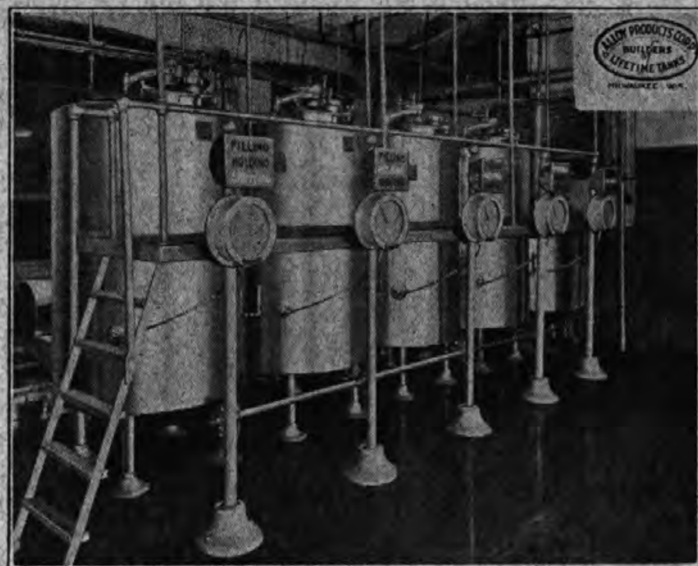
NINETEENTH ANNUAL REPORT

OF THE

International Association of Dairy and Milk Inspectors

INCLUDING PAPERS READ AT THE ANNUAL CONVENTION IN CLEVELAND, OHIO
OCTOBER 22, 23, AND 24, 1930

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



THOMAS HOLT

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

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PAUL B. BROOKS, M.D., Secretary-Treasurer
STATE DEPARTMENT OF HEALTH
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Price Two Dollars

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International Association of Dairy and Milk Inspectors

CONSTITUTION AND BY-LAWS

CONSTITUTION

ADOPTED OCTOBER 16, 1911

NAME

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

OBJECT

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

MEMBERSHIP

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

OFFICERS

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

AMENDMENTS

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

BY-LAWS

ADOPTED OCTOBER 25, 1913

ORGANIZATION

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

ARTICLE 1

MEMBERSHIP

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

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

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

HONORARY MEMBERS

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

ARTICLE 2

OFFICERS

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

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

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

ARTICLE 3

DUTIES OF OFFICERS

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

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

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

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

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

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

ARTICLE 4

MEETINGS

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

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

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

ARTICLE 5

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

International Association of Dairy and Milk Inspectors

OFFICERS, 1929 - 1930

President, Ralph E. Irwin .... Harrisburg, Pa.
First Vice-President, A. R. B. Richmond, Toronto, Ont.
Second Vice-President, Wm. B. Palmer, Orange, N. J.
Third Vice-President, H. N. Parker, Jacksonville, Fla.
Secretary-Treasurer, Paul B. Brooks .... Albany, N. Y.
Auditors: Thomas Holt .... Hartford, Conn.
F. D. Holford .... New York City

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Dr. George W. Grim	Ardmore, Pa.
Mr. W. D. Dotterrer	Chicago, Ill.

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Dr. Roy F. Leslie	Cleveland, Ohio

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Palmer, Russell R., Chief Milk Inspector, City of Detroit, 1300 Beaubien St., Detroit, Mich.

Palmer, Wm. B., Executive Officer, Milk Association of the Oranges, N. J., City Hall, Orange, N. J.

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

Parker, N. M., Chief Inspector Milk Supervision, State Board of Health, Jackson, Miss.

Pattison, Edwin, Milk Inspector, Health Department, Bloomington, Ill.

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

Pease, Dr. Herbert D., Director of Pease Laboratories, 39 W. 38th St., New York City.

Pierson, John, Health Inspector, 629 N. Parramara St., Orlando, Fla.

Pilgrim, Dr. S. L., Chief, Division of Food, Milwaukee, Wis.

Plimpton, Geo. E., United Farmers, 98 Cambridge St., Charlestown, Mass.

Possien, S. G., Chief Milk and Dairy Inspector, Board of Health, Mobile, Ala.

Posson, R. J., Sec'y-Mgr., Wash. Dairy Council, 502 Hill Bldg., Washington, D. C.

Prentiss, Russell I., Milk Inspector, Town of Lexington, Lexington, Mass.

Price, J. M., Dairy Inspector, Greenville, Miss.

Price, Dr. Wm. H., Athletic Club, Detroit, Mich.

Putnam, Geo. W., Research Engineer, The Creamery Package Mfg. Co., 1243 W. Washington Blvd., Chicago, Ill.

Quigley, J. V., President, Country Club Dairy Co., 5633 Troost Ave., Kansas City, Mo.

