refrigerating system to a motor truck with an insulated body, used for delivery of milk in Ann Arbor, Michigan. An insulated refrigerator body which holds eighteen 10-gallon cans of milk is mounted on the truck. This refrigerator body is cooled by means of a refrigerating machine. The condenser coils, compressor and compressor motor drive were located on top of the refrigerator body.

This equipment was enclosed in a hood which had louvers in its sides for ventilation.

The condenser is of the air-cooled type. The current for driving the compressor motor is furnished by storage batteries and the storage batteries in turn receive their charge from a generator which is driven by the motor truck engine.

We are advised that equipment of this type has been in operation for about one year, and is used every day between five in the morning and nine in the evening for both long-distance and short-distance delivery of milk, during which time the equipment has performed satisfactorily.

The refrigeration is distributed in the refrigerator body by means of direct expansion coils hung on the ceiling with drip pans underneath. The refrigerating machine is stopped and started automatically, being controlled by a thermostat, located inside of the refrigerator body. This thermostat stops and starts the small electric motor which drives the refrigerating machine.

In reference to the cost and operating expenses, we have been advised that when the truck body is built on the production basis, that it will not cost more than a high-grade refrigerator of the same storage capacity. Also, the cost of the refrigerating unit is about the same as standard models. No data on the operating expense of the truck have been obtained.

Under usual conditions, the mechanical refrigerating unit will consume about 25 kw.-hrs. of electrical energy per day. The machine is entirely automatic in its operation, and the motor requires hand oiling but once per month.

In order to keep the storage batteries fully charged on Sunday or other days when the truck is not driven but when the refrigerator body is in use, a motor generator may be used for supplying the electrical energy.

In 1920 a Chicago concern experimented with a refriger-

ating unit and insulated truck body for transporting meat and dairy products to nearby towns. An attempt was made to utilize a separate small gasoline motor attached beneath the large truck and to have the refrigerating unit in an enclosed compartment on the truck. Problems of cooling the small motor and of condensing the refrigerant halted progress of the experiment. The experimental apparatus was discarded and insulated truck bodies having provisions for ice and salt brine tanks inside were used.

Insulated truck bodies having overhead tanks and pipes which allow for the natural circulation of brine to conform to changes in level of the moving truck are now in successful use for the delivery of ice cream, milk, and other dairy products. The daily expense of refrigerating in such a system is limited almost entirely to the cost of the ice and salt used in making up the brine.

### Refrigerator Car Service

Applications of refrigeration to the handling of milk and dairy products bring out more and more the attention which has been given to this important subject. Congress has a keen insight into the needs of the interests which depend on railway service in marketing their products. The joint commission of agricultural inquiry has studied the car shortage question and in its report to Congress has recommended complete standardization of freight cars and control of distribution of all classes of freight cars. It also recommends the unification and joint operation of facilities at terminals wherever such unification and joint operation will result in economy and better service. On some railroads there is a shortage of locomotives and the supply of box cars, coal cars, stock cars, and refrigerator cars is inadequate to meet the demand during normal periods of activity and should be rapidly augmented. Emphasizing the dependence of shippers of perishable commodities upon

the refrigerator car supply, the commission recommends extensive and prompt additions to present refrigerator car equipment by each carrier in accordance with its needs or extension of private line car companies; a central control of refrigerator car supply and progressive retirement of the older and inefficient equipment.

In January, 1925, the number and ownership of refrigerator cars in the United States and Canada were as follows:

| Owner | Total cars |
|---|---|
| Railroads, each owning more than 20 refrigerator cars.... | 32,934 |
| Railroads, each owning less than 20 refrigerator cars.... | 173 |
| Canadian owned ..... | 6,084 |
| Mexican owned ..... | 2 |
| Private (railroad controlled) ..... | 95,114 |
| Private ..... | 6,014 |
| Packers ..... | 18,664 |
| Grand total ..... | 158,985 |

## Transportation Relief

A committee of the United States Chamber of Commerce studied the transportation situation of the country from the standpoint of motor transportation and in the following conclusions the dairy industry can no doubt find many points which apply directly to it and which should be put into effect if not already practiced:

1. The best interests of the public and the rail, water, and motor carriers lie in cooperation between the various agencies of transportation rather than in wasteful competition.

2. The greatest opportunity for cooperation is at the points where the capacity of the railroads is most limited and expansion is most difficult and costly; that is, in the terminal areas of our great cities.

3. Store-door delivery by motor truck, which would relieve congestion in these terminal areas and greatly increase the capacity of the freight stations, is undoubtedly

the greatest contribution which can be made to the solution of the terminal problem.

4. Organized motor transport can also relieve the railroads of various forms of uneconomical service, such as trap-car service, switching between local stations, and short-haul shipments within the terminal area. This will reduce yard congestion and release many cars for more profitable line haul.

5. To secure the fullest benefit from this organized motor transport will require the utilization and further development of modern technical equipment, such as demountable bodies, trailers and semitrailers, containers and container cars, and mechanical handling appliances.

6. Outside of the terminal areas there are distance zones, varying in different localities and for different commodities, in which one type of carrier, the motor for short haul and the railway (or waterway) for long haul, is clearly more economical than the other, and intermediate zones in which competition is inevitable. Motor trucks and busses should be used to supplement the facilities of existing common carriers.

7. It is to the public interest, as well as to the interest of the respective carriers, that the economic limitations of each type of carrier be recognized, that the railroads be permitted to discontinue unprofitable service to which the motor is better suited, and that the motor abandon its efforts to handle general traffic over excessive distances. However, because of the public interest which affects the operation of railroads, they have performed and must continue to perform some service which is unprofitable, chiefly in territory where the performance of highway transportation would also be unprofitable. If the railroads are to be deprived of a substantial share of their more remunerative traffic through unfair and, to the trader, uneconomical methods, the traffic remaining to the railroads must take on an

added burden in the form of higher rates or impaired service. In all cases where the railroad can handle traffic with greater or equal efficiency, all factors being considered, the public interest requires that it be allowed to do so. Unprofitable steam railroad service can in some cases be successfully replaced by the use of self-propelled railroad motor cars.

8. To insure to the public continuity and reliability of service, sound financial organization of motor transport is necessary, as well as public regulation of common-carrier motor service.

9. Passenger bus transport should be so regulated as to secure the best service to the public, certificates of public convenience and necessity as already required in many States being a useful means of insuring reliable and continuous service. Rail lines can often advantageously extend or supplement their service by bus lines, and in States where this is now prohibited such restrictions should be abolished.

10. Regulation of size, weight and speed of motor vehicles by States and municipalities should be made more uniform. Regulation of common-carrier operations of motor vehicles, including rate regulation, should be handled by the Federal or State authorities, under the commissions which now control the operations of rail and water carriers.

11. Trunk highways in any area should be able to carry the normal vehicular traffic of that area, and, if the traffic economically justifies the use of especially heavy trucks, highways with stronger sub-bases must be provided. This constitutes a problem requiring particular attention in the design of highway systems and in the regulation of traffic. In other respects present types of highways, present routes connecting principal centers of population and production, and the present trend in size, weight and speed restrictions of vehicles using highways show a rational system of highway development that should be continued.

12. Investigations now under way by the United States Bureau of Public Roads, State highway departments and other agencies to determine more fully the economic role of the motor vehicle should be continued.

"The congestion of transportation," the committee continues in its report, "today centers around the terminals of our great cities, and it is at these terminals that the railroads find the greatest difficulty in keeping pace with the public need. With hardly an exception the main tracks of our railroads have sufficient capacity for the movement of more freight than can be offered to them. With hardly an exception the railroads are constantly faced with a demand for more and better terminal facilities in the face of prohibitive real estate values and other stupendous obstacles to expansion. Here lies the greatest opportunity for the motor truck. By the use of motor transport the facilities of the terminals can be so expanded as greatly to increase their capacity.

"The general demand for more and better rail transportation is insistent, and the railroads are confronted by a serious dilemma. They must either add to their present terminal facilities or find a way to pass more freight through them. Enlargement or multiplication of terminal stations and team tracks in important terminal areas is practically impossible because of the prohibitive cost, objection of municipalities to the expansion of railroad holdings in congested areas, and, furthermore, the additional traffic congestion that would result from greater centralization of cartage operations in such areas.

"There are three principal directions in which the motor truck can serve to relieve the terminal situation:

"1. By organized cartage instead of the present go-as-you-please methods of receipt and delivery at the rail terminal; further than this, by store-door delivery, which is real completed transportation.

"2. By substitution of motor service for a part of the rail service.

"3. By complete elimination of certain rail service. This would cover intraterminal movement, such as movement between industries or different plants of the same industry within the terminal area, which would then be handled by motor truck."

## Outstanding Events Relating to Transportation of Milk and Milk Products

### *Long-Distance Bulk Shipment of Milk*

On September 27, 1924, a dairy in Pittsburgh, Pa., shipped an insulated glass enamel-lined truck tank filled with 1,350 gallons of pasteurized milk to Milwaukee, Wisconsin, where it was dispensed free to visitors at the National Dairy Exposition. The time in transit was approximately 60 hours, the distance being about 700 miles. Due to the volume of milk, the low temperature to which it had been cooled, the excellent insulation, the air temperature, and the weather during the journey, the reported rise in temperature in about 67 hours was 5° F., or from 36° F. to 41° F.

### *Milk Sent Through the Air*

On May 22nd a shipment of certified milk was made by air mail from San Francisco, Calif., to Atlantic City, N. J. It arrived in Atlantic City on the morning of May 24th, the day previous to the Annual Convention of the American Association of Medical Milk Commissions and Certified Milk Producers. As the milk was in an insulated container, practically no change occurred in the temperature or composition. This is no doubt the first shipment of milk across the country through the air and it was carried out

as a demonstration of expedited service for an essential food product.

### *Certified Milk Shipped Across the Country*

In a milk-scoring contest for certified milk held at Atlantic City in May, in connection with the annual convention of Certified Milk Producers and Medical Milk Commissions, milk which was produced in California and shipped, well iced, in an insulated shipping box, received the highest score of 99.5 points. The fact that the first ten entries all scored above 98 points and that three of them were shipped from California calls attention to the high degree of perfection which is possible in the preparation and shipping of raw milk in bottles over a long distance.

### *Portable Milk Receiving Station*

The New York Dairymen's League Cooperative Association has an emergency milk receiving station on wheels believed to be the first of its kind. This emergency portable receiving station can be drawn by a railroad locomotive to any point where it is desired and is of special service in case any receiving station is burned or otherwise put out of commission.

The portable plant is a complete receiving station capable of handling 250 cans or 10,000 quarts a day. The plant is contained in two standard refrigerator cars, each 40 feet long. One car is the power house, the other the milk-handling station. The power car contains a refrigeration plant, a high-pressure boiler for heating water and generating steam, a direct-current light and power system, and an electric-driven compressed air unit for the agitation of milk. The other car contains a weigh can; can washer, steamer, and dryer; receiving vat; internal tube cooler; and 600-gallon glass enamel-lined storage tank.

### *Butter*

Approximately 430,000 pounds of butter was made last year for the United States Navy by four creameries in Minnesota and one in Wisconsin. It is made from selected sweet cream, pasteurized and churned without ripening. The selection of cream and the entire process of manufacturing, packing, and sealing in tins are under the immediate supervision of an inspector working under the direction of the United States Department of Agriculture. All of this butter is packed in five-pound hermetically sealed tins, as it is used aboard warships and may be taken through the tropics without refrigeration. This was the sixteenth year the Navy Department had sweet cream butter manufactured for its use.

### *Ice Cream*

Sufficient ice cream was packed in the refrigerator of the S. S. *Berengaria* as it left New York on its world cruise of four and one half months to supply the passengers during the entire journey around the world. In addition to the natural refrigeration of the cold-storage room, which is kept at 18 degrees, the ice cream, which was packed in one-quart packages, will be packed with broken ice and salt about three times a week. The passengers will have the unique experience of eating the same kind of ice cream on their way home as they had during the entire cruise.

Two tons of ice cream were packed in the refrigerator of the Red Star Liner *Belgenland,* the largest liner to encircle the globe, as it started on its world cruise from New York. This supply will be renewed from time to time. Besides the two tons of ice cream, the *Belgenland* also carried 16,000 pounds, or 8 tons, of butter and two tons of cheese, which included half a ton of cheddar and 700 pounds of Camembert. The *Belgenland* carried 450 passengers and a crew of 601.

These accomplishments direct special attention to the efforts which are being made by some to reach perfection in the sanitary production, handling, and transportation of milk and milk products.

*"There is nothing so powerful as truth, and often nothing so strange."*

# ECONOMIC LABORATORY CONTROL OF MILK QUALITY BY MILK DISTRIBUTORS

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A discussion of my subject can best be presented by using as an illustration a cooperative arrangement that was entered into by the East Bay Milk Producers' Association, of Oakland, California, and the Alameda County Milk Dealers' Association, with headquarters in Oakland.

A feature of the agreement was an arbitration committee composed of Mr. Sam H. Greene, secretary-manager of the California Dairy Council, Prof. H. E. Erdman, of the Division of Rural Institutions, University of California, and the writer. The committee was requested to assist in bringing the producers and distributors together in matters in which there was disagreement.

The Arbitration Committee, meeting first with the directors of one association and then with the directors of the other, and finally with the Executive Committees of the two associations together, succeeded in bringing the two organizations together in the matter of price to be paid for milk and in other points of difference. Contracts were finally signed, effective on January 1, 1924.

With a desire to stabilize the unsettled situation, it was suggested to the producers' and distributors' associations that the University of California, as a neutral institution, might be willing to maintain a laboratory for chemical and bacteriological work that would serve the two associations as a demonstration of economy in avoiding duplication in laboratory work. An arrangement was made by which the

producers' and distributors' organizations shared the expense of equipping a laboratory and paying the salary of the laboratory man and the sample collector, the University furnishing the laboratory space and supervision of the work without cost.

## Milk Price Based on Butterfat and Bacterial Content

The purchase price agreed upon for milk from the Producers' Association was 26 cents per gallon for 3.6 per cent milk for the months February to July, and 27 cents for the months August to January, inclusive. For all milk from an individual member of the sellers' organization having in excess of 3.6 per cent butterfat, the buyer paid one quarter cent additional per gallon for each one tenth of one per cent of butterfat more than 3.6 per cent of butterfat, up to and including a butterfat content of 4.1 per cent; and for milk below 3.6 per cent, a deduction was made of one fourth cent per gallon for each one tenth per cent butterfat, down to and including a butterfat content of 3.1 per cent.

For all milk from an individual member of the sellers' organization delivered during a given month and averaging a bacterial count of less than 50,000 bacteria per cubic centimeter, the buyer paid the seller a bonus of one cent per gallon.

## Organization of the Laboratory Work

The responsibility for the chemical and bacteriological work and the collection of all samples was given to a graduate of the University, who was employed to supervise the sample collector and with the help of a half-time assistant plated all milk for bacteria and tested samples for butterfat.

Boxes containing a numbered rubber-stopped glass bottle for each shipper were delivered to the plants and taken up

by the sample collector each week. The butterfat determinations were based on composite samples collected daily by the weigher at each plant from each shipment received. These samples were collected weekly by the sample collector and taken to the laboratory for testing. When there was any irregularity in the butterfat tests from these composite samples, fat tests were also made of the officially collected samples taken for bacterial examination, and if they did not check closely with the composite samples, payment was made on the basis of the latter.

Samples for bacterial examinations were taken twice each week by the official sample collector, and the average for the eight counts made during a month was used as the bacterial quality upon which the bonus payment was made.

Ordinary glass tubes used for taking bacterial samples from cans become brittle when sterilized at high temperature daily, and the breakage is an item of considerable expense and some inconvenience. On account of this, aluminum tubes of the proper diameter were adopted for use. One tube full of milk was taken from each full can of milk received from each producer up to twelve cans. When more than twelve cans were received from one shipper, twelve representative cans were selected.

## Number of Tests Made Each Month

Samples were collected from 85 dairymen delivering milk to 12 plants. Four butterfat tests and eight bacterial examinations were made for each producer. Bacterial examinations were also made of sterilized cans in each plant once each week. This gives a total of 340 butterfat tests and 728 bacterial counts per month. The cost of maintaining this work, including the employment of two full-time men and a half-time assistant, as well as maintaining a Ford car, was approximately $470 per month.

When we consider that 12 plants received this service

at a monthly cost of approximately forty dollars per plant, the economy of this plan of conducting laboratory work is apparent. The results obtained in a central laboratory are more uniform; the work carried on by one or two experienced men is more satisfactory than that of several mediocre operators; standard methods are more apt to be followed; and more efficient equipment can be provided.

## Economic Laboratory Control by Milk Distributors

The time has arrived when the city milk distributor must check regularly the bacterial quality of the milk which he purchases and of that which he sells, if his business is to be properly protected. He should check the pasteurization efficiency in his plant, and the sterilization efficiency of his milk cans, bottles, and equipment. Good business management demands that this be done. The large distributors can maintain laboratories for carrying out this work, and it may be better that they have their separate laboratories. The smaller dealers may not be able to maintain separate laboratories. In such cases, I believe that a laboratory maintained cooperatively by several dealers can be a great aid to them, and that the cost would be reasonable.

Health departments can check the quality of milk coming into a city and the pasteurized milk being sold, but they cannot be expected to make tests of efficiency in milk plant operation. This work must be provided for by the dairy plant operators themselves.

In cities where there is a demand for it, a cooperative milk dealers' laboratory may be located in a plant of one of the larger dealers, or preferably in leased quarters apart from any distributing plant. The cost of properly equipping such a laboratory would be about nine hundred dollars. A capable man should be placed in charge of the work and be responsible for employing extra help and the conduct of the work. A trained sanitarian in this position may be

of inestimable value as an adviser to the plant operators when special problems arise that are difficult of solution.

The cost of maintaining a milk distributors' cooperative laboratory could be prorated among the dealers concerned on the basis of the number of samples to be tested each month, with a provision for a fixed charge for all extra samples submitted.

The laboratory which was operated for the benefit of the milk producers and distributors of Alameda County, as described in the beginning of this paper, was a complete success. It is believed that a similar laboratory operated cooperatively by milk distributors may be even more successful because of the closer mutual interest of those supporting it. Undoubtedly there are communities or counties in which the adoption of such a plan would be of valuable aid in maintaining uniformly a high quality of milk.

*"All truth is an achievement. If you would have truth at its full value, go win it."*

# REPORT OF COMMITTEE ON SANITARY CONTROL OF ICE CREAM

RALPH E. IRWIN, *Chairman*

The rapid increase in the use of ice cream, both as a confection and as a food, the character of the materials used in its manufacture, and the necessity for safety and cleanliness in its preparation no doubt directed the attention of the Executive Board to the necessity for the appointment of a committee to consider the sanitary control of ice cream. There are 4,500 plants in the United States now manufacturing ice cream for wholesale or both wholesale and retail trade. The total production of these plants for 1924 is given as nearly three hundred million gallons, making an annual per capita consumption of over two and one half gallons. This business represents an investment of nearly three hundred million dollars and has an annual production value of over two hundred and seventy million dollars. There are 32,000 employees dependent upon this business for a livelihood.

The standardization of ice cream is a live subject. The committee believes, however, that sanitation has little to do with the amount of the various materials used in the preparation of ice cream and that we should confine our attention to the quality of materials used, the efficiency and condition of equipment in the plant, the personnel of the plant, and the methods and equipment used in the final distribution of the finished product.

There are no national standards dealing directly with the sanitary control of ice cream. Therefore, the committee has confined its report largely to a study of existing State regulations, believing that State regulations should be understood

and possibly improved before an association like this may do much through municipal regulations.

Recently the National Association of Ice Cream Manufacturers opened an office in Harrisburg, Pennsylvania, with a permanent secretary in charge. This office has been most helpful through its Bureau of Service and Standards. It is from the file of this Bureau that much of the information was obtained relative to present State regulations. Four of our 48 States have furnished no information, 19 have no sanitary requirements, and 25 have done something. Practically all States have defined plain ice cream, fruit ice cream, and nut ice cream. These definitions usually state as follows:

Plain ice cream is a frozen product made from cream and sugar with or without gelatin, plus natural flavoring and not less than 8 per cent milk fat.

Fruit ice cream is the same as plain ice cream plus sound clean natural fruits and not less than 6 per cent milk fat.

Nut ice cream is the same as plain ice cream plus non-rancid nuts and not less than 6 per cent milk fat.

Such definitions are not considered of much sanitary value.

Two States require the ice cream mix to be pasteurized, as follows:

1. Iowa: 145° F. for 25 minutes, or 185° F. flash.

2. Louisana: 145° F. for 25 minutes, except for nuts, fruits, and flavoring.

Six States require the milk and cream used in the mix to be pasteurized, as follows:

1. Arkansas: 145° F. for 25 minutes, or 150° F. for 20 minutes, or 170° F. flash.

2. Connecticut: 142° F. for 30 minutes.

3. Kansas: 145° F. for 30 minutes, or 180° F. for 30 seconds.

4. Indiana: 145° F. for 30 minutes, or 165° F. for 30 seconds.

5. Nevada: 140° F. for 25 minutes, or 170° F. flash.

6. Tennessee: 145° F. for 25 minutes, or 150° F. for 20 minutes, or 170° F. flash.

It is apparent that little has been done through State regulations to insure the safety of ice cream. Much has been done, however, by the manufacturers themselves to insure safety. Many of the plants are giving particular attention to the sanitary condition of equipment, the pasteurization of the entire mix with the exception of a few flavors, and medical supervision over those employees coming in contact with the product. In contrast with this there are still large numbers of small manufacturers who have little or no interest in sanitation and certainly practice none.

It is believed that improvements may be made, and that usually such improvements will come through the use of State regulations as a basis. We are, therefore, submitting the information received from each State relative to the sanitary control of ice cream.

1. Alabama: Requires the cleansing of containers and prohibits the use of substances known to be deleterious to health.

2. Arizona: Requires the sterilization of utensils and the pasteurization of milk from tuberculous cows. Prohibits the use of adulterants and the handling of ice cream by those having infectious diseases.

3. Arkansas: Requires all milk to be obtained from tuberculin-tested cows, sterilization of cans before returned to the factory and again before filling by the manufacturer, and the pasteurization of milk and cream at 145° F. for 25 minutes, or 150° F. for 20 minutes, or 170° F. flash.

Prohibits the use of preservatives, saccharin, coloring matter, or flavors deleterious to health, and the handling of ice cream by those having an infectious disease.

4. California: Requires a permit from the Department of Agriculture for the manufacture of ice cream.

5. Colorado: Allows the use of eggs, gelatin and gums if not used to conceal inferior products.

6. Connecticut: Requires a permit from the State Dairy Commissioner for the manufacture of ice cream, the pasteurization of all milk and cream at 142° F. for 30 minutes, unless Grade A or certified milk is used. Work rooms must be clean, light, drained, screened, and ventilated in accordance with established sanitary principles. Operators must be provided with clean clothing, wash rooms, and shall not use tobacco while on duty. The use of adulterants is prohibited.

7. Delaware: No sanitary requirements.

8. Florida: No sanitary requirements.

9. Georgia: No information.

10. Idaho: No sanitary requirements.

11. Illinois: Requires a permit from the Department of Agriculture for the manufacture of ice cream.

12. Indiana: Requires (a) buildings well lighted and ventilated and no basement or cellar rooms unless approved by the State Board of Health. (b) Hot water and steam required for daily cleansing and sterilization of utensils and machinery. (c) The screening or artificial ventilating of mixing and freezing rooms that flies may be kept away from mixing vats and freezers. (d) Milk products which enter into the manufacture of ice cream shall be pasteurized by heating to 145° F. for 30 minutes or 165° F. for 30 seconds. (e) Recording thermometers of type approved by State Board of Health to be used on pasteurizing equipment. (f) Health certificates from ice cream handlers.

13. Iowa: Requires the pasteurization of the ice cream mix at 145° F. for 25 minutes or 185° F. flash and a recording thermometer record of pasteurization to be on file.

14. Kansas: Requires healthy dairy animals, clean

premises, healthy employees, and milk and cream to be pasteurized at 145° F. for 30 minutes or 180° F. for 30 seconds. Cans must be sterilized after use and returned to the manufacturer in 72 hours. Forbids the use of preservatives.

15. Kentucky: Requires all cows to be tuberculin tested and employees to hold health certificates. Forbids the use of preservatives.

16. Louisiana: Requires the pasteurization of ice cream mix at 145° F. for 25 minutes except the nuts, fruits, and flavoring. Requires a recording thermometer record of pasteurization, impervious floors, sterilization of utensils and containers after use, and clean storage rooms.

17. Maine: Requires all milk and cream to be from tuberculin-tested animals, employees free from infectious diseases, and sterilization of cans before returning and again prior to use. Forbids the use of adulterants.

18. Maryland: Requires clean factory and work room, no sleeping quarters in factory, employees with clean clothing and free from infectious diseases, wash rooms and sanitary conveniences clean and convenient.

19. Massachusetts: No sanitary requirements.

20. Michigan: Requires sanitary premises, and cans to be thoroughly washed before returned to the factory.

21. Minnesota: Requires sanitary premises and employees free from infectious disease. Prohibits the use of color in plain ice cream and the use of adulterants in any product.

22. Mississippi: Requires sanitary premises, clean utensils, healthful working conditions, and employees free from infectious disease.

23. Missouri: Requires the Food and Drug Commissioner to grade and regulate plants manufacturing ice cream. Prohibits insanitary premises and use of deleterious ingredients.

24. Montana: Requires clean premises, cleansing of cans

before returning to the plant and again before filling at the plant. Prohibits use of adulterants and use of milk from diseased animals.

25. Nebraska: No sanitary regulations.

26. Nevada: Bureau of Food and Drugs in charge. Requires milk and cream from tuberculin-tested herds or pasteurized at 140° F. for 25 minutes or 170° F. flash. Recording thermometers required and charts must be kept on file for two months.

27. New Hampshire: No sanitary regulations.

28. New Jersey: No information.

29. New Mexico: No information.

30. New York: Requires production and storage under sanitary conditions.

31. North Carolina: Requires license from Department of Agriculture, factories to be screened, equipment sterilized, and all conditions sanitary.

32. North Dakota: No sanitary regulations.

33. Ohio: Requires shippers and retailers to thoroughly cleanse cans and other containers as soon as emptied. Work rooms must be free from dust, dirt, and contamination of any kind, including unused tools, utensils and apparatus. Well-equipped wash rooms are required. Clothing of employees must be clean and no tobacco shall be used. Forbids the handling of ice cream except when making brick or fancy forms and then a separate wash room shall be provided.

34. Oklahoma: Requires the factory to be properly plumbed, lighted, drained, ventilated, and kept free from flies and bad odors. Prohibits sleeping quarters in the building and the employment of diseased employees.

35. Oregon: No information.

36. Pennsylvania: No sanitary requirements.

37. Rhode Island: No sanitary requirements.

38. South Carolina: No sanitary requirements.

39. South Dakota: No sanitary requirements.

40. Tennessee: Requires all ice cream manufacturers to obtain license and to meet the national Government standards. Ice cream shall not contain any poisonous or deleterious ingredients which may render ice cream injurious to health. Prohibits the use of rancid or renovated or process butter or any fat or oil other than milk fat or the fat or oil contained in eggs and nuts and the fat or oil of harmless substances used for flavoring. Prohibits the use of milk, cream or other dairy products that have not been pasteurized at a temperature of 145° F. for 25 minutes or 150° F. for 20 minutes or 170° F. flash or boiled momentarily.

41. Texas: No sanitary requirements.

42. Utah: Federal standards to be enforced.

43. Vermont: No sanitary regulations.

44. Virginia: No sanitary regulations.

45. Washington: No sanitary regulations.

46. West Virginia: No sanitary regulations.

47. Wisconsin: No sanitary regulations.

48. Wyoming: No sanitary regulations.

*"What the law insists upon, let it have of your own free will."*

# VETERINARIAN OR DAIRYMAN, WHICH?

PROF. A. D. BURKE,
Department of Dairying, Oklahoma Agricultural and Mechanical College, Stillwater, Okla.

Successful dairy inspection is the outgrowth of necessity, the direct result of a demand for safe milk. Its development has been one of slow growth rather than spontaneous origin, although the present system may scarcely be said to date back twenty-five years.

That a complete and efficient system of inspection may be established in a short period has been demonstrated notably in a southern city, where, if I am correctly informed, the entire dairy industry has been practically rehabilitated in a period not greatly exceeding three years.

However, in the majority of municipalities dairy inspection is the result of careful study and labor, built up step by step, through the unceasing tireless efforts of those interested. Its success depends upon six prerequisites:

1. An efficient inspector.
2. A well-equipped laboratory.
3. Sufficient financial support.
4. Eternal vigilance on the part of those engaged in the work.
5. Reasonable laws.
6. Cooperation.

The last five are fundamental. The first is vital. The inspector! What manner of man shall he be? That he must be conscientious, progressive, honest, punctilious, and impartial goes without saying, for these are basic traits. But we must go deeper. We must study the question of service.

An inspector is a guardian of public health. It is his

duty to prevent rather than correct the outbreak and spread of disease through dairy products. But once an outbreak occurs, then correction and prevention are equally essential. And in this particular the value of an inspector to his community depends upon his ability to control both problems efficiently. To this end he must be a sanitarian, a bacteriologist, and a chemist. The veterinarian is almost a perfect fit. His knowledge of diseases makes him so, for many diseases of cattle are related to human ills, and as all of us know, septic sore throat and tuberculosis may be directly traceable to infected udders of cattle. But these are only a small part of inspection demands. We are living in days of cooperation. Cooperative creameries and milk plants are being organized and in keeping abreast of the times the inspector must be an organizer and marketing expert as well as a sanitarian, for his stability in a locality largely depends upon his ability to work *for* as well as *with* the dairymen.

The inspector must be more. Service demands that he be a dairy technologist, for his problems are not alone with the farm. His relationship with the ice cream manufacturer, the milk dealer, the creameryman require that he be versed in those subjects dealing directly with dairy manufacturing. In my own experience as an inspector I have been called upon to assist in planning milk plants and ice cream factories, and having completed the plans, to advise regarding the type of equipment and its location, for efficient handling of dairy products results in economy, a safe product, and satisfied customers.

In the year 1916 I made a survey of milk inspection as related to processing dairy products. I was interested chiefly in pasteurization and wrote to every city south of the fortieth parallel with a population of eleven thousand or over. Replies indicated that pasteurization was little known and less understood, while opinions relating to the tuberculin test and farm inspection were fairly uniform. Last year I completed

a survey along similar lines and the information received substantiated my view that our knowledge of processing and handling dairy products is becoming standardized, whereas ideas regarding farm inspection in the use of score cards, temperature requirements, and dairy sanitation are beginning to vary, indicating that dairy inspection is no longer devoting itself exclusively to the farm but is acknowledging the importance of the mechanical, the technical, the marketing and the chemical phase. Thus brought face to face with inspection demands, we may now consider the question, "Veterinarian or Dairyman, Which "

A few days ago, while examining recommendations of a committee appointed from this Association, I came across the following: "Dairy and milk inspectors should be agricultural college graduates or should have at least attended such an institution long enough to have acquired a working knowledge of dairy sanitation, bacteriology and chemistry." My recent survey disclosed the fact that agricultural graduates trained in dairying head the list by two to one; indeed one reply suggested that more confidence was placed in a graduate dairy inspector by those engaged in producing milk, while still another regretted the employment of either the veterinarian or graduate dairyman.

I question all three suggestions above. I object to the first because we need more than a mere *working* knowledge of sanitation, bacteriology and chemistry. Dairy inspection requires both a practical and a scientific knowledge. I object to the second because he is a narrow dairyman who disparages or lacks confidence in the veterinarian attempting to protect and establish his herd, and I object to the third because I believe that proper training if not found in either the veterinarian or dairy student is difficult to obtain.

But to continue. The average annual salary of a dairy inspector varies from $1,800 to $2,200. I am informed by a veterinarian of prominence that the yearly income of a

man engaged in this profession is about thirty-six hundred to four thousand dollars. Now the point is this: Unless a veterinarian be employed at a relatively high salary with a definite understanding that no remuneration be received from outside sources, is he not likely to be lax in his attention to duties and have conflicting ideas regarding duties to himself and to his town? There are exceptions. The veterinarian may just be starting his career or perhaps his ideals serve "to overcome the objections of a low salary," and these are exceptions expressed by a member of this association. I believe he is correct. Veterinarians of my acquaintance have high ideals. Personal contact tells me so.

If a veterinarian admits a career just beginning, does he not have designs on the future establishment of a permanent business for himself? A commendable proceeding, but perhaps somewhat depressing to inspection work on account of the change in inspectors. Reasonable compensation might overcome the difficulty, but that is a future possibility and the veterinarian makes his plans, builds up a business, and works out his own salvation. Not so with the graduate dairyman. The establishment of a plant demands a considerable outlay. It is more or less of a plunge and his contentment must lie in the small but regular income, a devotion to his work, and service to his fellowman.

Again I offer an argument perhaps a little severe. It questions the efficiency of a graduate dairyman content to serve at the ridiculously low salaries frequently paid inspectors. The same might be said of the veterinarian, but we must not forget that the dairy industry, as one veterinarian informs me, is looked upon as the "backbone" of his profession.

But is it not true that the veterinarian in dairy inspection must devote his time to two different subjects, one largely foreign to his vocation, whereas the graduate dairyman de-

votes himself to his life's work and prepares for a greater service to the dairy industry?

I have mentioned the value of the veterinarian in preventing disease and protecting herds. There are numerous recorded occasions where the trained veterinarian detected disease, quarantined the herd, and undoubtedly prevented serious results. That is all true, and yet under average conditions few examinations of cattle can be made per month and to be thoroughly efficient they should be made daily. Unless this be done the spread of disease may result as well under veterinary inspection as under the graduate dairyman. Tuberculosis is our most dreaded disease. The tuberculin test is our method of detection, yet the tuberculin test is limited and its diagnostic value occasionally somewhat questionable. It detects but one disease, yet its value is so widely acclaimed that I fear many consumers begin to look upon it as the panacea for all bacterial infection of milk, and accordingly rest under a feeling of false security. Don't mistake my attitude. Not for one minute would I sanction even a thought of its rejection. I have seen its value established in no unmistakable way, and the veterinarian is universally accepted as the logical man to establish that value. However, our greatest safeguard to health, acknowledged by all, lies in pasteurization, which protects not against *one,* but against *many* diseases, and it appears that the inspector should be he who has the better knowledge of the process not only from the standpoint of sanitation but from its physical and chemical effect on the product as well.

We may continue and argue that the dairyman is a one-line man whereas the veterinarian may serve as a meat and food inspector and as a municipal sanitary officer. That is true, yet we must admit that even now milk inspection is suffering from insufficient personnel.

As a matter of fact I have studied the problem from all

angles. I have examined college curricula for both veterinary and dairy students. I have talked to dairy inspectors and I have engaged in the work myself. Let me sum up conclusions as follows:

Our cities may be divided into three great groups; small, medium and large. To the small town I have assigned a population as great as 40,000. It receives milk from relatively short distances; it contains few dairy establishments and these not elaborately equipped. Its problems are those of dairy sanitation and farm control, for the milk supply is largely local. To it I have assigned the veterinarian.

For the medium-sized town I have established a population limit of 150,000. Here our problems become more intricate. Much of the milk supply comes from a distance. Milk plants, creameries, and ice cream factories are established, and control involves a knowledge of milk processing. In addition many plant owners are neither technically nor scientifically trained and the inspector may be called upon for advice. To such cities I have assigned the graduate dairyman.

Consider the large municipalities. What of these? Scientific, chemical, technical, and processing problems become far more intricate. And here also belongs the graduate dairyman. Likewise bacteriological, sanitary and farm control become more complex. So I have assigned the trained veterinarian. Fail in one phase and we fail in the other. Each is important. Each is essential.

Veterinarian or dairyman, which? Both. And I thank you for the privilege of offering a fifty-fifty proposition.

*"Know when to speak, for many times it brings danger to give the best advice to kings."*

## REPORT OF COMMITTEE ON REMADE MILK

DR. J. H. SHRADER, *Chairman*

For the past several years, both in this country and abroad, there has been much discussion concerning remade milk, with particular emphasis upon two aspects of the question, namely: Laboratory methods of detection and nutritive value. With regard to the former, the great problem is to devise a method which will detect the presence of small amounts of remade milk when mixed in a large quantity of natural milk. This problem is still unsolved. However, with regard to the nutritive value there has been a great deal of work done and there are many authoritative statements from well-known public health officials. It is with particular reference to the latter that this report will deal.

Holt (*Diseases of Infancy and Childhood,* page 159) says that milk powder "* * * should not be advised when fresh milk can be obtained."

Dr. J. Lane-Clayton in a report to the Local Government Board (1913) finds that all the available evidence in this and other countries supports the view that the boiling of milk in no wise reduces its nutritive value to the young animal. (Quoted from *Hygiene and Public Health,* by Parks and Kenwood, page 368.)

The Committee on Nutritional Problems (Dried Milks) of the American Public Health Association reports (*American Journal of Public Health,* 1922, Volume 12, page 113): "Dried milk may be considered, for practical purposes, as free from the danger of the transmission of epidemic disease, except under the rarest and most exceptional circumstances, and its general use should mark a distinct gain from the standpoint of sanitation.

"The evidence * * * is quite consistent and plainly places dried milk with pasteurized milk as regards the various factors of food value * * * Aside from the question of antiscorbutic vitamin, which easily can, and in our opinion always should, be provided from other sources, we believe that milk dried by any of the modern methods properly conducted is the equivalent of the fresh milk from which it was prepared. * * * We believe there is ample evidence to support the position taken by the Commission on Milk Standards that there is no occasion for prejudice or discrimination against dried milk as compared with pasteurized milk even as concerns the most delicate factors of nutritive value. * * * Powder and butter preserve milk in the condition it was in on leaving the cow and prevent the undesirable and very possibly deleterious changes which occur during the holding and shipping of liquid milk. Cities not surrounded by a dairy section or cities in a hot climate can be provided with as good a milk supply as cities more favorably located."

This committee consisted of H. C. Sherman, Chairman; C.-E. A. Winslow; E. L. Fisk; I. Greenwald.

The Committee on Remade Milk, reporting to the 1919 meeting of the International Association of Dairy and Milk Inspectors, state: "We believe that as a substitute in time of serious shortage, remade milk would have a really great value in supplying milk to children who would otherwise suffer. Your committee believes that remade milk should not be sold in mixture with natural milk, but should be sold only unmixed as remade milk; and that it should be labelled so as to show clearly of what constituents it was prepared and by what method of manufacture these constituents were combined."

This committee consisted of Leslie W. Ferris, Chairman; Professor James O. Jordan; Professor C. B. Lane; Dr.

Wm. H. Price; Dr. Harry W. Redfield; A. F. Stevenson; George B. Taylor.

The following year the same committee made the following statement in their report, page 64: "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 supply, but that when used over a long interval of time may not be as desirable as natural milk."

R. H. Dennet, *New York State Journal of Medicine,* July, 1918, quoted in International Association of Dairy and Milk Inspectors, 1921, page 83, states: "Dried milk is even more digestible than boiled milk."

In a report to this Association entitled "Dried Milk Powder in Infant Feeding," on page 272 of our transactions of the 1923 meeting, Dr. Taliaferro Clark summarizes the results of the intensive investigation by the United States Public Health Service of the work in Boston on dried milk powder in infant feeding. Among other statements are the following:

"The study in nutrition resulted in findings distinctly favorable to the use of whole milk powder in infant feeding. * * * It seems safe to conclude that the infants on whole milk powder gained in weight more rapidly than did those fed on cow's milk.

"The infants fed on a modification reconstructed from unsalted butter and skimmed milk powder (Group III) increased less rapidly in weight in the older age group (4 to 6 months) and in the total group (all ages); but in the younger age group (1 to 3 months), the gain in weight closely approximated that of infants on whole milk powder for about 11 weeks, but after the twelfth week on this diet the rate decreased and the curve approached that of the children fed on a modification of cow's milk. * * *

"From the bacteriological standpoint it would seem that powdered milk, and especially the whole milk powder, can be safely used for feeding infants where breast milk or a good grade of fresh cow's milk cannot be obtained."

In the same year your Committee on Food Value of Milk and Milk Products, under chairmanship of O. M. Camburn, sfates on pages 149 and 150 of the annual report as follows:

"The conclusions of Dr. Clark and his associates[1] are to the effect that the dried milk powders and their remade products used in the study are safe for infant feeding, and in some cases seem to have distinct therapeutic value. It is found that pound for pound dry matter, the dried milks are equal to the common liquid milk in most phases; slightly inferior with respect to antiscorbutic vitamine and somewhat superior from the standpoint of curd formation."

"The Maternity Hospital of Minneapolis has been using powdered milk of special fat grade for 2½ years on their babies from birth to any age, using it both as supplement and as complement, using it continuously or interruptedly with breast feeding. Good results, freedom from bowel trouble, uniformity of product, availability, all appeal to the Hospital authorities to such an extent that orders have recently been increased for continued future sales."

In a report to *The Nation's Health,* Volume 7, April, 1925, page 254, Dr. Supplee and his collaborators report on "Dry Milk for School Service." Among their conclusions as to the beneficial effects of dry milk is the following:

"It will be noted that the largest increase in gain is found in the group receiving dry milk only. * * * The results are not unexpected in view of those which have long been observed from the use of this product in infant feeding. The data merely serve as additional information showing that this form of milk has nutritive value comparable to

[1]Clark, T., and Collins, S. D. P. H. Reports, Oct. 6, 1922.

natural fluid milk and other milk preparations. Further significance of the results lies in the fact that this form of milk embodies the factors of convenience and bacterial purity to the degree which enhances its adaptability for use where such factors are presented for practical consideration."

It is apparent from the above quotations that remade milk from milk powder is at least as good as natural cow's milk. There is much evidence that in many cases such a product is superior to natural cow's milk.

Every large city at times experiences a great shortage in its milk supply which necessitates the waiving of sanitary control and allowing the admission of milk from various uninspected sources to carry over the shortage period. Health officers might be excused in such emergencies for waiving requirements for approved dairy farm equipment, but they are not excusable for admitting milk which is abnormal or unnatural because of being off quality incident to high germ life infection. The mere fact that the milk is to be pasteurized is no reason for ignoring the menace of an excessive prepasteurized bacterial content. The situation becomes all the more aggravating for the reason that the same meteorological conditions which operate to reduce the milk supply likewise operate to lower the vitality of infants. It is at such a time of excessive heat and drought that the health officers should insure the very highest degree of purity to the milk supply in order to relieve the strain on the suffering infant. According to practises in the past, the health officer may follow either of two courses: Waive the requirements and allow anything to come in which is called milk, or keep the restrictions on and let the industry and public suffer. In many quarters to permit the use of remade milk from milk powder has not been tolerated.

Correspondence with the members of this committee as to their ideas for this report brought only a few replies.

Professor Washburn wrote that "dry milk is milk," and that natural milk is not uniform and yet it is all called milk, and further states that if there should be any objection on the part of the public to the flavor of a remade milk, that is a matter between them and the dealer when the latter uses remade milk to fortify the natural milk. Another reply was from Professor Hiscock, who wrote that the committee should endeavor to make a clean-cut statement of its attitude on this problem.

Your chairman has had no opportunity to submit this report to the committee members for their perusal and accordingly assumes entire responsibility for its contents.

In view of the above considerations as to the authoritativeness on which is based our belief in the high nutritive value of remade milk from milk powder, and in view of the problem confronting health officers in providing a satisfactory milk supply in times of shortage, we are led to the conclusion that a health officer would be warranted in admitting the use of such remade milk without prejudice, provided that he should require of the trade a finished product which in all respects equals the regular natural milk supply which the remade milk is offered to supplement. I, therefore, wish to present the following recommendations for adoption by this Association as a guide to milk control officials:

1. In times of natural milk shortage, remade milk from milk powder may be used by dealers to supplement their milk supply without any distinguishing labeling or other specific marking, provided that the said remade milk equals in quality the regular supply and that the milk powder has come from factories which are under sanitary inspection and whose milk before being made into powder complies with the sanitary requirements of the supply which it supplements.

2. When powdered milk is used as a large or small, but

nevertheless, continuous factor in supplementing the natural milk supply of a city, the labels or caps must bear the designation that remade milk constitutes part of the supply.

3. If the remade milk is used with a pasteurized milk, the whole mix must be pasteurized under the conditions which are required for the natural milk alone.

## DISCUSSION

MR. BROWN: I feel I should take issue with Dr. Shrader regarding the sale of remade milk without labeling in time of shortage. I would suggest a statement of fact be made. The necessity for supplementing the supply at times is real, and some way should be provided so that remade milk may be used when necessary.

*"Truth when not sought after sometimes comes to light."*

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

GEORGE E. BOLLING, *Chairman*

The committee is unable to present any report of work finished in 1925.

We have collaborated with the Committee on Bacteriological Technic of the Society of American Bacteriologists in the trial of numerous brands of peptone to learn their influence on plate counts of milk. It is believed this work should be continued on a broader scale.

As empowered by this Association in 1923, we have continued to examine dehydrated media intended for use in plate counts of milk. Our approval was given to the product of the Digestive Ferments Company, which was found to give results within acceptable limits with those obtained on standard media.

The committee feels that a general adoption of a supervised medium, obtainable from a central source, for use in milk control laboratories would tend to diminish opportunity for criticism from sources or individuals, who for one reason or another appear inimical to bacterial counts of market milk.

*"The greater the obstacle the more glory in overcoming it."*

# A DETAIL IN THE MOJONNIER TESTING OF ICE CREAM

C. S. MacBride, *Milk Specialist,*
Detroit Creamery Company, Detroit, Mich.

It is the policy of our laboratory to check in every possible way, to the end that our routine tests may be relied upon in guiding plant operations.