Rath, Dr. Floyd C., Assistant Health Officer, Dairy and Food Inspector, Madison, Wis.

Redfield, Dr. H. W., Mendham, N. J., R. F. D. 1.

Regan, Dr. J. J., Chief Veterinarian and Director of Labs., Dairymen's League, 11 W. 42d St., New York City.

Rempe, William, Chief, Milk Food Division, City Hall, Scranton, Pa.

Rice, Dr. John L., Health Officer, City Hall, New Haven, Conn.

Richmond, Dr. A. R. B., Chief of Division of Food Control, Department of Public Health, City Hall, Toronto, Ontario.

Roadhouse, Prof. C. L., Professor of Dairy Industry, University of California, University Farm, Davis, Cal.

Roberts, H. P., Dairy and Food Inspector, City Health Department, Fargo, N. D.

Robertson, Dr. T. R., Sanitary Inspector, Dyersburg, Tenn.

Romberger, Dr. E. E., Milk and Meat Inspector, 340 N. 6th St., Reading, Pa.

Rosenberger, Dr. M., Superintendent, Adohr Stock Farm, R. 2, Box 105, Van Nuys, Cal.

Ruffner, Dr. F. J., City Dairy and Food Inspector, Beloit, Kansas.

Russell, C. C., Dairy Inspector, City Health Department, Birmingham, Ala.

Schlegel, John M., Dairy Inspector, Chicago Health Department, Daleville, Ind.

Schofield, Dr. Earle F., Milk and Food Inspector, Department of Health, Greenwich, Conn.

Schmeing, J. B., Sanitary Inspector of Dairies, Covington, Ky.

Scott, John M., Chief Milk Inspector, Dept. of Agriculture, St. James Bldg., Jacksonville, Fla.

Secoy, Chas. W., Meat and Dairy Inspector, Bellevue, O.

Shain, Dr. Chas., Chief Food Inspector, Health Department, Hamilton, Ontario.

Shere, Lewis, c/o Diversey Mfg. Co., 53 W. Jackson Blvd., Chicago, Ill.

Shields, Fred M., Milk Specialist, State Board of Health, Jefferson City, Mo.

Shoults, Dr. W. A., Director of Food Division, Provincial Board of Health, Winnipeg, Manitoba.

Shrader, Dr. J. H., Director, Research Laboratories, National Dairy Products Corporation, Baltimore, Md.

Shroat, H. E., Assistant, Division of Milk Control, State Department of Health, 28 Evergreen St., Harrisburg, Pa.

Shull, Dr. Hubert, Food and Dairy Inspector, 414 W. Third St., Texarkana, Ark.

Shutt, Donald B., Dept. of Bacteriology, Ontario Agr. College, Guelph, Ont.

Sibbald, A. D., Assistant Dairy and Food Commissioner, Old Capitol, St. Paul, Minn.

Slater, J. P., Sanitary Inspector, Union County Health Unit, Eldorado, Ark.

Smith, D. R., Dairy Supervisor, Southern Dairies Inc., 60 M St., N. E., Washington, D. C.

Smith, E. J., Gabel-Risdon Creamery Co., Detroit, Mich.

Smith, Russell S., Associate Milk Specialist, c/o State Health Dept., Nashville, Tenn.

Snyder, R. D., Inspector and Chemist, Snyder's Dairy, Bloomsburg, Pa.

Spafford, H. A., Sanitary Engineer for Logan County, Logan, W. Va.

Steiger, L. T., Dairy Inspector, City Health Department, Memphis, Tenn.

Stevenson, A. F., The Borden Company, 350 Madison Ave., New York City.

Stovall, Roy S., Sanitary and Milk Inspector, New Albany, Miss.

Strauch, Thos. J., Chief Dairy Inspector, Bureau of Health, Richmond, Va.

Stricklen, Owen E., Plant Superintendent, Ann Arbor Dairy Co., 1132 Berk St., Ann Arbor, Mich.

Supplee, Dr. G. C., Director of Research Laboratory, The Dry Milk Company, Bainbridge, N. Y.

Swanner, R. O., Asst. Sanitarian, Milk Control Work, State Health Dept., Albany, N. Y.

Switzer, H. B., Chief, Rouses Point Import Milk Station, Rouses Point, N. Y.

Testerman, H. L., Inspector of Milk and Foods, Colorado Springs, Colo.

Thomas, R. C., Asst. Milk Specialist, U. S. Public Health Service, Washington, D. C.

Thomson, James E., Chief, Bureau of Sanitary Control, Borden's Farm Products Company, New York City.

Thrasher, H. J., Assistant Director of Inspection, Alabama State Board of Health, Huntsville, Ala.