Our ice cream mix is made up in batches of approximately eight hundred gallons each. Each batch is standardized to within a few hundredths of a per cent of the State standard for fat by use of the Mojonnier tester. As a further check, it is our policy to buy samples of our ice cream at random from retailers' cabinets and test it for fat and solids. We do this about twice a week. We noticed that these samples tested from .1 per cent to .6 per cent less than our desired standard, or less than the fat content to which our mix before freezing had been standarized. We immediately began a series of checks on our mix at different points in the plant to determine where this apparent loss occurred. We found this apparent decrease in the mix after freezing:

| Mix before freezing | Mix after freezing |
|---|---|
| 10.16 | 10.03 |
| 10.12 | 9.92 |
| 10.61 | 10.03 |
| 10.32 | 10.10 |
| 10.22 | 9.58 |

Our method of handling the cream from the freezer, and that purchased from the retailer, was to allow the sample to melt by standing at room temperature until completely melted and of approximately room temperature. As our mix is homogenized at high pressure, we could not account

for any fat separation taking place in the sample. After trying various methods of preparing the sample and weighing, we find that the following gives accurate results when testing frozen ice cream.

The sample is kept frozen until ready for testing. An extraction flask is tared on the balance and approximately five grams of frozen ice cream is placed in the flask. The flask is then placed in the cooling oven, melted to a constant temperature, and then weighed back on the balance. The rest of the test is made in the usual way. We find this method gives very accurate results as to comparison of the mix and frozen ice cream from the mix.

| Mix before freezing | Mix after freezing |
|---|---|
| 10.53 | 10.51 |
| 10.54 | 10.56 |
| 10.19 | 10.20 |
| 10.17 | 10.18 |
| 14.54 | 14.54 |

This apparent decrease is undoubtedly due to the nature of the sample, and to the fact that we do not get an absolutely homogeneous sample of the frozen ice cream. There is a possibility that this is due to a slight churning of the mix in the freezers and subsequent separation of the butter granules after melting. A higher homogenization pressure might prevent this.

The above data is submitted merely as an experience of a single laboratory and further inquiry should be made.

*"For every wrong there must be a remedy, but the remedy can be nothing less than the abolition of the wrong."*

# SOME HEAT-RESISTING STREPTOCOCCI FOUND IN MARKET MILK

H. O. WAY, Cleveland, Ohio

During the summer of 1923 one of the milk plants catering to a high-class residence section in Cleveland had considerable trouble with high bacteria counts. The building and equipment were in good condition. During 1922 a new pasteurizing room had been built. A battery of three new pasteurizers (Burrell spray system) and a new brine cooler had been recently installed. All surrounding conditions were of a high type and practically everything connected with the plant and its operation was beyond criticism. Day after day counts of 300,000 to 400,000 colonies per c. c. were obtained in the bottled milk. The Health Department had complained several times and urged that something be done.

Plant control samples for bacteria count in duplicate were taken twice a week by our laboratory. These samples were from the pasteurizing vat, an empty washed bottle at the filler, a bottle of milk ready to be placed in the cooler, and a bottle of the previous day's milk which had been hauled over one of the morning routes and returned to the plant.

Samples taken from the pasteurizing vat showed counts frequently as high as 200,000 or 300,000 colonies per c. c., the one general type of small colony predominating. Samples of the freshly bottled milk usually ran from 30 per cent to 50 per cent higher than the vat, while samples from bottled milk held in the cooler over night, hauled over the route in the morning and returned to the plant as surplus, usually showed a slight reduction from that taken at the time of bottling.

In this plant the milk passed from the pasteurizer vats through a centrifugal pump which forced it upward about fourteen inches and through an International filter. Samples plated from the pipes after having passed the pump, but before entering the filter, showed an increase in colonies of about twenty-five per cent. Other samples, taken as the milk passed from the filter to the cooler trough, showed an increase of approximately another twenty-five per cent, while samples taken from filled bottles showed practically no increase over that from the filter outlet.

In another plant located in the west end of the city, and about nine miles from the above plant, receiving its milk supply from a source fifty or sixty miles distant from that supplying the first plant, there was a similar experience with these organisms. In this plant, however, the milk passed from the pasteurizing vats (Creamery Package coil system) directly over the cooler by gravity without passing through either a pump or a filter. In this case the count in the freshly bottled milk varied little from that in the vats.

In a neighboring city about seventy miles southeast of Cleveland another plant, using the same type of pasteurizer as that in plant number two, had a like experience, but about this time they installed an International filter, through which the milk passed by gravity without being pumped or otherwise agitated. In this case the count was reduced about twenty-five per cent below that of the vat. In all three plants the vat count, when pasteurization (142°-145° F. for 30 minutes) was completed, usually varied from 100,000 to 300,000 per c.c. of the same type colonies.

Microscopic examination of the bottled pasteurized milk showed large numbers of streptococci occurring usually in pairs and sometimes four or six, while the raw milk showed chains of six, eight, or ten, and sometimes 14 or 16 cocci. This, we believe, clearly demonstrates that the increase in colonies was due not to growth, but to a

breaking up of chains. The heat of pasteurizing probably weakened or partly destroyed the gelatinous binding material and the agitation of the pump completed the breaking up of the chains into smaller elements.

## Source of Organisms

Considerable work was done in locating the source of these organisms in the supply of plant number one. Finding them in the pasteurizing vat in such numbers naturally led us to examine the consignments of the shippers. Several of them were found to contain large numbers of these organisms, while others had but few or none. Agar plate cultures were made weekly from each shipper for six weeks. Those having large numbers of these organisms on three or more consecutive examinations were sent a letter informing them of the condition and asking for their cooperation. A personal visit was also made by the writer to as many of the farms as possible to try to locate the trouble.

In about twenty per cent of these places udder infection other than garget seemed to be the most probable cause; and in one herd organisms of this type were isolated from the milk direct from the infected teats of several cows. In the other eighty per cent of places, teat cups and rubber tube connections of milking machines, improperly cared for, accounted for the trouble. When kept in ordinary cold water, or air-dried between milkings, they were found to contain millions of this type of organism; but when kept completely submerged in a hypochlorite solution the trouble disappeared.

The search for their origin was continued to the freshly voided urine and feces. The urine was found to be free except where contaminated with feces, but the feces contained myriads of organisms resembling these on agar,

though comparatively few are able to resist the same high degree of temperature.

A comparison of an aqueous extract of feces with a sterile milk extract of feces showed comparatively few in the aqueous extract that were resistant at the temperatures and conditions of pasteurization; but about five times as many resisted pasteurization conditions when milk was used to extract a like amount of the same sample of feces.

## Cultural Characteristics

On agar plates these organisms appear as very small, ("pin point") colonies. Under the low-power microscope (100 diameters) they are found to be of at least two types: one a slightly filiform or elongated colony, and the other nearly round, with a very slight halo. The one does not seem to coagulate milk, while the other does produce a slight coagulation in 72 hours at 37½° C. They grow readily on ordinary laboratory media at the usual temperatures, but do not grow at the temperature of pasteurization. A sample of milk containing about 80,000 colonies of these organisms per c.c. was placed at 142-145° F. for 72 hours, and at the end of that time was found to contain approximately the same number (within the usual limits of variation), thus showing that growth does not take place under conditions of pasteurization. We have found them to withstand 162° F. for one hour in milk. Further work on the cultural characteristics has been delayed for some months because of the pressure of routine laboratory work; but it is intended to make this the subject of a later report.

## Conclusion

As a result of the work so far conducted we find that when an unusual number of this type of organism is present in a milk supply, it is the result of (a) an infection

of the teats, and may be either in the milk canal or on the outside of teat; or (b) milking machine connections not properly cleansed and sterilized.

We feel justified, therefore, in concluding that when any pasteurized milk supply shows the presence of large numbers of these organisms, it suggests an insanitary condition either in the herd or in the equipment used in handling the milk.

*"We judge ourselves by what we think we are capable of doing, while others judge us by what we have already done."*

# REPORT OF COMMITTEE ON SERVING MILK IN SCHOOLS

PROF. W. P. B. LOCKWOOD, *Chairman*

1. *The proper place to serve and conditions of serving.* School buildings were not built with the idea of milk service, and consequently the work has to be adapted to different places, some schools serving in the rooms, some in the halls, and some even in the school yards. On account of the crowded conditions in many schools, facilities have not been ideal. Possibly the serving has not been ideal. I have heard the criticism that sometimes milk is served during the first few minutes at recess and then children allowed to go out and take violent exercise and play. From some standpoints this may not be best, but it seems to be the general opinion that it is much better for children to do this than not to receive milk at all.

2. *Caring for empty containers.* It is difficult to care for empty containers by simply rinsing them, as required by law in many places before returning bottles to the dairy. When rinsing is not done, particularly in the summer time, an undesirable condition may develop in bottles standing in school buildings until the deliveryman calls for them, which may not be until the following day.

3. *Some children do not like milk.* This is overcome in some instances by the mob spirit, the child wanting to make his room 100 per cent perfect, taking milk through the straw, etc. I have understood from our workers that some children have reached the point where they will not take milk at home unless it is given to them through a straw.

4. *Legitimate objection of some parents to their children being served with milk.* We have not experienced much of this opposition, although it is prevalent to some extent,

particularly in families that are financially able to give the child all the milk that is desirable at home and milk of an exceptional quality.

5. *Distribution of the milk to the children who need it most.*

6. *Financing of milk for those children who need it and cannot afford to pay for it.* Ofttimes it has been found that children who need milk most are the ones whose parents can least afford to pay for it. In many cases this is a serious problem. In other instances milk is provided by the city, Kiwanis Club, Rotary Club, women's clubs, etc.

7. *Attitude of teachers.* The attitude of teachers has a great deal to do with the success or difficulties encountered in serving milk in schools. Some teachers feel that it is one more thing put on them to do. Others who are not naturally inclined to handle money find it very difficult to keep accounts accurate. However, on the whole it has been our experience that most teachers are very glad to do their part of this work. Many of them have pointed with pride to what has been accomplished in helping individual children.

8. *Delivery and refrigeration of milk.* The proper delivery and refrigeration of the milk, particularly in warm weather, is a problem, as is the keeping the milk from freezing during the winter time, particularly in the North.

9. *Supply in country schools.* In country schools there is a serious question of proper supply. It has even been pointed out that the milk in the country is seldom, if ever, pasteurized and frequently is from cows that have not been tuberculin tested.

10. *Children carry money from home for milk and use it for other purposes.* The school milk has competition with candies, cookies, pop, and other things and it has been brought to our attention on several occasions that children sometimes use money meant for milk to buy other things.

11. *Necessity of keeping the children sold on drinking milk.* Children usually start enthusiastically to take the milk, other things come up, and some tire of it. In my correspondence with school authorities I find without exception all are using every effort possible through stories, lectures, nurses, teachers, and with both children and the home people to impress on them the need of the use of milk by children. It is an educational process and we feel that notwithstanding the difficulties, the use of milk by the school children is rapidly on the increase. It is also interesting to learn from milk distributors in the Boston district that in territories where milk is served in the schools they are selling larger quantities per family in the home, which shows conclusively that the work done in the school for the children is also carried on at home.

*"Whoever serves the children well has no need for ancestors."*

# THE HEALTH DEPARTMENT AND THE MILK DEALER

WM. B. PALMER, *Executive Officer,*

Milk Inspection Association of the Oranges, Orange, N. J.

The purpose for which a health department is organized is the safeguarding of the public health. Both the State and local health departments are created under the State laws, and in addition to regulations imposed by these same laws they adopt sanitary codes dealing with the various phases of public health. Observation of this mass of legislation will show that a large part has been designed to control the purity and quality of the milk supplies. Standards of chemical quality, bacterial content, and specifications for equipment, production, processing, and distribution are specified.

The control of the milk supply is an immense problem. By a study of the situation we find that it is an interstate, intrastate, intercity, and local problem. As to the matter of interstate products, practically no Federal authority is exercised as to sanitation, which is of primary importance to the health official. Likewise the State departments of health do not concern themselves in this matter, but devote their time to certain lines of supervision within their respective States. However, these departments cannot maintain sufficiently large staffs of employees and equipment to assume the responsibility as a State problem. Therefore it becomes a local problem and rests with each municipality to enforce the State regulations and adopt and enforce ordinances of their own suited to local conditions. Thus cities, as well as many other communities, are faced with the situation of supervising milk production over a milk shed covering hundreds of miles and numerous plants main-

tained by many dealers, supplied by a great number of farmers, and the milk from which is often dispensed in several cities.

Three phases of the problem are thus presented; namely, legislation, the health department, and the milk dealer. The matter of unifying legislation is evidently far distant, but much time and effort is being given to the subject, which will have a direct influence on revisions of present laws and ordinances as well as new regulations. Public health and food officials' associations have accomplished much to this end by drafting and recommending model ordinances. Boards of health have combined, organized as an association, and have adopted uniform ordinances.

Some health departments have made much progress, established laboratories, and have developed elaborate systems of supervision, which other municipalities obtaining milk supplies from the same sources have relied on for protection. Such cities should be made to realize their responsibilities in the welfare of their people and induced to provide adequate means for the adminstration of their health departments.

The licensing system established under the provisions of the State laws and in operation in the majority of municipalities is a means for control of the dealers and their supplies. The licenses provide that the licensee shall abide by the ordinances and regulations of the municipalities. In order to meet the demands set forth in these regulations it is absolutely necessary for the dealers to maintain field supervision and laboratory control. It is the duty of the health department to keep constant check of the supplies by inspection and milk analyses to ascertain if legal requirements are fulfilled.

Many of the larger dealers are employing inspectors and are operating laboratories, while numerous others have done little or nothing in this most important matter, which is of

vital interest to their business. This is possibly due to the fact that a great many persons engaged in the milk business are not aware of the scientific requirements necessary to safeguard their product and the public health, and this phase of the industry has not been forcibly brought to their attention. They are ignorant of the possible dangers involved in the production and distribution of milk, as well as the financial losses directly attributable to unsupervised supplies.

Health departments can be of great assistance to milk dealers in perfecting the scientific side of their business, thereby securing improved milk supplies and added protection to the public, as well as the development of cooperation with the dealers. They can assist in the instruction of dairy inspectors while doing field work, give advice in the establishing, equipping, and operating of laboratories, aid in the planning of creameries and milk plants and their equipment, and provide for scientific training of milk analysts.

The consolidating of milk control work can be perfected on the plan adopted by the Milk Inspection Association of the Oranges, N. J. This is an organization of boards of health of five cities with a combined population of approximately one hundred and forty thousand. The Association is charged with full power for the supervision of the milk supplies, and is equipped with a laboratory, office, and staff to carry on the work. Funds are provided by assessments which are included in each of the Board of Health budgets. The advantages of uniformity in regulations and control have been well demonstrated, with results beneficial to the producers and dealers as well as the municipalities. Duplication of work and expense has been eliminated and the system has proved to be satisfactory from the standpoint of economy and efficiency.

Boards of health can do much to simplify the present chaotic conditions in the milk business due to the many

types of legislation by adopting, as far as practicable, standard ordinances which have the approval of official organizations.

Further advancement can be gained by the consolidation of small milk dealers. This was perfected by the writer with the dealers of the Oranges, N. J., who incorporated and established a large pasteurizing and bottling plant in the city and operate a creamery from which all their supply is secured. The present output of this concern is about 6,000 quarts daily. Through this plan the sources of supply are centralized, small, inefficient, and inadequately equipped bottling plants are eliminated, improvement in quality of products is secured by the possibility of better control and the use of better equipment, and the enforcement of pasteurization is simplified by the volume of milk handled and the ability of the concern to install proper machinery and operate on an economical basis in competition with the big companies.

Health departments and officials can give much time with valuable results by securing the aid and cooperation of other agencies which are interested in the milk problem. In connection with the writer's work in assisting milk dealers to establish and perfect their own inspection and laboratory systems, the assistance of the New Jersey State Agricultural College was solicited. The needs of the industry were emphasized and request was made for a course in dairy bacteriology. As a result a two-weeks' short course is now being given at the College, starting this month. The technique of the standard plate counting methods of the American Public Health Association and chemical analyses of milk will be taught. The work will include both lectures and laboratory practice in making media, sterilizing media and equipment, taking samples, methods of preparing plates, counting and interpreting results, and other laboratory practice. Special attention will be given

to the matter of organizing the laboratory, choosing and buying the material for bacterial analysis, and to the discussion and comparison of the different methods in general use with reference to equipment needed. Tuition is free. A registration fee of ten dollars is charged to residents of the State, and fifteen dollars for nonresidents.

The College advises that they will have a large registration, which will possibly demand the repeating of the course. It will, therefore, be possible for milk companies and milk-products companies, as well as health departments, to have laboratory operators instructed in milk analysis. Aside from the benefits to be derived by the dealers, the public will also receive direct benefit because of the improved quality of the milk supply which is bound to result. This is also another means of bringing the dealer to a realization of his responsibility in the protection of the public health.

At the present time practically all of the milk dispensed in the Oranges is produced under supervision by inspection and laboratory control maintained by the dealers. A great deal of this has been brought about through the cooperation of the Milk Inspection Association with the dealers. The results justify the further development of these systems.

## Conclusion

1. Milk legislation should be unified.

2. Health departments should be properly equipped for the efficient supervision of their milk supplies.

3. Milk dealers should be educated to their responsibility in the protection of the public health, the necessity for safeguarding their milk supplies, and in the establishment of proper systems to be employed.

4. Health departments of communities with common sources of milk supply should combine their milk control work under uniform regulations.

5. Small milk dealers should be consolidated, thereby permitting the establishing of properly equipped plants, better control of the products, and the enforcing of public health ordinances.

6. Health departments and other agencies interested in the milk problem should provide special educational courses for inspectors and milk analysts.

## DISCUSSION

DR. SUPPLEE: I note the suggested short course in bacteriology. What is anticipated as the ultimate function of those having two weeks' training?

MR. PALMER: The object is to secure the installation of a laboratory and start work. It may not be ideal, but it is a step forward. Intensive training during two weeks sometimes leads to more progress than does training for a longer time.

*"People do not lack strength—they lack will."*

# REPORT OF COMMITTEE ON FOOD VALUE OF MILK AND MILK PRODUCTS

PROF. IRA V. HISCOCK, *Chairman*

Previous reports of this committee have dealt largely with accumulating evidence indicating the important place in the dietary of milk and milk products. Not only is milk considered a most suitable food for consumption by man, but it is indispensable in the diet of infants and invalids. Because of the fact, however, that milk is a food easily adulterated and contaminated, emphasis has been repeatedly given to the importance of careful supervision of its sanitary quality.

It is appropriate at this time to review the results of recent investigations of the nutritive properties of milk. In view of the stimulus given to campaigns for increased milk consumption during the past few years, it has also seemed again desirable to take account of stock, as it were, in order to ascertain if our efforts have been wisely directed and to what extent they have been successful. Incidentally, reference will be made to factors of a sanitary character which have an influence on the quality of market milk.

The statement is frequently made that cow's milk contains all the essential food elements in a form which is easily assimilated. There is ample evidence to justify this claim. From a practical milk inspector's standpoint, this fact should be borne in mind, although it is likewise important to consider any possible limitations of the product which may be demonstrated after careful research.

In the two previous reports, reference has been made to the low iron content of milk. It has been pointed out that because of this deficiency a child should not be confined too

long to milk as its sole food. Von Bunge was probably the first to show[1] that milk is low in iron. He also showed that mammalian young (the guinea pig excepted) are born with extra store of iron in the spleen and liver and that these reserves become sources of iron for hemoglobin building during the early periods of life when milk is the sole article of the diet.

Abderhalden demonstrated[2] that if an animal were kept for a prolonged period on a diet consisting only of milk, anemia would result with a marked decrease in the hemoglobin content of the blood. Addition of inorganic iron to the milk diet did not result in an increase in the hemoglobin, although there seemed to be some favorable effect upon the growth of the animal.

During the past year, Hart, Steenbock, and their coworkers[3] have reported that rabbits limited to a whole milk (cow's), sodium citrate diet develop a nutritional anemia characterized by low hemoglobin and erythrocyte content of the blood. Inorganic iron ($Fe_2O_3$) added to the basal ration will not *per se* correct this anemia. On the other hand, inorganic iron in the presence of fresh cabbage or alcoholic extracts of dessicated cabbage or of yellow corn meal (extracts free from iron) will prevent or cure such an anemia. Anemia on a milk diet was as readily induced when the animal was subjected to irradiation as without. These results and those of other workers in allied fields[4] are interesting and have attracted much attention, but as recognized by the authors, the data are too limited for final conclusions, and their significance with respect to the rela-

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[1] Von Bunge, G., Z. Biol., 1901, XLV, 532.
[2] Abderhalden, E., Z. Biol., 1900, XXIX, 193 and 483.
[3] Hart, E. B., Steenbock, H., Elvehjem, C. A., and Waddell, J., Iron in Nutrition, J. Biol. Chem., 1925, LVX, 67.
[4] (a) Sure, B., J. Biol. Chem., 1923-24, LVIII, 693.
(b) Evans, H. M., and Bishop, K. S., J. Metabol. Research, 1922, I, 319, 335, 1923, III, 201.
(c) Evans, H. M., and Bishop, K. S., J Metabol. Research, 1923, III, 233.

tion of vitamin E to the problem, for example, is not entirely clear.

A second line of investigation has had to do with the results of confinement on a sole milk diet in relation to reproduction. Unsatisfactory growth and reproduction in rats on a diet of milk have been reported by Mattill and Conklin,[5] and Mattill and Stone,[6] who believe that milk is lacking quantitatively and qualitatively in substances necessary for adolescent growth and reproduction. Sure,[7] and Evans and Bishop[8], working with milk and synthetic rations simulating milk have also noted failures in the reproductive functions in rats.

These findings have been attributed to a dietary deficiency, vitamin X. Whole cereals have been found to protect against sterility, or to cure it when once established. The factor essential for normal reproduction may occur in a wide variety of foods, as in egg yolk and in meat, but surprisingly enough it is reported to be exceedingly low in milk. Fresh milk has been utilized in these experiments, as have total milk solids such as skim milk powder and whole milk powder. As pointed out by Supplee and Dow,[9] however, while the evidence recorded by these investigators may seem to indicate the existence of an unknown factor X, such an hypothesis is not yet generally accepted.

Consideration has been given to suitable balances of the various constituents of the ration. Mattill and his associates[10] have shown that on a milk diet low in fat and without added lard, reproductive failure does not occur. These investigators have given particular attention to the matter of

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[5] Mattill, H. A., and Conklin, R. E., J. Biol. Chem., 1920, XLIV, 137.
[6] Mattill, H. A., and Stone, N. C., J. Biol. Chem., 1923, IV, 443.
[7] Sure, B., J. Biol. Chem., 1923-24, LVIII, 681, 693.
[8] Evans, H. M., and Bishop, K. S., J. Am. Med. Assn., 1923, LXXXI, 889.
[9] Supplee, G. C., and Dow, O. D., J. Biol. Chem., LXIII, 103.
[10] Mattill, H. A., Carman, S. S., and Clayton, M. M., J. Biol. Chem., 1924, LXII, 729.

reproduction when milk, either fluid or dried, was the variable component of the ration. Preliminary investigations by Supplee and Dow[11] have shown that oxidative changes which may take place under conditions prevailing in milk powder, stored in air over long periods, prevent reproduction. Successful reproduction and rearing of the young resulted when the butter-fat, as supplied by the Just process dry milk, comprised from 2.8 to 5 per cent of the ration, provided the milk powder had not been subjected to excessive oxidation after manufacture.