Tiedeman, Walter D., Assistant Sanitarian, Division of Sanitation, State Department of Health, Elsmere, N. Y.

Tobey, Dr. James A., Scientific Consultant, The Borden Company, 350 Madison Ave., New York City.

Tobias, James H., Dairy Inspector, Chicago Health Department, 307 Bent St., Elgin, Ill.

Tobin, Michael F., Inspector of Pasteurization, 245 Canal St., Providence, R. I.

Tolland, A. R., Dairy Inspector, Health Department, Room 1102, City Hall Annex, Boston, Mass.

Trish, Dr. Karl A., Food and Dairy Inspector, Health Department, City Hall, Kenosha, Wis.

Trotter, Dr. A. M., Chief Veterinary Inspector, Corporation of Glasgow, 60 Hill St., (East) Glasgow, Scotland.

Vener, Benj., 2738 E. 19th St., Brooklyn, N. Y.

Von Achen, S. O., Milk Inspector, Jefferson City, Mo.

Voorhees, Dr. L. A., Chemist, Department of Health, P. O. Box 114, New Brunswick, N. J.

Walker, Dr. W. F., Director, Committee on Administrative Practice, American Public Health Association, 370 Seventh Ave., New York City.

Walmsley, Dr. F. D., Borden's Farm Products Company of Illinois, 326 W. Madison St., Chicago, Ill.

Ward, Dr. Archibald R., Assistant Chief, Dairy Research Bureau, The Mathews Co., P. O. Box 834, Detroit, Mich.

Ward, Willard E., Agent, Board of Health, for Milk and Food Inspection, 14 Town Hall, Brookline, Mass.

Warner, W. J., State Dairy and Food Commissioner, Hartford, Conn.

Washburn, A. M., Director, Miss. County Health Unit, Blytheville, Ark.

Washburn, Prof. R. M., Director, Dairy Products Institute, Olsen Publishing Co., 505 W. Cherry St., Milwaukee, Wis.

Way, H. O., Director, H. O. Way Laboratory Service, 308 Western Reserve Bldg., Cleveland, O.

Weaver, B. F., County Sanitary Inspector, Moulton, Ala.

Webb, K. C., Dairy and Milk Inspector, 318 E. 28th St., Erie, Pa.

Weber, Clarence W., Sanitarian, Bureau of Milk Sanitation, State Health Dept., Albany, N. Y.

Wheeler, Ralph J., Milk Inspector, City of Pasadena, 547 Padilla St., San Gabriel, Cal.

White, G. T., Milk Inspector, 1130 Seward Ave., Detroit, Mich.

Wickham, Dr. J. C., Div. of Meat and Dairy Inspection, Cleveland Board of Health, Wooster, Ohio.

Widmayer, Fred J., Food and Milk Inspector, Scranton, Pa.

Wilcox, Dr. F. P., Director, Division of Dairy Products, Los Angeles County Health Department, Hall of Justice, Los Angeles, Cal.

Williams, Dr. R. W., Milk and Food Inspector, P. O. Box 923, Eldorado, Ark.

Wilson, Frank C., in charge Milk Laboratory, Food and Drug Department, State Board of Health, 152 State House, Indianapolis, Ind.

Yale, Maurice W., Chief of Sanitation Department, Pittsburgh District Dairy Council, 451 Century Bldg., Pittsburgh, Pa.

Yates, J. W., General Laboratories, Inc., 124 S. Dickenson St., Madison, Wis.

Young, Dr. Hulbert, Manager, Walker-Gordon Laboratory, Linden Ave. and Dolphin St., Baltimore, Md.

HONORARY MEMBERS

Evans, Dr. Wm. A., Health Editor, Chicago *Tribune,* Chicago, Ill.

Pearson, Dr. R. A., President, University of Maryland, College Park, Md.

Van Norman, Dr. H. E., The Borden Co., 350 Madison Ave., New York City.

Woodward, Dr. W. C., American Medical Association, Bureau of Legal Medicine and Legislation, 535 N. Dearborn St., Chicago, Ill.

NINETEENTH ANNUAL CONVENTION

HOTEL STATLER

CLEVELAND, OHIO

WEDNESDAY, THURSDAY, FRIDAY, OCT. 22, 23, 24, 1930

Friday, October 24
3.30 P.M.

BUSINESS SESSION

The business session was called to order at 3.30 P.M. with President Irwin in the chair.

Mr. W. J. Warner of Connecticut presented a memoir of the late Thomas Holt.

Dr. Grim presented the report of the Committee on Public Relations. Dr. Price moved that the report be accepted and referred to the Executive Committee with the understanding that the Executive Committee would take such action as it deemed advisable with reference to the suggestions contained in the report. Mr. Abele moved as an amendment that the Executive Committee be requested to make an early report to the members with respect to action taken on such suggestions. Dr. Price accepted the amendment and the motion was seconded and carried as amended.