It seems evident from the work of Anderegg,[12] of Daniels and Hutton,[13] and of Mattill, Carman and Clayton,[14] that all substances necessary for normal growth and reproduction are in milk, but that possibly certain of these substances may be in too small concentration for most satisfactory development without being supplemented. It has been observed, as above noted, that in animals fed milk low in fat, marked reproductive failure does not occur. Apparently, when more milk is taken, as would be the case in rats fed a low-fat milk, enough of the various essential substances are obtained for the production of a next generation. Daniels and Hutton have obtained five generations of normal young on whole milk (3.25 per cent fat) to which a four-mineral mixture (aluminum, manganese, fluorin, silicate, and milk) had been added and hence are of the opinion that the deficiency of milk lies in its inorganic element. They state, however, that whether all four of the salts used are in low concentrations in milk is not clear, nor have they been able to determine which are most essential. Aluminum and sodium silicate appear to be necessary, but they must be so incorporated in a diet that

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[11] Supplee, G. C., and Dow, O. D., J. Biol. Chem., LXIII, 103.
[12] Anderegg, L. T., J. Biol. Chem., 1924, LIX, 587.
[13] Daniels, A. L., and Hutton, M. K., J. Biol. Chem., 1925, LXIII, 143.
[14] Mattill, H. A., Carman, S. S., and Clayton, M. M., J. Biol. Chem., 1924, LXII, 729.

they are both available. The addition of the four minerals to a purified ration in the same concentration in which they were used in milk feedings was without effect. It is also suggested by these authors that failure may have been due to a lack of vitamin X in this mixture or to too little of the added salts.

These investigations have been briefly summarized in this report because of their general interest and because of their possible significance. From a practical standpoint it should be noted that most of the studies referred to above have been made on small animals, chiefly the rat. The life span of these animals is of course relatively very short as compared with that of man. Furthermore, man's diet is not confined entirely to milk even in the infancy period, when fruit juices or tomatoes or certain other products are given early to supplement the vitamin C content of raw as well as of pasteurized milk. The diet of infants is also regulated to make up for the low iron content of milk, which seems to be its most marked deficiency.

Considering the problem broadly, these deficiencies seem, therefore, to be of a minor character, for which suitable supplements may be obtained. As a food for the growing child, there is no substitute for milk. As in last year's report, it may be well to emphasize that milk is the best protein food for infants and is an important source of calcium and vitamins. McCollum has stated that milk is the most satisfactory article of food which is suitable for consumption by man, the fats of the milk constituting the most important source in the American and European diet of the dietary essential, fat-soluble A. Milk is unique in furnishing more calcium than any other common food. The results of work by Sherman and Hawley quoted in a previous report indicate that optimal storage of calcium is made when the diet contains one quart of milk a day for each child. The benefit of a liberal allowance of milk is not due

entirely to the calcium content, but to the well-balanced proportions of calcium, phosphorus, and other growth essentials.

From the standpoint of infant feeding it is agreed that breast feeding of infants should be encouraged whenever possible. Recent studies have made it evident that phosphorus plays a more important role in the metabolism of infants, more especially in the metabolism of bone, than had been realized. An inquiry as to the distribution of the phosphorus in the dietary of the growing child naturally implies a study of milk, which forms the sole constituent of the dietary throughout the first months of life and its basis during the following year.

Investigations of the total phosphorus content of milk have been numerous, whereas studies of the phosphatid fraction have been very limited. Whatever may be the viewpoint with regard to the significance of phosphatid in the diet, Hess and Helman[15] have emphasized that it is a constituent of almost all the cells of the body, and that in the human blood organic phosphorus constitutes over 80 per cent of the total phosphorus, and inorganic phosphorus only a small per cent. These authors have recently studied the phosphatid and total phosphorus content of human and of cow's milk. Their analyses showed that cow's milk contains about twice as much phosphatid as human milk. The amount was higher in milk or in cream with a high percentage of fat. The total phosphorus of cow's milk averaged about four times as high as that of human milk and was still higher in the milk of goats.

Realizing that the production of clean, safe milk is essential, considerable attention has been given by milk inspectors and also by representatives of the dairy industry to methods of production. Pasteurization by the holding process is now considered the most reliable safeguard at

[15] Hess, A. F., and Helman, D., J. Biol. Chem., 1925, LXIV, 781.

present available for practical use in communities. In addition, increased efforts are being directed to secure clean milk from healthy herds and handled by careful milkmen who are themselves free from disease. The importance of proper refrigeration is likewise recognized.

In view of the difference of opinion which still exists relative to the probable effect of heat on the chemical and physical properties of the mineral salts of milk, it is interesting to consider the studies of Bell[16] on the effect of heat on the solubility of the calcium and phosphorus compounds in milk. Some observers claim that the heating of milk causes part of the soluble compounds containing calcium and phosphorus to change to an insoluble condition and be precipitated, while others claim that there is no noticeable change in the solubility of the compounds. Not only is this found in the strictly chemical investigations of milk, but in the nutrition experiments conducted by Lane-Clayton (1916), Daniels and Loughlin (1920), and others on the nutritive value of raw and boiled milks. Reference to other observations has been made in the report of the Committee on Pasteurization.

In Bell's studies, fresh skim milk was heated to various temperatures in order to study the effect of heat on the solubility of the calcium and phosphorus content. These studies were made with the aid of Pasteur-Chamberland filters and a high-speed supercentrifuge. There appears from the results to be a loss in the soluble calcium and phosphorus contents of the skim milk due to heat, the loss depending upon the temperature to which the milk has been heated. The results from the methods employed, according to Bell, indicate that definitely measurable amounts of those substances are removed from solution in milks heated to 170 degrees F. or above. This temperature, however,

[16] Bell, R. W., J. Biol. Chem., 1925, LVIX, 391.

is 25 degrees higher than the maximum usually recommended for pasteurization.

The average American food supply has been found to be one-sided through liberal if not excessive use of meats and sweets and insufficient use of milk, fruits, and vegetables in the diet. The American Child Health Association recently surveyed health practices in 86 cities of 40,000 to 70,000 population. Their investigators questioned over thirty-five thousand school children as to their habits and diet and learned among other things that while more children drank cocoa or milk for breakfast than tea or coffee, 39 per cent drank coffee. Forty-two per cent of the fifth-grade children were found to drink less than a pint of milk a day, while 22 per cent drank no milk.

Information obtained from 168 cities and towns of 46 States and the District of Columbia in 1924 showed an average per capita consumption of 0.81 pint of milk sold in these cities per person per day. A daily per capita consumption of one pint or more was reported by 29 cities. Forty-nine cities and towns reported that less than a half pint of milk was consumed on the average by each person daily. Several of the large cities which reported a daily per capita consumption of less than a half pint in 1920 showed somewhat higher figures in 1924 and still further increases in 1925. Data supplied by the U. S. Department of Agriculture for the country as a whole show that from 1920 to 1924, milk consumption increased from 43 to 55 gallons per person per year. Butter consumption during that period increased from 14.7 to 17 pounds per person, while ice cream consumption rose from 2.46 gallons to 2.68 gallons, and cheese, from 3.51 pounds to 3.91 pounds. According to Dr. Larson, milk consumption has increased more rapidly than milk production.

Increased use of milk is particularly noteworthy in certain of the cities which have benefited for some time by ex-

cellent programs of milk supervision. In recent years, milk supervision in such cities as Birmingham, Boston, Detroit, New Haven, Ottawa, Richmond, and Toronto, for example, has been developed to a high degree of effectiveness coincident with increased milk consumption. The milk inspector is naturally eager that an adequate supply of safe milk be secured. His activities are chiefly educational. The director of one bureau of milk inspection voices the belief of many inspectors when he writes that the public will never use the amount of milk and other dairy products that they should until they have confidence in the quality of these products, and until they feel that all along the line, proper supervision is being given to the many steps in the handling and manufacturing of these products.

Nutrition workers and public health officials have expressed their belief that a quart of milk per day for every child, and at least a pint for every adult, is desirable. Although there are undoubtedly a few persons who have an undeniable idiosyncrasy, usually some anaphylactic manifestation, which may preclude the use of this food in their diet, while other persons may have a "fancied dietary grievance against milk," these by no means represent the mass of the population. Hence there still seems to be abundant occasion for the promotion of public health policies in urging increased milk consumption to the desirable amount above suggested. To quote from Dr. Haven Emerson's paper read at the World's Dairy Congress two years ago: "The wealth of the nation in human and material resources will surely be greatly enhanced when the consumer demands and is prepared to pay for a safe quality of milk and an amount which will safeguard the nutrition of his family."

Slow progress is being made in extending the sale of bottled milk in restaurants and hotels. It would be desirable to have all the milk served in these places handled in

this manner, but many proprietors of these establishments view the subject from the price basis alone. They do not consider that by the bulk method the opportunities for increase in bacterial content are multiplied and that in many instances the cream is unevenly distributed, so that it frequently happens that customers are served with skimmed milk instead of the normal product. The patrons of restaurants and hotels dealing in loose milk may be further defrauded by the dishonesty of the owners or help in these establishments through the wilful removal of cream and the serving of the resulting skimmed milk for whole milk. The prosecutions for milk varying from the legal standards of fat or milk solids plainly indicate that as between the bottled milk and bulk milk in shops, hotels, and restaurants, the samples of bulk milk are much more often found to be below standard.

As one means of improving a milk supply and maintaining high standards, the value of the public health laboratory can hardly be overemphasized. A recent study of the situation in 100 of the largest cities of the United States showed that bacteriological examinations of milk were made in 84 cities and chemical examinations in 66 cities. It is doubtless true that in a large proportion of the cities in which these examinations are not made by the local public health laboratory, this service is provided by State laboratories or by local plant laboratories. The frequency of analyses varies considerably, but in most cities carrying on active milk supervision, efforts are made to secure samples from each dealer at least once a month and from pasteurization plants more frequently, as once a week. It is urged that efforts be made to secure greater uniformity in laboratory bookkeeping in order that the results of examinations in different cities may be more accurately compared. The results of laboratory analyses are published either in bulletins or in the daily press in a little over half of the cities of

the United States and Canada supplying this information.

Finally, it is noteworthy that there has been a tendency during the past two years, particularly in several cities, to make special surveys of the milk situation from a standpoint of both milk consumption and of milk supervision. An excellent report has recently come to hand as a result of a study of Memphis's milk supply, while Detroit has reported upon its situation through the *Weekly Health Review*. A milk survey of 39 towns and cities of Kentucky was made last year by the State with the cooperation of the American Child Health Association, and a state-wide program of control similar to that of Alabama and of North Carolina has been inaugurated. The *Ohio Health News* for May 1, 1925, contains a summary of replies to questionnaires sent out to 182 health districts by the State Department. The results of these questionnaires showed a most creditable improvement during the past three or four years in measures for safeguarding the milk supply and for improving its quality. In New York State, through the Department of Farms and Markets, and with the cooperation of divisions of sanitation and labor of the State Department of Health, surveys of individual city milk supplies have been carried out, and efforts have been made to impress dairymen with the idea that it is to their advantage to produce good milk.

As a result of the efforts of city and State health officials, strengthened by excellent cooperation on the part of milk producers and dairy organizations, this country now has a milk supply of which it may be justly proud. A large percentage of our people, particularly those of the largest cities, may have the benefit of high-grade milk. Communities having lax supervision, or ordinances which are out of date, are rapidly falling in line. The past two years have witnessed notable progress in this regard.

The milk inspector's task includes more than supervision

of production. Milk consumption to reach the desired standard of one quart of milk per person per day should be our goal. The value of pasteurization of milk and the need for the proper care of milk in the home should be taught. It is our duty to endeavor to impress these truths upon the public which we serve.

*"Then, welcome each rebuff*
*That turns earth's smoothness rough,*
*Each sting that bids nor sit nor stand but go!"*

# A WELFARE DEPARTMENT OF THE DAIRY INDUSTRY

SAM H. GREENE, *Secretary-Manager,*
California Dairy Council, San Francisco, Cal.

It is a fact not yet generally recognized that the same fundamental principles underlie the dairy industry and the same factors are involved in it as in the case of other industries.

The accepted principles that economy in production and manufacture, quality of product, and scientific distribution are essential to its welfare is as true of the dairy industry as of any other. The factors of production, transportation, manufacture, and distribution, both wholesale and retail, must be recognized in dairying, as well as in other industry.

It is necessary, however, to take account of the fundamental differences in the organization of industries, for these differences necessitate different methods of accomplishing the same purposes. Those which are entirely sound and successful in one industry may be unsound and unsuccessful in another. Failure to recognize the force of this principle has caused some painful consequences in California, and, I imagine, in other States also.

Not all industries are organized on the same lines; some are very closely knit, while others are loosely linked up. The Standard Oil Company is a good example of closely organized industries. It controls its own production, has something to say about transportation (inasmuch as it owns its pipelines, steamers, and tank cars), does all of its own manufacturing, and distributes its own products, some of them, as in the case of gasoline and lubricating oils, directly to the ultimate consumer. It does all of its financing and

maintains its own research, experimental, educational, and publicity departments.

The work of all of these branches of its tremendously varied activities is carefully and efficiently coordinated by means of boards of directors, conference boards and other machinery set up within its own organization.

Now dairying is one of the most complex and loosely organized of all industries. Production of raw material is in the hands of our dairy farmers who are generally intense individualists, often do not agree among themselves in settling the problems of production, and seldom accept advice from others, even from other dairy farmers. Transportation is in the hands of the public utilities, railroads, steamers, motor truck lines. Manufacture is almost as divided as production, and fully as unorganized, and distribution of butter and cheese is carried on largely by those who have little interest in the welfare of the industry, so little that most of them do not consider themselves to be a part of it.

The research and educational work is carried on by the Federal Government, the State agricultural colleges and in some of the higher universities, and I should mention the dairy and agricultural journals. Fair treatment—regulation—is enforced by the States, and, previous to the organization of the National Dairy Council, the only publicity our industry received was through county and State fairs.

Each of these groups is usually entirely independent of the others, financially and in every other way. They do not pull together and frequently are so antagonistic to one another as to cause the loss of enormous sums of money and to retard progress to an almost unbelievable degree.

If the cost of producing oil in any particular field is out of line with the cost elsewhere, an investigator from headquarters goes into that field and ascertains the facts. Then another man goes there, lays the results of the investi-

gation before the field superintendent, and they work out plans to get the cost of production down, calling in assistance from as many of the other branches as may be neceessary.

Investigations of production in dairying are made usually by Federal and State agencies, but what usually happens when the results are ascertained? When a man from headquarters goes into an oil field and tells the superintendent his cost of production is too high and he must get it down or the Company will get another man—that cost usually comes down. If a man were to go to a dairy and tell the dairy farmer his cost of production was too high and he must reduce it, the dairyman would, quite likely, run him off the ranch with a pitch fork. The same comparison holds true in the departments of manufacture and distribution.

In short, then, whereas all departments in the Standard are coordinated in a unified policy of procedure, each department of the great dairy industry is a separate entity and a law unto itself. Yet the problems of the two industries are identical. It is when we try to solve these problems that we find we must use different methods.

With these thoughts in mind, the leaders of dairying in California determined to attempt the formation of an organization that should be more than a mere advertising club, although promotion of the sale of dairy products is, of course, a major function.

These thoughts were well fixed in the minds of the men who came together in July, 1919, to organize the California Dairy Council. They desired to form an organization that should be more than a mere advertising club, although promotion of the sale of dairy products is, of course, a major function. They wished to create an organization which would embrace all branches and elements of the industry, the dairy farmers, the creameries, milker-owned

manufacturing and distributing concerns, the plants, cheese, ice cream, condensed and powdered milk plants, the co-operative-farmer organizations, and farm-dairy and creamery supply and machinery men, feed dealers and bankers, the College of Agriculture, the State Department of Agriculture, the State Board of Health and State Board of Education. It was the thought of this organizing group that in such an organization, policies and plans could, in time, be worked out, which would be acceptable to all and which would result in saving some of the present great economic waste and consequently react to the profit of the entire industry.

To be successful, the Council would have to confine itself strictly to the broad fundamentals, leaving the more detailed plans and the special problems to the attention of the particular group most intimately concerned.

The Council is composed of what we term as active and associate members. The active-member class embraces those directly engaged in the industry, producing, manufacturing, and distributing dairy products, and those who supply feed, machinery, and finances. The associate-member class embraces the educational, regulatory, medical, and welfare people (who render extremely valuable service to the industry), and all others who may be interested and desire to keep in touch with our activities even if they are not directly connected with them.

In the course of one generation, dairying has developed from an individual farm activity to a great national industry, employing twenty-five million cows, and in all its branches combined, the largest number of people that are engaged in any single industry in the nation. The annual value, at wholesale prices, of all dairy products is close to three billions of dollars. Yet the various divisions of this enormous industry frequently operate without much consideration of their relationship to the other divisions. As

an example, I find there is an opinion prevalent among the canned-milk division that there is overproduction, and that it is a mistake to encourage additional production at this time. The facts are that the country, as a whole, is just barely on a self-supporting basis, when all products are considered together. The trouble is that too much milk has gone to the condenseries, when it should have gone into some other dairy product. If this condition were better understood, it would be less difficult to allocate the milk so as to avoid an overproduction of the condensed product, with a consequent loss to both the producer and the condenser.

What the dairy industry needs is a board of directors, a body with which all other industries provide themselves. Naturally, the kind of board which I have in mind could not operate in the same way that the Board of Directors of the United States Steel Corporation functions. Nevertheless, there is insistent need for an overhead body of leaders of the industry that shall direct itself to the consideration of the broad problems of the entire industry, the analysis of these problems, and the making of recommendations to the industry for their solution. Such a body would naturally also work to bring out closer harmony among the various divisions of the industry.

That is what we have tried to do for the dairy industry of California in planning California Dairy Council. We confine ourselves to four major purposes, and believe these best serve the interests of everyone in the industry. The four purposes are:

1. Education of the public at large as to the true food and health values of dairy products.
2. Cooperation with the major branches of the industry for the attainment of higher standards of production and quality all along the line.

3. Acting as spokesmen for the entire industry when it is desirable to go on record as a whole, as in matters of legislation, or when it is attacked in a general or wholesale way.

4. To provide a forum to which the members of the industry may bring their disputes and, through broad discussion, aid in finding a solution intelligently based on right and justice. In this last it is specifically provided that the Council itself can take no action nor express itself as an organization by resolution.

California Dairy Council has been in existence six years, and our people are more firmly convinced than ever that our plans were wisely formed. Dairying has been advanced to a higher plane in our State, and we look forward to the time when our industry will be as remunerative and as attractive as any other business calling.

*"The art of a thing is, first, its aims, and, next, its manner of accomplishment."*

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

EDITH L. MOORE, *Chairman*

A questionnaire mailed to the members of the Committee brought forth information and opinions on several points of importance.

## PERSONNEL OF THE DAIRY, HEALTH, INTELLIGENCE, AND SKILL

Health examinations were deemed desirable but were not considered practicable, because of the difficulties in making them continuous enough to be effective. In the majority of answers as to the intelligence and skill of milk handlers, we observed that many farm hands are obliged to perform the dairy duties of a farm on which dairying is a side line. In some places transient help is employed, some of whom are not clean and without skill or experience in the care of cows or milking and without the desire to become clean or skilful. The wages usually paid in these cases do not encourage the better class of workmen to engage in dairy work. In the States in which greatest progress in the dairy industry has been made, however, as well as on the large dairy farms, this situation does not prevail, as the importance of trained workers adequately paid has become recognized. A member of the committee made the observation that higher paid workers would mean an increase in the price of milk. The dairyman should be able to understand that better care of his animals and milk would improve its quality and thus repay him for his expenditure. This can be done in connection with a pasteurizing plant which

could more easily place a better price on better grades of milk as it is received. Scattered throughout the country, the committee reports there are plants grading milk and paying for milk on a grading basis.

### Animals, Their Health, Tuberculin Testing, and Surroundings

Biochemical and microscopical analyses coupled with tuberculin testing and physical examination seem to be the chief means we have of obtaining an index as to the health of cows. Physical inspection is considered a desirable procedure, although in certain areas it is confined to emergency conditions when a veterinarian is called. Tuberculin testing was regarded as a necessity by all but two members of the committee. In a few instances where tuberculin testing has not been generally adopted, difficult enforcement of this law has been reported. Members located in Canada, Kentucky, Houston, and other localities where all dairy animals are regularly tuberculin tested and have been for years report increasing success in this regard. Premises should be maintained with the same degree of cleanliness as required for certified raw milk.

### The Sanitation of Milking Barns and Equipment

The answers with one exception were in accord, and all save one member of the committee agreed that as much care as possible should be taken with the raw product, and the factors necessary for the production of a good grade of raw milk be carried out.

### Temperature

All members of the committee were in favor of keeping milk at as low temperature as possible, preferably 50 degrees F. or below. Shipping in insulated cans was

agreed by all as a very desirable but not practicable way of preserving a low temperature on the way to the pasteurizing plant. Unless milk is properly cooled and shipped in refrigerator cars or on trucks well stocked with ice, it will arrive at the pasteurizing plant at a temperature conducive to deterioration or spoilage, especially in summer, after standing on the highway or railroad platforms in the sun.

## Summary

To summarize, it is the consensus of opinion of the committee that to produce a satisfactory quality of raw milk for pasteurization it is desirable that

1. Dairy employees should be healthy and possess a working knowledge of dairying.
2. Herds should be healthy as shown by physical inspection and the tuberculin test.
3. Sanitation in and around the dairy should be exercised and careful sterilization of utensils should be practised.
4. Proper cooling and refrigeration at 50 degrees F. or below should be carried out.

*"Let all things be done decently and in order."*

# CERTIFIED MILK

DR. W. A. SHOULTS, *Director of Food Division,*
Provincial Board of Health, Winnipeg, Manitoba

While all milk intended for human consumption should be produced and handled as carefully as circumstances will permit, it is particularly important that a supply of dependable quality should be available for the nourishment of infants and invalids, whose powers of resistance are low. With this idea in mind Dr. Henry L. Coit, of Newark, N. J., formulated in 1891 a list of safeguards which is the basis of, and with some revision, constitutes the requirements for, the certified milk of today.

A careful perusal of these requirements will convince any thoughtful person that the production of certified milk is not an enterprise to be undertaken without serious consideration. The cows that produce it must be selected with great care to insure their freedom from disease, and must thereafter be housed, fed, and tended in a manner to keep them healthy and in good condition. Cows later developing any morbid condition of the udder or other disease that may endanger the wholesomeness of the milk must be immediately removed from the milking line, and serious involvement of the gland proper is ample justification for permanent exclusion from the certified herd. Once a cow has suffered from serious disease of the udder, the trouble is very liable to recur at each subsequent freshening, and it is doubtful if animals so affected ever again become satisfactory milk producers. The value of bacteria counts as a guide in such cases should not be overestimated, as subsequent low counts cannot be taken as conclusive evidence of complete recovery.

All persons engaged to carry out the dairy operations, as well as those with whom they may come in contact, including the cook and others who prepare and serve the meals, should be submitted to a rigid medical examination to establish their freedom from infectious disease before being admitted to the plant. Thereafter regular medical examinations should be made at intervals of not less than thirty days. Nose and throat swabs not infrequently reveal carriers of infectious diseases among apparently healthy persons, who would not otherwise be suspected of harboring organisms that may infect milk. As an additional safeguard we have found it a good practice to sterilize all dishes after each meal by boiling for thirty minutes, and have designed for this purpose a simple and inexpensive sterilizer which has been used with very satisfactory results. In all cases where any doubt remains as to the healthfulness of either attendants or animals, the consumer should be given the benefit. Certified milk usually retails for approximately double the price of ordinary market milk and the public have a right to expect, not only that it shall be rich in butter-fat, but that every known precaution to keep the product pure and wholesome shall be religiously observed. Periodical, painstaking examination of dairy hands and cattle, by competent physicians and veterinarians, has shown that disease germs of man and animals can be excluded with reasonable certainty.

The original conception of certified milk contemplated supervision by a so-called medical milk commission. Medical milk commissions may include in their personnel prominent physicians whose names may be used to good purpose in advertising the product, but who, unfortunately, are often so fully engaged with other interests that they are unable to devote the time and attention necessary to the proper supervision of certified milk. And if in some sections of the country certified milk has

failed to become as popular as might be expected, it is probably because of careless and inefficient supervision rather than through any fault or weakness in the features which constitute the standard for the product. In recent years there seems to be a growing disposition to place the supervision of certified milk in the hands of responsible public health bodies which include in their organization men especially trained in this branch of public health work. In the interests of uniformity it is desirable that milk should be certified by State or Provincial boards in preference to local or civic health departments. This movement deserves encouragement.

There may be some who advocate the use of pasteurized in preference to certified milk, and while it may be true that a milk produced and handled in accordance with certified requirements and then pasteurized would be the product par excellence, in comparing the merits of certified and pasteurized milk it must be borne in mind that practically the only available pasteurized milk is a composite milk derived from numerous sources, some of which may leave much to be desired from the standpoint of the most approved methods of producing and handling milk. While I have no desire to minimize the value of pasteurization, the process is not absolutely fool-proof. Possible imperfections of mechanical apparatus, carelessness in operation, and the ever-present chance of human error may not be entirely eliminated.

A certified milk plant established in any dairying district furnishes a good example to other dairymen and lends a stimulus to the production of cleaner and better milk. Under present conditions certified milk deserves a place in the general supply of the larger cities, and where appreciated at its true value a reasonable percentage of the population will be prepared to pay the price required to reward the producer for the extra care and expense entailed.

## DISCUSSION

PROFESSOR ROADHOUSE: The regulations of the medical milk commissions are carried out in all certified dairies with which I am familiar. Health departments may be subject to political exchange and therefore in some cases made less efficient than are independent medical milk commissions.

DR. HARDING: The impossibility of safeguarding raw milk was clearly shown by an epidemic occurring in California.

DR. HOLFORD: The Certified Milk Producers' Association is trying to work out plans to make really active those medical milk commissions that are now more or less inactive.

DR. HARDING: It is true that a very unwise propaganda is being spread about the country in favor of raw milk, that in my opinion is little less than criminal.

*"It is folly to expect men to do all that they may reasonably be expected to do."*

# REPORT OF COMMITTEE ON MILK PLANTS

C. S. MacBride, *Chairman*
Plant Equipment and Methods

A very important contribution relative to milk plant operation and equipment is embodied in the United States Public Health Service Bulletin No. 147. This bulletin covers the experimental work performed at Endicott, N. Y., relative to the thermal death point of various pathogenic bacteria.

The engineering staff in that study noted the following faulty construction in the types of apparatus used:

"1. In the flow-type machine there was lack of proper insulation of the holding tanks and lack of proper baffles to prevent irregularities in rate of flow. Even with these and other improvements the flow-type machine is much more difficult to control than either of the other types. Only by the most intelligent supervision can serious irregularities be controlled in a flow-type machine of this kind.

"2. In the pocket-type machine there were leaky valves, and pipe connections without insulation, and with dead ends.

"3. In the vat-type machines there were imperfect insulation, valves with dead ends, and coils causing foaming and splashing."

The following improvements in the three types of apparatus are recommended:

"1. Flow type:

a. Proper insulation of tanks and pipes.
b. A new type of nested baffles.
c. Rate controller for milk flow.

"2. Pocket type:

a. Elimination of rotary valves.

b. The piping attachments containing dead ends should be removed, and a better system of pipe inlets and outlets installed.

"3. Vat type:

a. Better insulation.

b. Removal of dead-end valve outlets and inlets.

c. Prevention of splash and foam."

This committee believes that these recommendations should be given serious consideration, inasmuch as they were formulated from observations on these types of machines when handling infected milk, and run under normal plant conditions. It is encouraging to know that the manufacturers of pasteurizing machinery are working on this problem to eliminate these defects.

So many changes are continually taking place in plant equipment and methods that it is not within the scope of this paper to enumerate them. However, there are several things in which improvement can yet be made. Thermometer recording devices covering a narrower range with more space between degrees and larger figures on the accompanying charts would facilitate more accurate reading of temperature records. Suitable apparatus for thoroughly drying cans after washing would go far towards keeping bacterial counts under control. Definite data on the proper amount of air space necessary when piling cases of milk in storage refrigerator rooms so as not to prevent air circulation would also improve the quality of our milk supplies.

Glass-lined tank truck and tank cars are rapidly coming into general use. This eliminates spoilage of milk in transit and leaves the farm, country station, and city plant for inspection. Is it not probable that in the past we have neglected the importance of the country receiving station as an aid in improving our milk supply? When we consider that each country station is the focal point for the receipt of perhaps a dozen different types of

milk quality, it would seem that concentrated effort at this point would be of far-reaching effect. By this we do not mean periodic inspection of the milk as it arrives at the station, and the return of a few cans to the dairyman, but intensive effort with the station personnel, so that they will come to consider the rejection of poor milk as a part of their daily routine.

## Milk and Metals

Another subject that is receiving the attention of plant operators and sanitarians is that of the action of milk on the various metals used in the construction of milk plant equipment. At times metallic flavor has appeared in various dairy products to such an extent as to render them unfit for consumption, or at the best very unpalatable. Butter is more often subject to this defect than other dairy products.

In the report of your Committee on Dairy Methods for 1924, we find the following: "On the basis of our information, therefore, it is illogical to assume that contamination of milk by metallic copper exists to a degree to constitute a universal menace to the healthfulness and nutritive value of the urban milk supply. On the other hand it is practically certain that contamination does take place in numerous instances, and with more or less frequency."

It is well known that some metals, their salts and oxides have toxic properties. They are poisonous, and the undesirability of the presence of such metals or their compounds in milk is obvious. Nor does the assumption that they would, at worst, be present in milk in very small quantities only, eliminate their danger to health. These poisons are known to be cumulative in their effect, that is, they are not voided by the system, and the continuous consumption of even very small quantities may in the long run prove highly toxic. Since milk appears with

great regularity in the diet of the majority of families and especially because it represents the more or less exclusive diet of babies and small children as well as adults with impaired digestion and invalids, who are less resistant to health-jeopardizing products, the presence of toxic metals in milk is doubly objectionable. (Hunziker, *Creamery and Milk Plant Monthly*, July, 1925.)

The replacement of our metallic equipment by glass will eliminate any danger that might arise from this source, but there is some equipment, such as coolers, that must be of metal. While we have no definite knowledge that milk ever contains metals or their derivatives to such a degree as to render it toxic, it behooves the dairy industry in general and sanitarians in particular to investigate this problem to the end that the desirability of milk as a food for infants and children may never be questioned.

## Milk Economics and Plant Inspection

Milk plant operation concerns itself with milk economics as safeguarding the capital invested and with milk sanitation as safeguarding the health of the consumer. Despite the fact that many plant operators can see no clear connection between these two concepts, they are, nevertheless, inextricably associated, and to win ultimate and continued success the operator must emphasize sanitation. Success is possible only if it be upheld and strengthened by good will and public confidence. To say this in another way, the quality of the product and the faith of the consumer in that product determine, in the long run, the magnitude of the success.

Since our rules and regulations influence plant operation so seriously, does it not behoove us who frame them to study milk economics as well as milk sanitation, to try so to coordinate the two as to secure a maximum of sanitation at a minimum of economic waste? Practical execution of this endeavor must be predicated on the maintenance

of milk plant inspection personnel thoroughly trained in milk sanitation, equally conversant with actual plant work, and sufficiently intelligent to assist any particular operator in adjusting one to the other. The milk plant inspector should be so trained in plant economics that he will know the economic effect of his orders and can weigh results expected against the expenditure necessary to obtain them. Perhaps right here we have fallen down a bit. Not intentionally of course, but because we have been so absorbed in our own problems of milk sanitation as not to appreciate to what a very serious extent our edicts, often hastily uttered, affect the particular plant operator involved, and in turn react upon our future inspection work. The point is that it should not suffice merely to tell the plant operator what to do, and what not to do. This should be elucidated by explanation as how best to carry out the instructions given as they apply to the plant under inspection, and why the order was necessary. Thus, and thus only, can we expect plant operators to comply with our requests.

## DISCUSSION

DR. GRIM: We need improved equipment. Dead ends, leaky valves, etc., must be done away with. We must have these things in mind to insure proper pasteurization.

DR. HARDING: The results of the work at Endicott, N. Y., fill a volume. We are comforted by some men who believe 142 degrees F. for 30 minutes really pasteurizes and makes milk safe.

*"Houses are built to live in, not to look on; therefore, let use be preferred before uniformity, except where both may be had."*

# SOME PHASES OF THE METHYLENE BLUE QUESTION

Dr. H. A. Harding and Dr. Archibald R. Ward,
Detroit, Mich.

During the past year the methylene blue or reductase test has been used by an increasing proportion of those charged with the commercial or the official supervision of raw milk supplies. In connection with this wider use, experience has suggested some simplification of the application of the test. The results obtained from its application have been scrutinized from various angles and the problem of making these results of more service to the dairy industry has been attacked.

## Simplification of the Test

The Standard Methods of the American Public Health Association contemplate the collection of a ten-cubic-centimeter sample of milk by means of a 10-c.c. pipette. Samples are most frequently collected as the milk is being delivered to the milk plant or the receiving station. Under such circumstances a glass pipette is easily broken, while its use is inconvenient and time consuming. It is the growing practice to collect the milk sample from the weighing can by means of a metal dipper so designed as to deliver ten cubic centimeters of milk.

This measured amount of milk is transferred directly to a test tube having an etched surface on which is written the number of the patron furnishing the milk. The dipper is scalded in a can of hot water and is ready to be used again. The tube is then placed in a wire basket in iced water to remain there until the remaining samples are collected.

The wire baskets are sufficiently wide to accommodate two rows of tubes. This permits the direct observation of all of the tubed samples without removing them from the basket.

The standard solution of methylene blue is made by dissolving one of the tablets obtained from the National Aniline & Chemical Co., Inc., in 200 cubic centimeters of water and not 800 as stated in the Standard Methods. These Methods likewise presuppose the addition of one cubic centimeter of this solution to each sample of milk by means of a one-cubic-centimeter pipette. It has been found to be much quicker to add this solution by means of a graduated burette, the burette containing more than sufficient fluid to treat all the tubes in a single basket.

The methylene blue solution is added to the tubes of milk while they are still in the iced water and the basket of tubes is agitated sufficiently to thoroughly mix the milk and the coloring matter. If the tubes are of narrow bore it may be necessary to provide corks so that the mixing may be accomplished by inverting the basket of tubes a couple of times.

The samples having been prepared while cold, the iced water is replaced with water at slightly more than 100° F., so that the samples will be quickly brought to that temperature. It is customary to allow two minutes for the milk to reach this temperature, with agitation of the baskets to facilitate the change of temperature. The desired temperature having been secured, a properly regulated alcohol lamp under the water bath usually suffices to keep the temperature fairly constant.

Following the classification in the Standard Methods, the samples which become decolorized within twenty minutes are in Class 4 as very bad milk; those changing between twenty minutes and two hours are in Class 3 as bad milk; those changing between two and five and one-half hours in

Class 2 as milk of fair average quality; and those remaining blue at the end of five and one-half hours in Class 1 as good milk.

Where interest is restricted to locating the least desirable milk, a sufficient amount of information may be at hand at the end of twenty minutes when those in Class 4 are located. The test may be stopped at this point and the remainder of the day given to visiting the farms or attending to other duties. If it is desired to locate the samples in Class 3, an alarm clock may be set for the end of the two-hour period and the test left with only sufficient attention to assure the maintenance of the desired temperature. At the laboratory the samples may be transferred to an incubator, where they will require no further attention except to observe them at the close of the appropriate intervals.

In this way one may test as many as 250 samples and yet have much of the day for other duties.

## Seasonal Variations

The application of the test to milk supplies has shown that samples taken in midwinter may classify as 1 and 2, when an examination of the same supply in midsummer may find the same dairies largely in Classes 3 and 4. This is merely another way of saying that most milk is received in winter with good keeping quality, while in summer the reverse is commonly true. On the other hand, where the test has been applied regularly and proper inducements have been offered to the producer the milk may practically all classify as 1 and 2 in midsummer.

## Causes of Class 4 Milk

If sediment tests are made from samples of the same milk submitted to the reductase test, it will be seen that there is not a very close correlation between the presence of dirt and the lack of keeping quality as shown by the methylene blue.

On the other hand, Class 4 milk is practically always connected with either the use of improperly prepared cans, the use of improperly prepared milking machines, or the lack of proper cooling of the milk, particularly the evening milk.

## Relation of Reductase Test Results to Bacterial Counts

It is the natural inclination to contrast the results from a new test with those obtained with one with which we are more familiar. We have long used the bacterial count as a measure of the keeping quality of the milk. We have not been satisfied with this means of measurement because the tests which have been made showed that there was only a general relation between the bacterial count of samples of milk and the intervals before they became noticeably sour or actually curdled.

The comparisons of the bacterial counts with the reductase intervals has shown that there is a fairly good degree of correlation between them but that in individual cases there are marked exceptions. When we remember that bacterial counts made in separate laboratories frequently differ widely it would be unreasonable to expect that any single set of bacterial counts would agree perfectly with any other milk test. Allowing for the variations in bacterial count determinations, there is a fairly satisfactory agreement between them and the results from the methylene blue test. It was the insistence of the late Professor Cooledge that these very differences between the bacterial counts and the reductase test were the best of evidence of the superiority of the methylene blue. In these cases the results of the methylene blue test were more nearly in accord with the true keeping quality of the milk than was the bacterial count, due to the fact that in some cases a large part of the bacterial count was made up of germs which exerted little influence upon the souring of the milk.

## Limitations of the Methylene Blue Test

Every technical test has its limitations and we are only in position to rate the value of a test when these limitations as well as its advantages become known.

The methylene blue test is at its best in the location of the samples of milk which are of highly unsatisfactory keeping quality. The samples placed in Class 4 are judged with a high degree of accuracy and speed.

Because of the desire to obtain results quickly it is required that the samples be held at 100° F. This is a temperature above that to which milk is held under normal conditions and one which leads to the development of a flora which under ordinary conditions would be at least partially repressed. The longer the milk is held at this temperature the more unnatural will be the outcome. Accordingly the better the quality of the milk the more unsatisfactory the results obtained from this test.

Information is lacking as to the extent to which samples held at 70° F. and at 100° F. would react differently and investigations along this line would be a welcome contribution to our knowledge of this valuable test. It is entirely possible that the slight slowing up of the results which would result from the lower temperature would be more than offset by the increased correlation with the actual keeping quality of the milk.

## Application of the Methylene Blue Results to Payment for Milk

It has long been the hope of the students of milk improvement that the time would come when we would be able to pay for milk on the basis of its real quality. It is the belief that when the producers of milk are paid in proportion to its quality the public can obtain as high a quality milk as it is willing to pay for.

It is now well-established practice to pay for the richness

of the milk by a differential based upon the fat content. In like manner a beginning has been made toward paying for the sweetness or the keeping quality of the milk on the basis of the results from the reductase test.

In the application of the Babcock test to the payment for richness it is customary to agree upon a price for some definite richness of milk and pay a bonus or deduct for deviations from that standard. In a like manner it is possible to agree upon some class of milk as the one to receive the basic price and upon a bonus or deduction for classifications above or below this basic one. The plan has been tried of taking Class 2 milk as a basic and paying a bonus for the milk found to belong in Class 1 and making a cut for Class 3 and a larger cut for Class 4.

It has been found desirable to base the Babcock determination upon composite samples. No method of making reductase tests from composite samples has yet been devised, but it is possible to make tests at weekly intervals and base the payment upon the results of such weekly tests.

The actual experience in applying this method of payment has not yet proceeded sufficiently to provide satisfactory basis for determining the amount of bonus which will bring about the desired improvement in the quality of the milk. Evidently it will be well to begin with a small bonus or cut of five or ten cents per hundred until both producer and purchaser become familiar with the workings of this system of differential. Later the amount of bonus may be increased to the point where it is found to produce the desired effect upon the quality of the supply.

## DISCUSSION

MEMBER: I doubt if we should encourage the reductase test at the expense of or in preference to the bacterial count. With the plate count one can to some extent recognize the kind as well as the number.

MEMBER: How old may a solution be used?

DR. HARDING: A new solution only costs two cents, so why use an old one?

MR. BULMER: What would be a reasonable number of tests to establish the basis for grading with the methylene blue test?

DR. HARDING: Experience along this line is limited. Testing once a week will be helpful.

*"Shadow owes its birth to light."*

# COOPERATIVE MILK INSPECTION IN THE IMPROVEMENT OF MILK AND OTHER DAIRY PRODUCTS

DR. ROY F. LESLIE, *Chief Meat and Dairy Inspector,*
Cleveland, Ohio

I am sure this Association's growth and interest in this work has increased its field of activity greatly and produced much good for the dairy industry without departing from its policy for technical and other discussions.

As I see it, we have a wonderful opportunity as an association, and also as individual members. Good, clean, pure, fresh, wholesome, appetizing milk and milk products are just beginning to be appreciated by the layman and by the medical profession. This is evidenced in many ways, not only by the gradual steady increase in the use of dairy products, as explained by Dr. Larson, of the United States Bureau of Dairying, but also by the high place that the dairy cow is being given in progressive rural districts, in local and State fairs, in national exhibits, such as the present wonderful Dairy Show in this city.

Although we have this evidence seemingly on every hand, are the people now getting milk and milk products of the quality they should have? In too many cases, no; only recently we had two epidemics of typhoid fever in our State, and only about a year ago we had one of diphtheria—all traceable to an improperly controlled milk supply. Some things may happen, no matter what the precautions, but we are finding more and more that where proper safeguards are set up, fewer and fewer complaints and cases of sickness come from the milk supply.

For the information of the public, let us talk and

write about pure milk and good sanitary conditions. Then let us go out and work to that end. In northern Ohio the Northern Ohio Dairy Inspectors' Association was formed a little over a year ago. Sectional meetings are held every three months and membership is open to all interested in better milk and the dairy industry. At present there are approximately one hundred members, and each member is in a way a dairy inspector and booster for better dairy products. By these meetings, first in Akron, then Ashtabula, then Sandusky, etc., we are getting acquainted by personal contact and the problems of a modern milk supply are being better understood. This leads to better cooperation, and where there is cooperation many things can be accomplished that otherwise would be impossible. If we inform the public and those in the industry regarding what is going on and what the aims and ideals of the industry are, it is much easier to approach the dairyman, milk dealer, and consumer on inspection and other matters. The day of some agency of common counsel in the dairy industry is seemingly here, and in addition to technical and control measures it is becoming more and more the duty of some common unit to cooperate and advise with the different branches of the milk business, and in this way all can better work for the common good.

Through public opinion properly expressed, the people usually get what they want in this country. It may not seem so during some short periods, but over longer periods you will find it is so. About three years ago, when more and more milk was being handled through the stores in Cleveland on account of two cents' reduction on store milk, made possible by a cash-and-carry plan, the public began to check on the freshness of its milk supply and in many cases investigation of complaints found old milk being offered the public. This resulted in the passage of an ordinance requiring the day of the week fol-

lowing the day of pasteurization to be placed on the milk cap. When this ordinance first went into effect it was surprising to observe the small, mean tricks attempted to defeat its purpose. The people, being informed, became more careful observers, and today very little old milk is offered for sale.

Great strides are being made by cooperation of many agencies in an educational way. This is important, and we can do great good, indirectly, by advice and counsel to promote such movements as those for better sires, area testing for tuberculosis, greater production, better feeding, etc. Cooperation of the courts when necessary for the improvement of supplies can be obtained by having clear-cut records showing the case in its true light and the cooperation of neighboring health departments. In our section we have a definite policy of refusing a permit to any dairyman that has either been refused a permit or excluded by any other health department, and he is referred back to the department that he first had dealings with, as it is usually found that they have the best understanding of the case.

The milk ordinance of Cleveland provides for approved dairies, which are to score 75 or more, use small-top milk pails, have a tuberculin-tested herd, clean windows, good surroundings, and capable management. Under this section we now have some seventy-five approved dairies. These dairymen are all cooperating for better milk and milk products.

Last, but not least, after we have informed the people, secured their assistance, and made them familiar with our work, let's enlist their aid in the proper support of inspection activities. Only a few cities today pay their dairy and food inspectors salaries that compare with those paid in the police and fire departments. How can we expect to compete with changing conditions and keep up to date if proper personnel and equipment is not provided?

Ten cents per capita per year, in a large city, is often given as a fair rate for milk inspection and control work. Would this be an excessive rate for the many additional safeguards and protections that can be provided through inspectional activities?

We, as inspectors, through the impartial agency of the health departments that we represent, with proper financial support can be of great assistance to producer, distributor, and consumer in the improvement of milk and other dairy products.

## DISCUSSION

MEMBER: What is done when a dealer is caught removing caps and substituting other caps on bottled milk?

DR. LESLIE: Revoking dealer's license is one form of punishment. In Cleveland milk caps are dated on the day following pasteurization.

*"The less supervision a man requires, the more money will he find in his pay envelope."*

# A MUNICIPAL MILK SUPPLY FROM TUBERCULIN-TESTED CATTLE

DR. F. C. RATH, *Dairy and Food Inspector,*
Madison, Wis.

For some time past it has been definitely known that to a certain extent tuberculosis in humans is of bovine origin. With this in mind, and to give the citizens of our communities a safer and better milk supply, we realized that certain conditions must prevail. In order that the pure and normal milk of a healthy cow may be furnished in a safe condition to the public, it is necessary that all cows be tuberculin tested. Milk should be produced and handled by a careful and intelligent farmer, and then, last of all, to make it still more safe, it is to be effectively pasteurized.

In 1923 steps were taken toward obtaining all of our milk supply for Madison from tuberculin-tested cows by calling into conference the officials from the larger dairies, local and State veterinarians, county board members, and the local manager of a large packing house, together with officials of the Health Department. This conference resulted in the appointment of a committee to send out questionnaires to the farmers who sold milk to the pasteurizing dairies to ascertain whether they would be willing to test their cows. This resulted in 60 per cent of these farmers, who represent 50 per cent of our entire milk supply, declaring their willingness to test, or stating that they had already tested.

This result, together with the fact that the raw milk distributors, who produce 25 per cent of our supply, are previously required to test their cows, assured the committee that a compulsory tuberculin test for all milk

could easily be passed because the majority of the farmers desired it.

Because of this decision our present ordinance was prepared, presented to the Common Council, and unanimously passed September 30, 1924.

Section 16 of our milk and cream ordinance reads:

"No license shall be issued until all cows of the applicant have been examined and tested for tuberculosis by the tuberculin test, and found free from tuberculosis, and the milk or cream of no cow or cows shall be sold or offered for sale, which milk or cream shall become the property of any licensed person until such cow or cows have been tested for tuberculosis by the tuberculin test at the expense of the applicant, by some competent person approved by the City Health Officer or by the State Veterinarian, or by the State Live Stock Sanitary Board, and the tuberculosis certificate filed with the Health Department, which certificate shall give an accurate description of the different cows, stating age, breed, and distinctive markings.

"The Health Officer of said city may require at any time a test or retest of any herd furnishing milk and cream in the city of Madison suspected of unsanitary or diseased condition, and shall require such a test at least every two years unless any test shall disclose tuberculosis in any member of the herd tested, in which case tests of such herds shall be made semi-annually thereafter so long as said tests shall disclose such tuberculosis.

"If after the issuance of the license any of the cows of any licensee be disposed of and replaced by others, or if additional cows be added to the number stipulated in the certificate of health hereinbefore mentioned, or if any change be made in the location of a dairy or the place of business, the owner must forthwith inform the Board of Health in writing of such change or increase in the number of cows. If after the issuance of the license there

are introduced into the herd any new cows, or any which have not been examined or tested as hereinbefore provided, no milk or cream shall be sold or disposed of from such herd in said city until said new cows have been examined and tested as herein provided. Whenever it shall be found that any milk-producing cow is affected with tuberculosis, or any other disease rendering the milk impure or unsanitary, no milk or cream from the cow or cows from the herd in which they are kept shall be sold or offered for sale in this city until such cow or cows have been removed, killed, or such disease cured."

Two hundred and ninety-seven herds, or 6,817 cows, were tested, and out of these herds 151 cows reacted. In one herd 42 out of 54 cows reacted. This means that 2.21 per cent of our total milk supply came from tuberculin-infected cows.

According to the United States Department of Agriculture, the average cow in Wisconsin gives 4,906 pounds of milk per year, or 13.4 pounds per day. This number of pounds per day, multiplied by the 151 tubercular cows, gives us 2,023.4 pounds, the amount of our milk supply which was produced by infected cows.

When we realize that in 1923 the average per capita consumption of milk in Madison was .458 pounds per day, we appreciate that it was possible that 2,027 babies or children might have drunk milk from diseased cows. This product might have been deleteriously affected by the metabolic disturbances which were caused by the febrile condition of the cow. In addition, the fat content of this infected milk might have been reduced.

Six months later another test was made of all infected herds showing reactors. Twenty-four cows reacted. The third test was made six months after the second test. Only 11 cows reacted.

It has been said that the eradication of tuberculosis from dairy herds supplying a city with milk is in part a

health measure, and, as we all know, pasteurization may not be 100 per cent perfect at all times; so if all cows supplying milk have successfully passed the tuberculin test, it is clear that another very valuable factor of safety has been added to the milk supply. Conditions being equal, a healthy herd of cattle will produce more milk at a lower cost than a diseased herd, which should prove advantageous to both producer and consumer.

In addition, the farmer has a safer supply for his own immediate household, and makes more difficult the repetition of the case of "Black Lady," a pure-bred cow belonging to a family in Paris, Illinois, who infected five out of seven children who drank her milk.

The packers are now realizing the importance of tuberculin testing of cows because of the possible infection of hogs. The local branch manager of a packing company informed me that they are paying ten cents more per hundred pounds for hogs coming from accredited counties.

In Madison, we require all pasteurizing dairies to file with the Health Department their daily record temperature charts of their entire run. Upon our inspection of plants we check for accuracy the intake and the outflow thermometers of the holders. All plants are required to pasteurize by the holding method. By these requirements, we are able to scrutinize our pasteurizing plants very closely and, we think, more efficiently.

We have developed a system by means of which we keep data of all the dairy herds supplying milk to the city of Madison. The tuberculin tests are recorded on standard-sized cards. Each dairy is distinguished by a card of some certain color, such as white, buff, or blue, and the records of the dealers supplying milk to each of the dairies are placed on the card corresponding in color to that of the dairy which they supply. The upper part of the card provides a space for the name and address of the dealer. The lower, and major, portion of the card

affords a place in vertical columns to record the date of testing, the number of cows tested, and the number of reactors. After a test has been made, the time is figured for the next date of testing and this date is inserted in the space below the last date of testing. Thus, at a glance, the name of the dealer, dairy, and tester, the last date of testing, and the next required date of testing may all be observed. Each producer is notified sixty days in advance of the expiration of his test sheets. A copy of this notice is also sent to the dealers.

We have progressed in providing our community with a milk supply from tuberculin-tested herds. In conclusion, it is interesting to note that Dr. John R. Mohler, Chief of the Bureau of Animal Industry, Washington, has stated that from the rapid rate at which sentiment is growing for milk from tuberculosis-free herds of cattle, he believes that the time is not far distant when milk ordinances will be promulgated in every city and town in the United States requiring the tuberculin test.

*"There's no good in arguing with the inevitable. The only argument available with an east wind is to put on your overcoat."*

## FIELD NOTES

DR. C. A. KRAUSE, *Chief Food Inspector,*
Portsmouth, Va.

An observation of the situation in the field leads me to believe that constant progress such as has been made in the past can only be maintained by constant effort directed principally toward improvement in production.

This will be comparatively easy with the larger producers but a more serious problem with the far greater number of small producers. Where milk from many producers must be combined for transportation, the properly equipped depot will and can separate or distinguish milk from bad producers and, by refusing such milk, can force improvement upon the producer. This has in part the effect of turning such products into other channels rather than developing proper supply unless the producer can be reached, helped, and encouraged. Some cities are now forced to accept more or less unsatisfactory supplies or curtail their milk supply. We must stimulate production, particularly in the South, but quality and safety are probably even more important in the South and the business itself is jeopardized if every factor of safety is not carefully considered. The exception is the small and uninterested producer, who does not understand his business and is therefore willing to jeopardize himself and the distributor. We make every effort to reach the smallest producer but there is a limit to physical capacity, due often to lack of adequate financial support. We provide the information and assistance needed by the producer and our expectations are usually reached with the larger and better class of producers, but the ignorant or careless type, who are just trying to get by, are a menace to the business and require constant supervision. Should

it become necessary to eliminate them, production that is needed is largely lost.

Would it not be possible for this Association to prepare a manual covering every detail of milk production, with sterilization and temperature charts, etc., which the producer could study and digest at leisure? This would eliminate the personal factor often charged to the inspector, and if coming from this type of organization would be of assistance in standardizing inspection. This would enable the inspector to provide *all* the information so necessary for the production of graded milk before production is attempted. It would also eliminate future excuses and would be of assistance to the inspector and producer in covering the field of detail and in teaching the producer what he is fighting and how to do it. It might also be a means of extending milk work into virgin fields or smaller centers not now reached, and in that way not only assist small towns but open new fields of supply.

The efforts of the United States Public Health Service to effect a nation-wide standard ordinance seem to be meeting with apathy where existing ordinances are satisfactory. The greatest obstacles seem to be the grading system as applied to local raw milk and the 50,000 bacterial count limit. Southern health officers feel that a different standard should obtain as between the extremes North and South, and that from a practical standpoint and from a health standpoint all raw milk should be based on a 10,000 bacteria per c. c. count limit.

In Portsmouth we have an allowance of 100,000 bacteria per c.c. Our average is not over 80,000 per c.c. so far this year. This is due to our method of securing samples. Known samples are not sought, but we rather concentrate on the particular ones where the records or faults in methods or equipment lead us to expect trouble. This system has a wholesome effect on the producer if there is any ambition present, but if not, it is our job

to establish such ambition. We are rating distributors monthly on bacteria only, first, second, and so on. This proves a good sanitary index and stimulant. We have dairies with a consistently low count month after month, but we have never had a dairy continue for any great length of time and never exceed the count limit. Our standard is not high, even for the South, but we consider our method of sampling milk to be very effective.

Another feature rather uncommon is the control of one- and two-cow dairies within the city, requiring the same equipment and methods as the regular dairies. The city ordinance limits residents to two cows within the city limits. This we consider a necessary evil, but their control is comparatively simple and eliminates many possible so-called "milk bootleggers."

The question of practicability is often argued. This is wrong. Infant welfare should come first.

We have no fault to find with the use of land plaster and shavings, but if not properly used they may cover a multitude of sins. Often the physical examination of the cows and employees is rather limited of necessity. The inspector can be of much assistance and a friend of the producer if proper service is rendered.

Publicity and public support of milk work is not just what is should be locally. No doubt this Association is disseminating information of unestimated value, but could it not through greater publicity reach the public locally and in new fields, thereby increasing its usefulness? A great many of our members may not need assistance in their publicity, but there is a great field that is not reached. Publicity coming from this organization would be most influential, and the public must be appealed to for financial assistance. I would suggest a Publicity Committee to formulate a publicity policy.

An innovation in the way of a publicity feature was put

on by us during a food show last winter, which not only drew much favorable comment but gave us an opportunity to demonstrate and explain to the public what we are doing and how we are doing it and also the results obtained. A background of National Dairy Council posters was provided. The center of the exhibit was a model dairy, with milk house and equipment. All equipment complied with specifications of the milk ordinance. The dairy has a glass roof, clean cows, milkers in white suits, metal stools, small-top milk buckets, tubular cooler, cans, bottles, cases, milk truck, boiler, washer, steam turbine, and sterilizer. All equipment used in testing milk samples was demonstrated, milk being used even to the reading of the plate counts. Pathological specimens in specimen jars demonstrated the advantages of tuberculin testing and the dangers of uncontrolled milk supplies. During the week of the show we were able to give much information to the public. In a special demonstration, we found it would take one man about one and one-half hours to demonstrate and cover the subject reasonably well. Interest at no time lagged. The children were given "A quart of milk a day" buttons and health rule milk bottles furnished by the National Dairy Council. Three men were required with the exhibit. The dairy outfit was loaned to a local pasteurizing plant for their exhibit at a large fair recently and was the subject of much favorable comment.

My personal opinion is that the greatest progress in milk production will not be entirely in more and better equipment but rather in methods. The elimination of unnecessary equipment will automatically eliminate bacteria and expense, an appeal to both control officer and producer.

We are now using with good results concrete tanks with cakes of ice and submerged cans and a cooler, pumping the ice water through the cooler back into the tank. We believe the cooler could be dispensed with and the circulation

be provided in the tank proper. If aeration is desired, a flat corrugation small enough to be boiled or otherwise made sterile could be used. With raw milk producers the storage of bottled milk is a problem, unless cold storage is available. Ice boxes are inefficient, as a covering of ice is necessary on each case.

Manufacturing interests have developed practical, economical methods of manufacture. Why cannot the dairy interests? Why not have a sanitary wash room where an expert with every equipment, including running water, completely prepares the cow for milking? The cow could then pass into a white, clean stall where the expert milker, equipped with towels and strainer cloths for each cow, milks into a specially constructed receptacle having sanitary piping direct into the pasteurizing vat in a room just beyond. From the pasteurizing vat, milk could flow by gravity direct to cooler and bottling machine, could be bottled, sealed, and kept cold in a refrigerated room, the general idea being to specialize each man on his job and eliminate all equipment possible and also to eliminate expense and labor. Four units of twenty-five cows each to milk house would produce about an ordinary batch for pasteurization. This may sound like a pipe dream, but it would to some extent eliminate the immense amount of labor and upkeep of the large dairy barns. It would, however, be necessary to have feed barns, which are comparatively inexpensive, especially in the South. It is my opinion that development along these lines may eventually come to pass.

I do feel that some new ideas must be advanced and, although laying myself open to criticism, I hope I have opened a field for discussion.

*"It is not a lucky word, this 'impossible.' No good comes of those that have it so often in their mouth."*

# THE METHYLENE BLUE TEST AS AN ADJUNCT TO MILK INSPECTION—SECOND YEAR'S REPORT

C. H. CHILSON, *Director of Dairy and Food Inspection,* Board of Health, Detroit, Mich.

Our paper on this subject one year ago records results and conclusions based upon a few months' reports, during which time we were learning whether it was possible to use the methylene blue test in conjunction with the present inspection system, and also to learn the best methods of procedure. Our conclusions were that the series of tests which covered this period of several months showed the methylene blue test to be of value to inspection in that it enabled the inspector to differentiate between bad and good milk. We have made this test a part of our routine work and the purpose of this paper is to show what results we are getting and also indicate just what the test will show the inspector regarding the milk supply.

We have been sampling all the milk coming into the city from the country receiving stations, and also the milk of producers at country stations. By so doing we have been able to get a fairly good picture of our supply. We have not had time to sample the milk from the stations and producers a sufficient number of times to eliminate all undesirable conditions, but in another year's time, I believe by the use of this test we can show considerable improvement in our milk supply.

Most of the results shown herein represent summer work, because we learned that this test shows that about ninety-five per cent of the milk during the winter months will not show reduction in less than three hours and many samples

will hold up for five hours. This, of course, is changed when the hot weather comes. We find, of course, that there are several factors which cause poor quality milk, but the greatest contributing factor is improper cooling.

The following table shows tests made of milk from 110 country receiving stations as delivered to the city plant. Samples were taken at the city plant. An average of 7.5 tests per station were made from January 1 to September 15, 1925.

Table 1

| No. of tests | Good Milk—3 hrs. or over—M.B. test | Fair Grade Milk Less than 3 hrs. but not less than 2 hrs. | Poor Grade Milk Less than 2 hrs. but not less than 30 min. | Very Bad Grade Milk Milk 20-45 min. |
|---|---|---|---|---|
| 823 | 66.0% | 14.3% | 8.9% | 9.8% |

In this way information regarding the quality of the milk at each station is obtained.

The next step is to check the producer's milk at the country receiving station to determine who is producing good and bad grades of milk. A systematic check-up at the farm, followed by one or two more tests, will either alleviate the condition or eliminate the shippers. Testing the milk as delivered by the farmer to the station is very important.

Is there consistency in production? We find this to be irregular to some extent. In Table 2 is shown the results of first and second tests. The second test was made several weeks after the first test.

In last year's work, bad conditions were found at one of the stations. The test was applied and the results followed up by farm inspection. A few days after this a second test was made which showed a betterment of conditions. Having spent ten days of intensive work at this one place, nothing was done until a year later. The results of this work are shown in Table 3.

Table 2

| Station | No. Shippers | Per Cent Good Grade 1st test | Per Cent Good Grade 2nd test | Per Cent Fair Grade 1st test | Per Cent Fair Grade 2nd test | Per Cent Bad Grade 1st test | Per Cent Bad Grade 2nd test | Per Cent Very Bad Grade 1st test | Per Cent Very Bad Grade 2nd test |
|---|---|---|---|---|---|---|---|---|---|
| Uti. Cop. | 84 | 59.5 | 66.4 | 10.0 | 17.8 | 10.0 | 4.0 | 19.0 | 10.0 |
| N. Bal. | 117 | 40.0 | 42.6 | 23.0 | 21.3 | 21.3 | 17.0 | 15.3 | 18.2 |
| Arm. | 45 | 62.2 | 93.5 | 13.3 | 3.2 | 6.6 | 0 | 17.7 | 3.2 |
| Sco. | 121 | 43.0 | 48.0 | 24.0 | 24.0 | 12.4 | 14.0 | 19.8 | 14.0 |
| Ric. | 178 | 43.2 | 55.5 | 10.0 | 22.0 | 46.0 | 7.8 | 0 | 14.5 |
| Mil-(S) | 67 | 54.0 | 93.0 | 22.0 | 4.0 | 18.0 | 3.0 | 5.0 | 0 |
| Sal. | 52 | 88.0 | 96.4 | 7.0 | 1.8 | 1.0 | 1.8 | 3.0 | 0 |
| Bel. Riv. | 69 | 90.7 | 75.7 | 9.3 | 5.6 | 0 | 7.2 | 0 | 11.5 |
| Peck | 43 | 95.3 | 98.8 | 4.7 | 0 | 0 | 0 | 0 | 1.8 |
| Roseburg | 31 | 96.0 | 100.0 | 3.5 | 0 | 0 | 0 | 0 | 0 |
| Total | 807 | | | | | | | | |
| Average | | 67.2 | 77.0 | 12.7 | 10.0 | 11.5 | 5.5 | 8.0 | 7.3 |

Table 3

| Per Cent Good Grade | | | Per Cent Fair Grade | | |
|---|---|---|---|---|---|
| 1924 1st test | 1924 2nd test | 1925 test | 1924 1st test | 1924 2nd test | 1925 test |
| 54.3 | 70.8 | 65.3 | 13.5 | 15.2 | 19.4 |
| **Per Cent Bad Grade** | | | **Per Cent Very Bad Grade** | | |
| 1924 1st test | 1924 2nd test | 1925 test | 1924 1st test | 1924 2nd test | 1925 test |
| ..... | ..... | 8.3 | 32.0 | 13.2 | 7.0 |

For a number of years the scoring of farms has been an important part of our work. It should occupy a place in the inspection system, although too much reliance cannot be put on the barn score as an indication of the quality of the milk supply. The inspector can always see buildings and equipment, but it is an impossibility to watch the methods used in milking and caring for the milk. The methylene blue test will assist the inspector in this respect.

At one station, out of 65 farms scoring 60-69 points, 27, or 41 per cent, produced a "good grade" milk; 8, or

12 per cent, fell in the "fair grade" class; 30, or 46 per cent, produced a "very bad grade."

The following table shows a further survey.

COMPARISON OF METHYLENE BLUE TEST WITH FARM SCORES—468 FARMS REPRESENTED

| 57 Farms, or 12 Per Cent, Scoring 50 or Below | | | |
|---|---|---|---|
| Good Grade | Fair Grade | Bad Grade | Very Bad Grade |
| 64 per cent | 16 per cent | 16 per cent | 4 per cent |
| **411 Farms, or 88 Per Cent, Scoring above 50** | | | |
| Good Grade | Fair Grade | Bad Grade | Very Bad Grade |
| 66 per cent | 16 per cent | 9 per cent | 9 per cent |

## Conclusions

After working nearly a year and a half with the methylene blue test we are convinced that it can be successfully used in connection with our present system of inspection. It will uncover defects in production that cannot easily be detected by farm scoring and physical examination of the milk, such as temperature and sediment tests.

The quality of the milk supply can be raised by systematic application of this test.

*"What's well begun is half done."*

# METHODS OF DELIVERING MILK IN SOME EUROPEAN CITIES

PROF. W. A. STOCKING,
Cornell University, Ithaca, N. Y.

It was my privilege to spend about three months in Europe last year, during which time I tried to learn something of the methods of handling milk in the various countries visited. Having grown so accustomed to the modern methods of delivery in our cities, it was quite a surprise to me to find some of the old methods still in use, although I had always known of the primitive methods practised in some foreign countries.

Within a half hour from the time I left the steamer at Naples, I saw herds of goats being driven about the streets and milked in accordance with the requirements of the individual housewife. I also saw cows, usually in pairs, accompanied by one or two calves, led from house to house, the milk being drawn into a receptacle furnished by the housewife. The receptacles consisted of open basins, pitchers, bowls, and even second-hand beer bottles. In some sections of Naples the housewife living on the second, third, or fourth story let her receptacle down from the window by means of a basket and rope; the dairyman drew the required amount of milk, placed it in the basket, and the purchaser then pulled it back to her window. This method at least had the advantage of saving steps both for the housewife and the milkman.

In Rome I was informed that the most of the milk delivered in the city comes from northern Italy in the form of condensed or powdered milk. It is then reconstituted to a three per cent basis. The delivery is made by means of small two-wheeled push carts, the milk being placed in a

metal tank, into which is suspended a smaller metal tank containing ice. The milk is drawn by means of a faucet from the bottom of the tank, the dairyman carrying his measures of various sizes in a compartment at the front of the cart. The construction of this tank is shown in the accompanying illustration.

COMMON TYPE OF CART USED FOR DELIVERING MILK IN ROME

In Venice the milk is carried in cans suspended over a man's shoulder by means of a wooden yoke, large cans being used for carrying the main volume of milk, a smaller one with a spout being used for filling the consumer's receptacle.

The City of Milan endeavored a few years ago to establish a municipal milk plant for the purpose of furnishing a high-grade milk, chiefly for infants and children. They built a large establishment, including cow stables, stables and storage for their delivery teams, and a large processing and manufacturing section. All these divisions or departments were equipped in excellent, sanitary, and up-to-date manner. Like most enterprises of this sort, however, they soon found that it did not pay financially, and when I was there they had given up keeping the herd and

were buying milk from producers outside the city. The milk was bottled in several sizes of feeding bottles in which it was pasteurized, cooled immediately, and delivered ready for use. They were also making a limited amount of cultured buttermilk and put out some natural pasteurized milk which was furnished primarily to lunch rooms in connection

METHOD OF MILK DELIVERY IN VENICE

with the city parks, where it might be secured for the children who were playing there. I had an opportunity to sample the milk furnished at these places, and found it of excellent flavor. So far as I was able to learn, the Italians depend chiefly upon various types of cheeses for their dairy products, and do not use the large amounts of fluid milk which we use in this country. Cheese, however, is used

much more freely than we use it here; it is served with all meals.

The common method of hauling the milk from the farms to the central plants in northern Italy is by means of two-wheeled carts with very large wheels. These carts are drawn by either a single horse or mule.

In Switzerland milk is retailed directly from small push carts or through small dairy stores located at various points

METHOD BY WHICH MILK IS BROUGHT TO CENTRAL PLANTS IN NORTHERN ITALY

in the city. The wholesale delivery is made in cans similar to our forty-quart cans in use in this country. I saw several types of delivery carts which were either pulled or pushed by one man, or with the assistance of a husky dog. The accompanying illustration shows one of the common types which I saw in some of the Swiss cities.

One of the common methods by which the farmer delivers his milk to the shipping station is to carry it on his back in a deep can made concave on one side to fit the back. This is carried by means of straps coming over the shoulders.

The delivery methods in Paris compare more with our methods here than those already discussed. Large covered wagons drawn by either one or two horses seem to be the usual method of wholesale delivery both to restaurants and to the small retail dairy stores, where milk could be purchased in bottles of the usual type of our soda-water bottle. Paris was the first place I found where any special attempt was being made to control the quality of milk by means of

ONE FORM OF RETAIL CART USED IN SWITZERLAND

chemical and bacteriological supervision. I was fortunate in being able to visit the control laboratories of the largest dairy company in Paris and found them well equipped with apparatus and in charge of highly trained men. Their control work seemed to be on a very thorough basis which would compare very favorably with similar work in this country. So far as I could learn the milk was all being pasteurized at temperatures considerably higher than those used here.

The thing which I found of special interest in Belgium

was the sanitary dairy maintained in connection with one of the large retail milk companies. The herd was housed in stables to which only the regular attendants were allowed access. The walls, mangers, and partitions between the cows were finished with white tile similar to those used in modern bathrooms. Each cow stood on a cocoa mat, approximately two inches thick, which was removed each day, thoroughly cleansed by washing, and allowed to dry in the sun. The milk produced in this stable was immediately bottled, hermetically sealed, and subjected to a temperature of 180° F. for twenty to thirty minutes in a chamber to which steam was admitted. This milk was then immediately cooled by submerging in cold water and shipped to the Belgian Congo, shipments being made twice each month by steamer.

This company was also putting up several brands of pasteurized milk for infant feeding. The company had a well-equipped control laboratory and seemed to be putting out a very high grade of milk.

Two of the types of retail delivery outfits which I found in Holland are shown in the accompanying illustrations. A number of modifications of these general types were quite common. From all of these the delivery was made either by dipping from the can or by drawing from a faucet at the bottom, delivery being made into whatever receptacle the housewife furnished.

The milk supply from London comes in from the surrounding country by train, as in our American cities. The common type of can is about fifty per cent larger than our forty-quart can, much larger at the bottom and sloping up to a neck of approximately the size of our standard cans. I rode from Oxford to London on a train which took on cans of milk at practically every station, similar to the method used in many places in this country. London is equipped with many up-to-date city plants and the milk is delivered on small push carts, similar to those

RETAIL MILK CARTS IN HOLLAND

shown in the accompanying illustration, or from small retail stores. The housewife received milk either in the bottle or by having it drawn from the large brass container by means of a faucet at the bottom.

I had the opportunity of visiting several of the London milk plants and also their control laboratories. The control work appeared to be on a thoroughly high-grade basis

COMMON TYPE OF CART USED FOR MILK DELIVERY IN ENGLAND

from the standpoint of chemical and bacteriological supervision. They showed me their bacteria counts running back over a series of years and these would compare very well indeed with similar counts for milk in our larger cities. One thing which especially interested me in London was the fact that one company making a specialty of homogenizing milk was selling at retail approximately 10,000 quarts per day, and I was told that the demand for this milk was steadily increasing.

I have attempted to give you just a few glimpses of some of the things which I saw in Europe, and I trust that they are of as much interest to you as they are to me.

*"Those who cover the most ground never seem to be in any particular hurry."*

# A PROPOSED CONTROL BASIS FOR CREAM SUPPLIES

DR. J. H. SHRADER,
*Director,* Bureau of Chemistry and Food, City Health Department, Baltimore, Md.

In the spring of 1924, Dr. Clyde L. King, Secretary of the Commonwealth of Pennsylania and milk arbitrator for the Baltimore milk industry, wrote me as follows: "I note with special interest that you are taking the bacteria test before the milk is pateurized. I think this is entirely in the interest of the trade as well as in the interest of the health of your people. Here again it is hard to see why such precaution should be taken with whole milk when nothing is done to protect cream....You are making the producers of whole milk in the Baltimore territory come up to extraordinarily high standards as compared with most producers in the country and yet you are feeding your babies cream that comes from territory that has not been inspected....It seems to me that the weak and vulnerable point in the....work you are doing is the cream situation."

Upon receipt of this candid and friendly criticism, I caused a thorough inspection to be made of the conditions of producing and shipping cream on the Baltimore shed, which comprised the Middle Atlantic States, Virginia, West Virginia, Iowa, Wisconsin, Illinois, and Michigan. Generally speaking, conditions were found which were current in the milk trade fifteen to twenty years ago before the municipalities had enforced sanitary requirements for milk as such. Much cream was stored or held on the farm in horse troughs, dairy houses were rare, barns were not clean, utensils were greasy, and deliveries of cream (farm-separated) were made two or three times weekly. Many of the

creameries could not pass inspection. At some, an inspector from the State had never been seen. The bacteria content previous to pasteurization often ran into many millions, and the process of pasteurization of the cream was often indifferently done. Conditions in New York State were an exception to the rule. There we found no creamery which would receive anything other than daily-delivered fresh milk produced under conditions comparable to those for milk production, and from this high-quality milk the creamery separated its own cream under good sanitary conditions. The excellent sanitary conditions prevailing in these creameries, as well as the adequacy and construction of equipment, is a tribute to the Health Department authorities and creamery owners alike. It may also be added that there is a most apparent appreciation of the essentials of milk sanitation among creamery superintendents and managers, a fact which has no doubt much to do with the splendid condition found in these plants.

It was learned during this week that the New York City milk control officials require the same sanitary standard for cream production and handling as they do for milk; and the splendid condition of the milk and cream shed is evidence of its effectiveness. There is no lack of cream regulations in other States and municipalities, but the field conditions as we observed them do not indicate that much use is made of them.

An examination of the country-wide bacterial standards for cream in relation to the allowable number of bacteria in milk showed a surprisingly chaotic condition. The following table gives the ratio of cream bacteria standards to milk bacteria standards which are recorded in the regulations of 14 States and 21 of the larger cities:

| | |
|---|---|
| 5 : 1 | 2 : 1 |
| 1 : 1 | 3½ : 1 |
| 6 : 1 | 4 : 1 |
| 1½ : 1 | 3 : 1 |

Of all these different allowable cream counts to milk counts, the five-to-one ratio was by far most general. It had been adopted in the beginning of milk and cream regulation and reflected the *then* trade practice of using gravity cream, now fast becoming obsolete. The practical disappearance of the basis for the five-to-one ratio and the scattering field of other adopted ratios made it incumbent upon us to find out just what is a practicable ratio that could reasonably be complied with under present commercial conditions.

Lamson, in the *Journal of Dairy Science,* vol. 1, page 498 (1918), reports that under commercial conditions and using the Breed counting method, the number of bacteria is less or only slightly more in separated cream than in the whole milk from which it is separated. His averages are: whole milk 8,000,000; cream therefrom 10,000,000; and skimmed milk therefrom 8,000,000. He concludes that it would be desirable to have a common bacteriological standard for market whole milk and cream.

The United States Department of Agriculture has been doing some work on this for some time. A private communication from Dr. Ayers was to the effect that some of his preliminary work showed that the bacteria counts of cream were of the same order of magnitude as those of the milk from which it was separated. Mr. Ernest Kelly has likewise informed me that his office has completed a study on this question and that the publication is in press.

In order to ascertain the conditions on the Baltimore milk and cream shed, we determined to make a series of tests on creameries in actual operation under normal commercial conditions and ascertain the relative bacteria counts of the whole milk and the separated cream therefrom. In every case the milk was forewarmed to about eighty-five degrees and passed in a continuous stream through a power centrifuge. Our work was done in two creameries in the months of November, December, Janu-

ary, and February. Samples were taken from the flowing streams of whole milk, cream, and skimmed milk at frequent intervals throughout the runs in order to obviate chance discrepancies. The agar plate method according to the Standard Methods of Analysis of the American Public Health Association and the Babcock butterfat method were used.

BACTERIA COUNTS ON WHOLE MILK, CREAM AND SKIMMED MILK

| Whole Milk | | | Cream | | | Skimmed Milk | | Ratio |
|---|---|---|---|---|---|---|---|---|
| Bacteria per c.c. | Butter fat per cent | No. of samples | Bacteria per c.c. | Butter fat per cent | No. of samples | Bacteria per c.c. | No. of samples | Bacteria count of milk to cream |
| 468,000 | 4.3 | 9 | 357,000 | 50. | 9 | 543,000 | 9 | 1 : 0.8 |
| 1,299,000 | 4.3 | 9 | 793,000 | 29.9 | 10 | 402,000 | 9 | 1 : 0 6 |
| 481,000 | 4.0 | 10 | 354,000 | 48.3 | 10 | 317,000 | 10 | 1 : 0.7 |
| 426,000 | 4.1 | 10 | 270,000 | 28.7 | 10 | 444,000 | 9 | 1 : 0.6 |
| 74,000 | 4.1 | 10 | 69,000 | 33.8 | 10 | 85,000 | 10 | 1 : 0.9 |
| 287,000 | 3.8 | 9 | 236,000 | 18.7 | 7 | 259,000 | 9 | 1 : 0.8 |
| 48,000 | 4.6 | 10 | 88,000 | 30.5 | 9 | 66,000 | 10 | 1 : 1.8 |
| Average: | | | | | | | | |
| 440,000 | 4.2 | | 309,000 | 34.3 | | 302,000 | | 1 : 0.9 |

Total number of samples: whole milk.....67
cream .....65
skimmed milk .....66

A large ice cream plant in Baltimore made a similar determination at their creamery with the following results:

Average bacteria count of 8 samples of whole milk 115,000
" " " " 8 " " cream .... 90,000
" " " " 8 " " skimmed milk .....200,000

of which the ratios are 1 : 0.78 : 1.74.

From the above data, which is in quite good agreement, it seems reasonable to conclude that cream separated from milk by power centrifugation carries about the same bacterial count as the original milk.

At the present time, without any regulation as to bacterial limits, the cream put out on the streets in Baltimore analyzes as follows:

June—40 per cent of samples under 100,000 (bacterial standard for whole milk)
July—60 per cent
August—70 per cent
September—50 per cent

## Conclusions

From observations of field conditions over a large milk and cream shed, from laboratory analyses of samples of cream produced under commercial conditions, and from examination of samples of cream taken from street delivery and with no bacterial standard as a guide, it seems that it is possible and practical for milk control officials to require the same sanitary and bacterial standards for cream production and handling as they require for whole milk.

*"The act of contemplation then creates the thing contemplated."*

# REPORT OF COMMITTEE ON PASTEURIZATION

DR. WILLIAM H. PRICE, *Chairman*

Properly supervised, holding pasteurization ranks first among safeguards for milk supplies. It makes milk safe by destroying pathogenic organisms that may be contained in it. It reduces the bacterial content of milk, and thereby defers spoilage. It leaves living enough acid-forming bacteria to permit souring in the usual way. It extends the area from which milk may be secured, and, as a result, makes available abundant supplies of safe milk at prices lower than otherwise would prevail. It has no significant adverse influence on the food values in milk. Its cost of operation is insignificant when comparatively large volumes of milk are concerned. It concentrates enforcement of this ultimate safeguarding measure upon a relatively small number of dealers, and in consequence, and considering the beneficial results it provides, is comparatively easy of introduction and continuance. These facts justify a review of the subject, including extracts from reports of previous committees, even at risk of repetition.

## HISTORICAL

About 1860, Louis Pasteur began his studies of the "diseases" of wines and beer, and proved them to be of bacterial origin and preventable by heating to temperature lower than boiling. He demonstrated the biologic character of milk spoilage, which proceeds from fermentation of lactose as the result of bacterial action; and he recommended heating to temperatures lower than boiling as the preventive. Jacobi in New York and Soxhlet in Munich reported favorably on the practice of heating cows' milk, as a method of safegarding the lives and health of arti-

ficially fed infants and other milk consumers. Some other clinicians and the American Pediatric Society reported adversely, and there was division of opinion in medical circles regarding the process. The thermal death-points of the pathogenic organisms that might be contained in milk were investigated and reported by various observers, sometimes with apparently widely different conclusions.

By 1898 the efficacy of the process had become so clearly established that Denmark enacted a law requiring that all milk intended for calf feeding be heated to 176 degrees F. A few milk dealers began to employ flash pasteurization in this country. In 1903, Park and Holt conducted extensive investigations in New York and reported that the general practice among the tenement population of heating milk was undoubtedly an important factor in reducing infant morbidity and mortality. An increasing number of reports of milk-borne epidemics directed attention to the possibility of destroying pathogenic organisms by heating public milk supplies. Public health officials began to recognize the value of pasteurization as a preventive of infantile diarrheas and of communicable disease transmission.

The uncertainties of the flash method in actual plant operation, and the adverse influence of its high temperatures on the physical and chemical characteristics of the milk, as well as its disturbance of the relative proportions of the nonpathogenic organisms contained, suggested heating to lower temperature and holding for longer periods —the holding pasteurization which has become the commonly recognized practice.

## Destruction of Micro-organisms

### *Pathogens*

Theobald Smith in 1899, and Russell and Hastings in 1900, reported the destruction of pathogens in milk when

heated to 140 degrees F. for 20 minutes. Rosenau confirmed their findings in 1908, after investigating the thermal death-points of typhoid, diphtheria, tuberculosis bacilli, and others. These investigations were laboratory studies, or were conducted with obsolete commercial equipment; and Rosenau recommended increasing the temperature to 145 degrees F., and the holding period to 30 minutes, to provide a margin of safety against lapses in temperature and holding period under working conditions with the equipment then available.

In 1923 Campbell Brown reported a controlled study under laboratory conditions of the thermal death-points of many strains of both human and bovine tuberculosis that had been, artificially, heavily inoculated into milk. He submitted abundant evidence that under laboratory conditions 140 degrees F. held 20 minutes is sufficient and is necessary to insure destruction of both human and bovine strains. Campbell Brown also recommends that the heat factor be increased to 145 degrees F. and the holding factor to 30 minutes under actual working conditions, to guard against lapses below the minimum essential temperature and holding period. When 158 degrees F. was employed as the heat factor, Campbell Brown found that five minutes' holding was sufficient and was necessary to accomplish the same bacterial destruction as 140 degrees F. held 20 minutes.

### *Nonpathogens*

Pasteurization is of economic value in that it destroys a high percentage of nonpathogenic organisms, including acid formers in milk, and thus defers spoilage. The percentage of bacterial destruction depends to some extent on the total number of bacteria present, and on the proportion of heat-resistant organisms contained, and such resistance is believed to pertain more to bacteria of original contamination than to those of multiplication. But

when reasonable care is employed in applying the process, it is customary to expect a reduction of 98 per cent or more with ordinary market milk. When the combination of approximately 145 degrees F. for 30 minutes is employed, the surviving bacteria include the acid formers in sufficient proportion to cause the milk to sour in the usual manner. A greater total reduction could be effected by employing higher temperatures, but the undesirable peptonizers might then be likely to predominate.

Pasteurization provides the only practicable means for insuring destruction of pathogenic organisms and enormously reducing nonpathogenic organisms in milk.

## Physical, Chemical, and Nutritional Changes Effected by Pasteurization

### *Physical*

When milk is pasteurized for 30 minutes at temperatures even slightly exceeding 145 degrees F., the depth of cream which rises in the bottles is measurably reduced, and on visual comparison many housewives will reject such milk in favor of raw milk or milk pasteurized at lower temperature, although all three have the same fat content. To consumers, reduction in cream layer signifies skimming or watering, and they are quick to condemn such milk and the process which produced that result. So long as safety is assured and no fraud is committed, it is of public health as well as economic importance that cream layers be allowed to remain at their natural levels, to the end that milk consumption be stimulated. Fortunately, with adequate equipment and careful operation, it is possible to effect the bacterial destruction desired without appreciably affecting the cream layer, by holding for 30 minutes at a temperature approximately 145 degrees F., never lower than 142. That combination of temperature and holding period has proved adequate to protect the public

health; and it is the combination recommended by this Association.

### *Chemical*

Rupp, of the U. S. Department of Agriculture, made extensive investigations of the chemical changes produced in milk by pasteurization, and arrived at the following conclusions:

"1. Milk pasteurized by the holder process at 145° F. for 30 minutes does not undergo any appreciable chemical change.

"2. The soluble phosphates of lime and magnesia * * * in the serum of both raw and pasteurized milk are practically the same.

"3. The albumin does not coagulate at 145° F., but 5.75 per cent of it is rendered insoluble at 150° F. As the temperature increases, the amount of coagulated albumin increases, amounting to 12.75 per cent at 155° F. and to 30.78 per cent at 160° F.

"4. The time required for coagulating the casein by rennin is slightly less in milk pasteurized at temperatures up to 149° F. than it is in raw milk. At 158° F. there is a slight retardation, while at 167° F. the time has almost doubled.

"5. The acidity as determined by titration is slightly diminished in pasteurized milk."

### *Vitamins*

The available evidence indicates that vitamins A and B are not affected by pasteurization as ordinarily practised. Probably water-soluble C is adversely affected, but that is not a serious matter. Freshly drawn raw milk, and even mother's milk, are relatively poor sources of water-soluble C. Exclusively milk diets should be supplemented by the daily addition of half an ounce of orange or tomato juice.

### *Nutritional*

Park and Holt in New York, Weld in Washington, and others fed alternate babies on raw and on pasteurized milk and compared the results as measured by gains in weight and general well being of the infants. These were clinical studies, and the conclusions arrived at were favorable to pasteurized milk, and indicated that the nutritive values of milk were not injured by proper pasteurization.

## Public Health Value

### *Prevention of Communicable Disease Transmission*

Without doubt, the common testimony of sanitarians and public health officials is the best evidence of the efficiency of properly supervised holding pasteurization. It is the obvious answer to the health officer's problem of the incubating, the mild missed, the convalescent, and the carrier types of communicable diseases occurring on dairy farms, whether of human or bovine origin. Medical examination and dairy farm inspection are manifestly inadequate in that respect; and the bacterial count throws no light whatever on the subject. Tuberculin testing is an exceedingly important economic measure; it limits the spread of bovine tuberculosis among domestic animals and enables the development of choice herds of large producers with comparative safety. Tuberculin testing by the area plan merits support on its own account from all who are influential in the dairy field; but as it discloses the presence of only one of several communicable diseases, it claims no comparison with pasteurization as a safeguard for the public health.

The common knowledge of the efficiency of pasteurization as a safeguard for milk supplies was reduced to a scientific basis by Dr. Edward S. Godfrey, Jr., of the New York State Department of Health, whose publication in *The Nation's Health,* January 15, 1923, was discussed in the 1923 report of this Committee. Dr. Godfrey collected and

analyzed the data regarding all "outbreaks of communicable diseases in which milk that was pasteurized, or even purported to be pasteurized, was found to be or was suspected of being the agent of transmission." Dr. Godfrey's investigation is so valuable that we deem it advisable to repeat his "Summary and Conclusion" in this report:

"Sixteen instances have been collected of outbreaks of communicable disease attributed to infection by milk, or milk products, which had been—or purported to have been —pasteurized. In one instance the milk probably had nothing to do with transmitting infection. In four instances the milk was pasteurized by the 'flash' system or some other method which failed to conform to the standards of the health authorities. In one instance, the thermographic records for several days preceding the outbreak could not be found, hence there is a doubt as to whether a proper temperature was reached and maintained for the proper length of time. In this instance there was also an opportunity for the milk to have become infected subsequent to pasteurization.

"In seven instances in which pasteurization was properly carried out, the evidence as to subsequent infection is conclusive in all but two. In one of the two exceptions there was very strong circumstantial evidence of infection by the employee who capped the bottles. In the other the source of infection was not located. Although it could be considered that infection *may* have passed through the pasteurizer, there is no evidence that it did.

"Hence it is a fair conclusion that pasteurization as now commonly defined in health laws and regulations will destroy any infection implanted previous to the process. Since from 85 to 90 per cent of milk outbreaks have been due to infection at the farm, pasteurization will prevent from 85 to 90 per cent of milk-borne infection. With modern dairy machinery, which reduces human handling to a minimum and provides ample facilities for the sterilization of utensils, the number of infections occurring through milk will be infinitesimal. The remaining sources of danger are slight except in hotels, restaurants, boarding houses, and in shops where bulk milk is permitted to be dipped. The fact that it has been possible to collect

these reports of outbreaks emphasizes the necessity of supervising the process of pasteurization and of properly protecting the product afterwards."

Pasteurization is no safeguard against subsequent infection, which must be guarded against; and the "flashing" of milk, and the heating of milk to other temperatures or for other periods of holding than those defined in the 1923 resolution, cannot be depended upon to be effective. The presence of pasteurizing equipment in a plant is not assurance that all milk passed through the plant has been pasteurized; neither is a properly recorded temperature chart. These are matters for competent official supervision to insure.

The evidence is conclusive that communicable disease infections do not survive properly supervised holding pasteurization. In the event that they are alleged to have done so, full information would disclose subsequent infection or lapse from the proper temperature or holding period.

### *Milk Conservation*

Pasteurization is so highly regarded as a preventive of communicable disease transmission that its value as a conserver of milk supplies is often lost sight of. It is impossible to believe that without the process of pasteurization modern cities could be supplied with adequate volumes of milk at prices that would enable the great mass of the population to participate in them.

## Communicable Diseases Transmitted by Raw Milk

The Twenty-eighth Biennial Report of the State Board of Health of California, period July, 1922, to June, 1924, contains a report ot 240 cases of typhoid fever transmitted in and about Santa Ana by raw milk. These followed a sudden and explosive outbreak of water-borne typhoid in which some of the milk handlers doubtless

were infected. Cases due to infected milk began to be reported about the middle of February, 1924. Pasteurization of all milk supplies was ordered and became effective March 17, following which date there was a marked diminution in the number of cases reported and no milk-borne cases of typhoid were reported in Santa Ana following March 31, showing that pasteurization was effective in bringing this raw-milk-borne outbreak to an end.

*Public Health Reports,* October 17, 1924, and June 10, 1925, contain reports of outbreaks of communicable diseases transmitted by raw milk supplies; one of typhoid fever in Tennessee, the other of scarlet fever in Montana.

We are indebted to the California member of this Committee for certain information that is of definite interest to other communities:

"The California Dairy Law requires that all animals from which milk is sold within that State shall pass an official tuberculin test, or the milk shall be pasteurized. As the result, when a study is made of the percentage of milk pasteurized in the various cities in California we find that the percentage is in indirect proportion to the number of animals tested."

This is an object lesson in psychology that is of intense practical importance. Public health administrators should recognize and act upon the fact that when communities are allowed the alternative of these two procedures, they incline to accept one and reject the other in part. Both procedures are important and desirable; pasteurization for safeguarding the public health from all infections, tuberculin testing for the protection and promotion of animal industry and of the public health against bovine tuberculosis infection.

## Manufactured Products

Because of its universal use and the large volumes involved, market milk demands and usually receives first

attention in the matter of pasteurization. Here, narrow and exacting requirements for heating and holding are imperative—approximately 145 degrees F., never lower than 142 degrees F., for the full period of 30 minutes. But within their spheres, raw cream and ice cream made from raw milk products are likely to become the agents of communicable disease transmission; and there is a speculative danger in butter and in some forms of cheese made from raw materials. Pasteurization of materials used in these manufactured products was discussed at length in last year's report, and the following conclusions were presented:

"Adequate safeguarding requires the pasteurization of cream, skimmed mik, and ice cream mix. With these commodities, 160 degrees F. held not less than 10 minutes may be considered a safe alternative for 142-145 degrees F. held not less than 30 minutes, which is the only temperature and time recognized for fluid milk. * * * *

"No reports of actual outbreaks of communicable disease transmission through butter have come to the attention of the Committee. However, pasteurization of milk and cream intended for manufacture into butter is desirable, and the trend of the industry is favorable to the process. Either of the two (above named) combinations of temperature and time factors is recommended.

"Only one actual outbreak of communicable disease transmitted through cheese has come to the attention of the Committee. Others have probably occurred when a proper period of storage had not been maintained. Under specially favorable plant conditions it is practicable to manufacture good cheese from pasteurized milk and cream; but such specially favorable (plant) conditions are not generally present in the cheese industry. Pasteurization is desirable of the milk ingredients entering into the manufacture of cottage, "cream" and other cheese whose normal process of manufacture does not involve a period of approximately fifty days' storage before marketing. Present information

warrants the conclusion that fifty days' storage is destructive of specific infectious organisms in cheese."

"The committee does not recognize the 'flash' process. It may be that heating milk and cream momentarily to 185 degrees F. is effective in destroying germ life; but difficulties arise in maintaining that temperature * * * and in its supervision."

The present Committee is not inclined to alter those conclusions, although our failure to recognize "flash" pasteurization at 185 degrees F. has been criticized by men who are distinguished for their contributions to dairy research and efficient dairy plant management. This Committee has not argued the thermal death-points of pathogens by heat momentarily applied. Neither have we recommended the entering of action against manufacturers who apply heat momentarily at 185 degrees F. to dairy products intended for manufacture. But there is something more to be considered in the framing of a law, or of a recommendation by this Committee, than a pronouncement of procedures that would be effective *if applied;* the question of the probability of the application of such procedures is also involved. The Committee demurs rather than questions the efficiency of 185 degrees F. "flashed" as a destroyer of pathogens. It is likely that a few of the largest and best operated plants would actually *apply* uniformly and efficiently 185 degrees F. "flashed" to milk products intended for manufacture. But authorities of broad observation are familiar with the lapses from uniformity and from temperature of 185 degrees F. when dairy products are "flashed" momentarily, and also with the difficulty of maintaining supervision that is adequate to determine what temperatures and what uniformity have actually prevailed with "flash" pasteurization. In the event of an epidemic, the shortcomings of "flash" pasteurization would be held responsible. Your Committee is not inclined to recognize a process so constantly under suspicion.

## Pasteurization of Fluid Milk

### *Raw Materials*

Pasteurization is not intended as a substitute for clean production and handling. Good raw materials should flow into the pasteurizer; and statements to the contrary should be taken as mere alibis of producers and others who have been caught napping or of inspectors who lack ability to formulate and execute a well-conceived program of clean production coupled with efficient pasteurization. Quality counts in the building up of a milk business; and it would be a rash dealer who would disregard the off flavors and odors prevalent in milk that had been carelessly handled previous to pasteurization. The essentials of clean production and handling are not difficult or expensive to perform, they will be performed by some producers and dealers in every community; and their performance will be recognized by sufficient consumers to turn volume of business in their favor. Volume of trade fights on the side of cleanliness in production and handling previous to pasteurization.

### *Definition*

This Association has defined pasteurization as follows:

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

Those procedures are possible of accomplishment in ordinary plant practice, they are comparatively easy of

official supervision, and they result in the advantages of efficient pasteurization. Variations from the procedures defined above are likely to occur in the absence of competent supervision, and when they occur such variations are likely to produce results differing slightly or greatly from those contemplated and desired.

An extensive monograph would be required to present an adequate description of the construction, equipment, and operation involved in actual plant practice. Such monographs are available, the process has been adequately described in the reports of previous committees, and the members of this Association are presumed to be familiar with it. The principles involved are concisely stated in the report of the committee of 1921, as follows:

"In the proper control of pasteurizing plants there are three fundamental items to be considered:

"1. The construction and equipment of the building and the apparatus used;

"2. The mechanical control of the apparatus;

"3. The personal control of the operation of the plant.

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

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

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

Members of this Association are quite familiar with the

fundamental requirements of ample capacity, simplicity and accessibility in constructon, positive heating and holding as previously defined, and automatic recording of these, prevention of subsequent contamination, and, finally, prevention of lapses from these requirements.

It is obvious that one of the important points at which lapses may occur in the process of pasteurization is that at which the heated milk is held for a period of time after having reached the maximum temperature. If the time for which the milk is held is less than that for which a standard has been set, then the efficiency of the process is called in question. When the holders in use are of the absolute or positive type, it is comparatively easy to determine the holding time. If, however, the continuous or flow-type holders are employed, there is much less certainty. Those who recognize that lapses from the theoretical holding time may interfere with the effectiveness of the milk treatment have made many attempts to test the actual holding time of the various forms of the apparatus in use, and in making these tests have employed various methods.

The time which elapses between the entrance of a particle of milk into a holder and the discharge of the milk from the outlet determines the holding period. It is clear that in a flow-type holder there are several elements which may interfere with a uniformly even flow of milk. Among these are included the temperature of the milk, the uniformity of the temperature, the speed of flow, the uniformity of speed of flow, and the possible loss of temperature through radiation during the period.

It is evident that if the tests made are to be of value, we must duplicate as nearly as possible the conditions which are found in the actual treatment of the milk during pasteurization. These should include temperatures and speeds of flow which are actually used during the pasteurizing process.

It has been the general practice to employ water instead of milk in making these tests. Three methods for determining the holding time are used: First, the introduction of some color into the inflowing water. Second, the sudden and wide variation of the temperature of the water flowing into the holder. Third, the introduction of *B. prodigiosus* at the inlet. By noting the time at which there appears at the outlet, either the color, or the variation of the temperature, or the bacteria which have been used, it is possible to estimate the actual holding period.

Probably none of these methods are capable of securing entirely accurate results. Differences in specific gravity in using the first two methods create disturbing currents, and with the latter method, where bacteria are used, it is impossible to duplicate pasteurizing conditions for the reason that it is necessary to use water at tap temperature instead of at pasteurizing temperature. A high temperature would destroy the bacteria. The unavoidable fluctuations in temperature which occur around 145 degrees must strongly influence the holding time with most flow-type holders.

The introduction of pathogenic bacteria into the milk being treated, and testing for those which survive at the outlet of holder, throws valuable and practical light on the effectiveness of the process in destroying germ life, but is not so valuable with respect to indicating the actual holding time of flow-type holders.

Therefore, if holders of the flow type are used, it seems necessary to advise that a wide margin of safety be allowed over the time for which claims are made that the apparatus will hold the milk. As previously stated, when holders of the absolute or positive type are used it is comparatively easy to determine the holding time.

### Endicott Study

Bulletin 147, entitled "Commercial Pasteurization," published by the United States Public Health Service, reports

an extended and exhaustive study of the engineering, cream-line, and pathogenic bacteria destruction factors with various types of pasteurizing equipment and different temperatures of heating. In all, 198 individual pasteurizing operations were conducted and studied in detail, and 3,385 samples of milk were analyzed for pathogenic bacteria, on which 6,574 bacterial tests were made. Engineering observations totaled 4,606 in the course of these studies, and 162,153 pounds, or approximately eighty thousand quarts, of milk were used. The bulletin includes 217 pages, of which fully two fifths are tables—a volume of data that preclude adequate summary, and permit only reference to outstanding conclusions, by this Committee at this time.

The study was made possible by the Borden Company of New York City, which contributed its plant at Endicott, N. Y., and other resources to the experts, who had a free hand in planning, organizing, and conducting the undertaking and in reporting the conclusions. It was a progressive study and consisted of series of tests pursued at intervals during the period December, 1921—April, 1923. Subsequent series were conducted with reference to the results obtained from preceding ones. Armstrong, Moore, North, Park, Phelps, Rosenau, and Wadsworth were the experts who planned and conducted the study and framed the report; and their assistants who acted as bacteriologists, engineers, observers, etc., included many of the most prominent authorities in their fields in the country.

The tests employed were extreme in their severity, including conditions that would hardly be expected to occur under ordinary commercial conditions. They tend to recall the crushing tests employed by engineers to determine strength and factors of safety with metals and other substances. The possibilities of weakness, and the means of overcoming them, of various types and constructions and

methods of operation of pasteurizing apparatus were scientifically determined.

The possibilities of weakness consisted of those which have been enumerated in previous reports of this Committee: irregularities of rates of flow, especially with flow-type holders; lack of adequate insulation; lack of automatic temperature control; leaky valves; dead ends; foamy milk. All these possible defects may be readily overcome; and the means for doing so are described in detail in the bulletin.

With the holding process, the temperature of 145 degrees F. was found to be the critical one at which damage to the creaming properties of milk begins. A reduction in creaming properties results from the holding process at temperatures above 145 degrees F.

The conclusion with respect to pathogenic organisms and their destruction is especially significant to those charged with the framing and enforcement of legislation regarding pasteurization:

"The temperature and time for pasteurization contained in the milk regulations of the cities of New York, Philadelphia, Baltimore, and many other large cities, * * * which is that 'milk or cream shall be heated to a temperature of at least 142 degrees F. and held at such temperature for 30 minutes or more,' provides an adequate margin of safety, and is recommended as a proper standard for the definition of pasteurization by health authorities. This standard has been in use for some years with results satisfactory to the health authorities. In order to conform with this standard the industry must adjust the temperature of pasteurizing machines a degree or two above the minimum temperature of 142 degrees F. to allow for fluctuations. This standard therefore requires that the pasteurizing machines shall be regulated so as to maintain an average temperature of from 143 degrees F. to 144 degrees F. Such a standard allows a minimum

margin of safety for 30 minutes of 4 degrees F. and an average margin of from 5 degrees F. to 6 degrees F. above the thermal death-point of 138 degrees F. for the tubercle bacillus.

"It is essential that proper emphasis be placed upon the words 'heated' and 'held' in the definition of pasteurization here recommended. Well-designed plants under competent operating supervision can be made to adhere closely to the standard minimum requirements. There are often, however, plants which are poorly designed and operated, especially the smaller plants, in which there are variations in both the temperature of heating and the time of holding which cannot be offset even by raising the minimum time and temperature limits. It is not the proper function of a statutory definition to attempt to establish limits based on such inefficient processes. The proper remedy for such variations consists in more competent supervision by public health officials and by all who are responsible for the operation of pasteurizing machinery."

In an editorial note accompanying the publication of Bulletin 147, the Public Health Service "takes this opportunity to reiterate its indorsement of the efficient pasteurization of milk as a public health measure."

*"Man is never watchful enough against danger that threatens him every hour."*

# PRESENT STATUS OF PASTEURIZATION

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Early in the year the Bureau of Dairying sent questionnaires to the health officers of every city and town having a population of 5,000 or more. This questionnaire dealt with the requirements for pasteurization, the grades of raw milk allowed, the inspection of pasteurizing plants and employees, etc. While the results are not as yet fully tabulated, I would like to bring the following information to your attention.

The control officers of 371 cities returned the questionnaires; but 22 gave no information. Of the remaining 349, many did not answer all of the questions; so the summaries given in many cases will be for a lesser number of cities.

Table 1 gives information, tabulated by population groups, regarding general pasteurization requirements of cities from which information was received.

TABLE I

GENERAL PASTEURIZATION REQUIREMENTS OF 349 CITIES

| Population groups | Cities requiring all milk to be pasteurized. | Cities allowing some raw milk. | Cities permitting forms of raw milk indicated | | | |
|---|---|---|---|---|---|---|
| | | | Certified. | T. B. tested. No bacterial standard stated. | T. B. tested. Bacterial standards stated. | Bacterial standards. T. B. test not stated. |
| 500,001 and over..... | 0 | 10 | 10 | 0 | 2 | 6 |
| 100,001 to 500,000..... | 0 | 37 | 29 | 4 | 14 | 14 |
| 75,001 to 100,000..... | 0 | 19 | 14 | 2 | 12 | 9 |
| 50,001 to 75,000..... | 0 | 25 | 16 | 2 | 8 | 24 |
| 25,001 to 50,000..... | 2 | 61 | 35 | 5 | 15 | 30 |
| 10,001 to 25,000..... | 2 | 110 | 35 | 15 | 21 | 47 |
| 10,000 and under..... | 3 | 80 | 9 | 15 | 9 | 10 |
| Total ..... | 7 | 342 | 148 | 43 | 81 | 140 |

It will be noted that the larger cities are inclined to exempt from pasteurization very little raw milk except certified.

Attention is also called to the last three columns in Table 1. It can be seen that the totals, added to the certified total, are greater than the number of cities allowing raw milk. This is accounted for by the fact that some cities allow two grades of raw milk, such as certified and Grade A; or Grades A and B raw. Both grades were reported, which makes some duplication.

It must also be taken into account that the classifications under the last three headings are as shown by the answers. Undoubtedly omissions have been made in some of the replies, especially those tabulated in the last column.

The bacteria standards for raw milk from tuberculin-tested cows varied from 10,000 to over 500,000 bacteria per c. c. The most widespread standards were between 50,000 and 100,000 per c. c., 32 cities so reporting. The next was 25,000 to 50,000 per c. c., such standards being in force in 22 cities.

Of the cities answering the questionnaire, 328 gave definite answers as to the per cent of milk pasteurized. A tabulation of these replies is given in Table 2. The 1921 figures were secured by this Bureau in a similar way at that time.

TABLE II

EXTENT OF PASTEURIZATION IN 1921 AND 1924.

| Population of cities | Number of cities reporting pasteurized milk. | | Number of cities reporting no pasteurized milk. | | Per cent of cities reporting pasteurized milk. | | Average per cent of milk pasteurized in cities reporting. | |
|---|---|---|---|---|---|---|---|---|
| | 1921 | 1924 | 1921 | 1924 | 1921 | 1924 | 1921 | 1924 |
| More than 500,000..... | 12 | 9 | 0 | 0 | 100 | 100.0 | 95 | 98.1 |
| 100,001 to 500,000..... | 42 | 37 | 0 | 0 | 100 | 100.0 | 72 | 81.7 |
| 75,001 to 100,000..... | 15 | 19 | 0 | 0 | 100 | 100.0 | 68 | 66.6 |
| 50,001 to 75,000..... | 29 | 25 | 5 | 0 | 85 | 100.0 | 65 | 66.6 |
| 25,001 to 50,000..... | 55 | 58 | 7 | 2 | 89 | 94.4 | 58 | 67.0 |
| 10,001 to 25,000..... | 77 | 84 | 49 | 21 | 61 | 80.0 | 51 | 42.5 |
| Less than 10,000..... | 36 | 53 | 52 | 20 | 41 | 72.6 | 53 | 33.6 |

The first thing worthy of attention is that in 1924 a larger number of the smaller cities (under 25,000 inhabitants) than in 1921, reported having some pasteurized milk; and conversely a lesser number reported no pasteurized milk. Indeed, in 1924, there was not a city in the population group of 50,001 to 75,000 which did not have some pasteurized supply; while in 1921, five cities in this group reported no pasteurization.

The per cent of cities having pasteurized milk and the average per cent of milk pasteurized is even more striking. It may be noted that the cities of 25,000 or fewer inhabitants had a smaller per cent of milk pasteurized in 1924 than in 1921. This is believed to be due to the fact that a large number of small cities having no pasteurized milk in 1921 reported pasteurized milk in 1924. With their small per cent of pasteurized milk in 1924, they are believed to have pulled down the average per cent of milk pasteurized in their population groups.

Table 3 shows municipal requirements for pasteurization time and temperature in 226 cities. In all, 337 cities replied; of these 226 reported standards, 83 stated that they had no such regulations, and 27 failed to answer the question.

## TABLE III.

MUNICIPAL PASTEURIZATION REQUIREMENTS OF 226 CITIES AND TOWNS.

| Requirements | | Population | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 500,001 and over | 100,001 to 500,000 | 75,001 to 100,000 | 50,001 to 75,000 | 25,001 to 50,000 | 10,001 to 25,000 | 10,000 and under | |
| Legal | | 9 yes 1 no answer | 36 yes 1 no answer | 16 yes 1 no 2 no answer | 23 yes 2 no 1 no answer | 52 yes 7 no 2 no answer | 62 yes 33 no 12 no answer | 32 yes 38 no 8 no answer | Total |
| Temperature ° F. | Time Min. | | | | | | | | |
| 136 | 30 | | | | | 1 | | | 1 |
| 140 | 20 | | | | | | | 3 | 3 |
| 140 | 25 | | | | | 1 | 1 | | 2 |
| 140 | 30 | 1 | | | 1 | 3 | 1 | 4 | 10 |
| 140-142 | 30 | | | | | | 1 | | 1 |
| 140-145 | 25 | | | | | | 1 | | 1 |
| 140-145 | 30 | 2 | 2 | 2 | 1 | 2 | 7 | 3 | 19 |
| 140-146 | 30 | | | | | | 1 | | 1 |
| 140-150 | 20 | | | 1 | | | 1 | | 2 |
| 142 | 20 | | | | | | | 1 | 1 |
| 142 | 30 | 1 | 10 | 4 | 4 | 13 | 6 | 4 | 42 |
| 142-143 | 30 | | 1 | | | | | | 1 |
| 142-145 | 30 | 3 | 13 | 2 | 4 | 16 | 17 | 4 | 59 |
| 142-146 | 30 | 1 | | | | | 1 | | 2 |
| 142-147 | 30 | 1 | | 1 | | | | | 2 |
| 142-148 | 30 | | 1 | | 1 | | 1 | | 3 |
| 142-149 | 30 | | | | 1 | | | | 1 |
| 143 | 30 | | 1 | | | 1 | 4 | | 6 |
| 143-145 | 30 | | 1 | 1 | 1 | | 1 | | 4 |
| 144 | 30 | | | | | 1 | | | 1 |
| 145 | 20 | | | | | 2 | | 2 | 4 |
| 145 | 25 | | 2 | | | | | 1 | 3 |
| 145 | 30 | 1 | 6 | 5 | 11 | 10 | 18 | 10 | 61 |
| 145-148 | 30 | | | 1 | | 2 | | 1 | 4 |
| 145-150 | 30 | | | | | 1 | | | 1 |
| 146 | 30 | | | | | | 1 | | 1 |
| 155 | 5 | | | | | 1 | | | 1 |
| 160 | ½ | | | | | 1 | 2 | | 3 |
| 180 | ½ | | | | | | | 1 | 1 |
| Total | | 10 | 37 | 17 | 24 | 55 | 64 | 34 | |

It will be noted that while 226 cities reported standards, there are 241 regulations given. This is due to the fact that several cities had two or more standards in which the time of holding varied with the degree of heat applied.

Twenty-nine different standards were reported, showing a wide variation and lack of uniformity. The smaller towns lacked such regulations much more than the larger cities.

The regulations most used are given in Table 4, arranged according to their frequency.

TABLE IV

MOST PREVALENT PASTEURIZATION STANDARDS.

| Temperature °F. | Time Min. | Number of cities |
|---|---|---|
| 145 | 30 | 61 |
| 142-145 | 30 | 56 |
| 142 | 30 | 42 |
| 140-145 | 30 | 19 |
| 140 | 30 | 10 |

Table 5 shows the bacteria standards for pasteurized milk. Where the footnotes so indicate, standards for Grade A pasteurized milk are included.

TABLE V.

NUMBER OF BACTERIA STANDARDS FOR PASTEURIZED MILK

| Bacteria per c.c. | Population groups. 500,001 and over | 100,001 to 500,000 | 75,001 to 100,000 | 50,001 to 75,000 | 25,001 to 50,000 | 10,001 to 25,000 | 10,000 and less |
|---|---|---|---|---|---|---|---|
| 10,000 and less..... | | 1 (A) | | | | 4 (B) | |
| 10,001 to 25,000..... | 2 (A) | 3 (C) | 2 (B) | 4 | 7 (B) | 8 (B) | 6 (B) |
| 25,001 to 50,000..... | 4 (A) | 19 | 10 (A) | 12 (D) | 26 (F) | 24 (E) | 10 (B) |
| 50,001 to 100,000..... | 8 | 10 | 7 (A) | 7 | 18 | 20 | 11 |
| 100,001 to 300,000..... | | 6 | 1 | 3 | 4 | 6 | 1 |
| 300,001 to 500,000..... | | 4 | 1 | 2 | 1 | 7 | 4 |
| 500,001 and over..... | | | | | | | 1 |

(A) Includes 1 Grade A requirement.
(B) Includes 2 Grade A requirements.
(C) Includes 3 Grade A requirements.
(D) Includes 4 Grade A requirements.
(E) Includes 7 Grade A requirements.
(A) Includes 8 Grade A requirements.

An important factor in proper pasteurization is the proper control of time and temperature. The present requirements are shown in Table 6.

TABLE VI

CONTROL OF PASTEURIZATION.

| Population groups | Automatic control of pasteurization temperature required. | | Recording thermometers required. | | Pasteurizing plants regularly inspected and thermometers checked. | |
|---|---|---|---|---|---|---|
| | Yes | No | Yes | No | Yes | No |
| 500,001 and over..... | 7 | 3 | 10 | 0 | 10 | 0 |
| 100,001 to 500,000..... | 23 | 14 | 33 | 4 | 33 | 3 |
| 75,001 to 100,000..... | 8 | 10 | 15 | 3 | 17 | 2 |
| 50,001 to 75,000..... | 10 | 16 | 22 | 4 | 21 | 5 |
| 25,001 to 50,000..... | 27 | 31 | 48 | 10 | 48 | 7 |
| 10,001 to 25,000..... | 38 | 47 | 55 | 30 | 58 | 27 |
| 10,000 and less..... | 20 | 35 | 29 | 26 | 27 | 25 |

Regarding the medical inspection of employees in pasteurizing plants, there seems to be room for much improvement. Only 114 cities out of 293 inspect the health of plant employees, and only 76 out of 293 inspect the wagon drivers. From the replies received, inspection is often very superficial, consisting of a "physical examination" at periods varying from once a month to once a year; the yearly examinations being by far the most common.

Regulations for sterilizing bottles in pasteurizing plants were reported by 289 cities. Of these, 187 required "live steam"; 21, "boiling"; 38, "chemicals" (including in some cases alkali); and the rest minor variations of these methods.

Concerning the difficulty of enforcing regulations, the following were listed as causing the greatest trouble:

| | |
|---|---|
| Control of raw milk before pasteurization | 38 |
| Bacteria standard for pasteurized milk | 25 |
| Raw milk standards | 19 |
| Medical inspection of employees | 19 |
| Bottle sterilization | 14 |

These tables show clearly that this association may well lend its influence toward the unification and clarification of pasteurization regulations and their enforcement. Such work is needed and is of vital importance to the safety of our milk supplies.

*"No large enterprise can exist for itself alone. It performs some great service, not for itself, but for others."*