Dr. Brooks presented the report of the Secretary-Treasurer. This report contained several recommendations, including one that a stenographer be employed to take notes throughout annual meetings and one that the Association record its construction of the constitutional provision with reference to eligibility for membership. Mr. Warner, referring to the first recommendation, stated that the Association in 1927 and 1928 had authorized the employment of such a stenographer at the discretion of the Secretary-Treasurer.

Dr. Price moved that the constitution be construed as requiring an official governmental connection, either past or present, for eligibility for membership. Motion seconded by Dr. Grim. After general discussion the motion was carried.

Dr. Harding moved that the further suggestions and recommendations contained in the report of the Secretary-Treasurer be referred to the Executive Committee with power to act. Motion seconded. Mr. Kelly moved as an amendment that any recommendations with reference to amendments to the constitution or by-laws be referred to the Committee on Revision of the Constitution and By-laws. Dr. Harding accepted the amendment and the motion as amended was seconded and carried.

Mr. Bowman presented the report of the Committee on Resolutions. He offered the adoption of the following resolution relative to the death of Thomas Holt:

> WHEREAS in the death of Thomas Holt, Dairy and Food Commissioner of the State of Connecticut, the cause of public health lost one of its outstanding champions and faithful workers in a branch of service which has come to be identified increasingly as of basic public importance, namely, the protection and safeguarding of milk and milk products, and
>
> WHEREAS the State of Connecticut and the regulatory milk officials of the North American Continent have lost a distinguished leader, a wise counsellor and a modest but valiant fighter for the highest standards in milk and food control work.
>
> THEREFORE BE IT RESOLVED, that the International Association of Dairy and Milk Inspectors herewith formally and with a deep feeling of loss records its sense of sorrow that so distinguished and so sincere a worker in its ranks has departed this life, and attests herewith in minutes to be spread in its records this evidence of deep respect and its feeling of loss in the death of Thomas Holt.
>
> BE IT FURTHER RESOLVED, that a copy of this resolution be sent to the bereaved family.

Resolution seconded and carried.

MEMOIR—THOMAS HOLT

W. J. Warner

Commissioner, Dairy and Food Commission

State of Connecticut, Hartford, Conn.

Thomas Holt, Dairy and Food Commissioner of the State of Connecticut, was born in Littleboro, Lancashire, England, January 21, 1863, son of John and Alice (Fletcher) Holt. The father conducted a dairy business and the sons learned dairying in a thoroughly practical manner, helping on the home farm and with the dairy business. Thomas also learned the carpenter's trade and when he was nineteen years old, decided to come to America where he believed he would have better business opportunities. He came alone and landed in Boston on the fourth of July, 1882.

From Boston he proceeded to Fall River, Massachusetts, where he worked as a carpenter for six months. Shortly after, he went to what is now known as South Dakota and took up a claim of three hundred and twenty acres of government land, on which he engaged in raising cattle and wheat. He remained there four years but tiring of the climate he disposed of his business and property and went to Tennessee and later to Fort Payne, Alabama, where he entered the milk business and kept a herd of eighty cows. He was not satisfied, however, in the South and leased a farm in New York for a time, coming to Southington, Connecticut, in 1895, where he purchased land and conducted a dairy farm, having a herd of one hundred and forty cows. He remained there for twenty-three years, concentrating his energy and attention upon the development of his business. He was appointed Deputy Commissioner of the Dairy and Food Department in 1914 and four years later bought his farm in Newington, where he also engaged in the dairying business and where he lived at the time of his death.

When Mr. Holt was appointed Deputy Commissioner, the working force of the department consisted of the Commissioner, Deputy Commissioner, five inspectors and a clerk. The clerk and inspectors were not full-time employees as the appropriation was not sufficient to keep them on that basis.

The Milk Regulation Board was created by an act of Legislature in 1917, providing rules and regulations for the inspection of stables, dairies, cheese factories and pasteurizing plants. The food control work also extended to bakeries, stores, restaurants and hotels and included inspection of ice cream manufacturing plants, carbonated beverage plants and supervision of springs and wells where water was bottled for sale, as well as the handling of food in a sanitary manner at roadside stands and shore resorts, the proper labelling of food and many other activities. The department now employs fourteen men and two women inspectors and an office force of four girls.

Mr. Holt took a deep and helpful interest in public affairs, serving one term as assessor in Southington and filling the office of first selectman for five years. In Newington he was a member of the Finance Board, the Town Plan Commission, Fire Commissioner, the local Grange, State Grange and was a Mason.

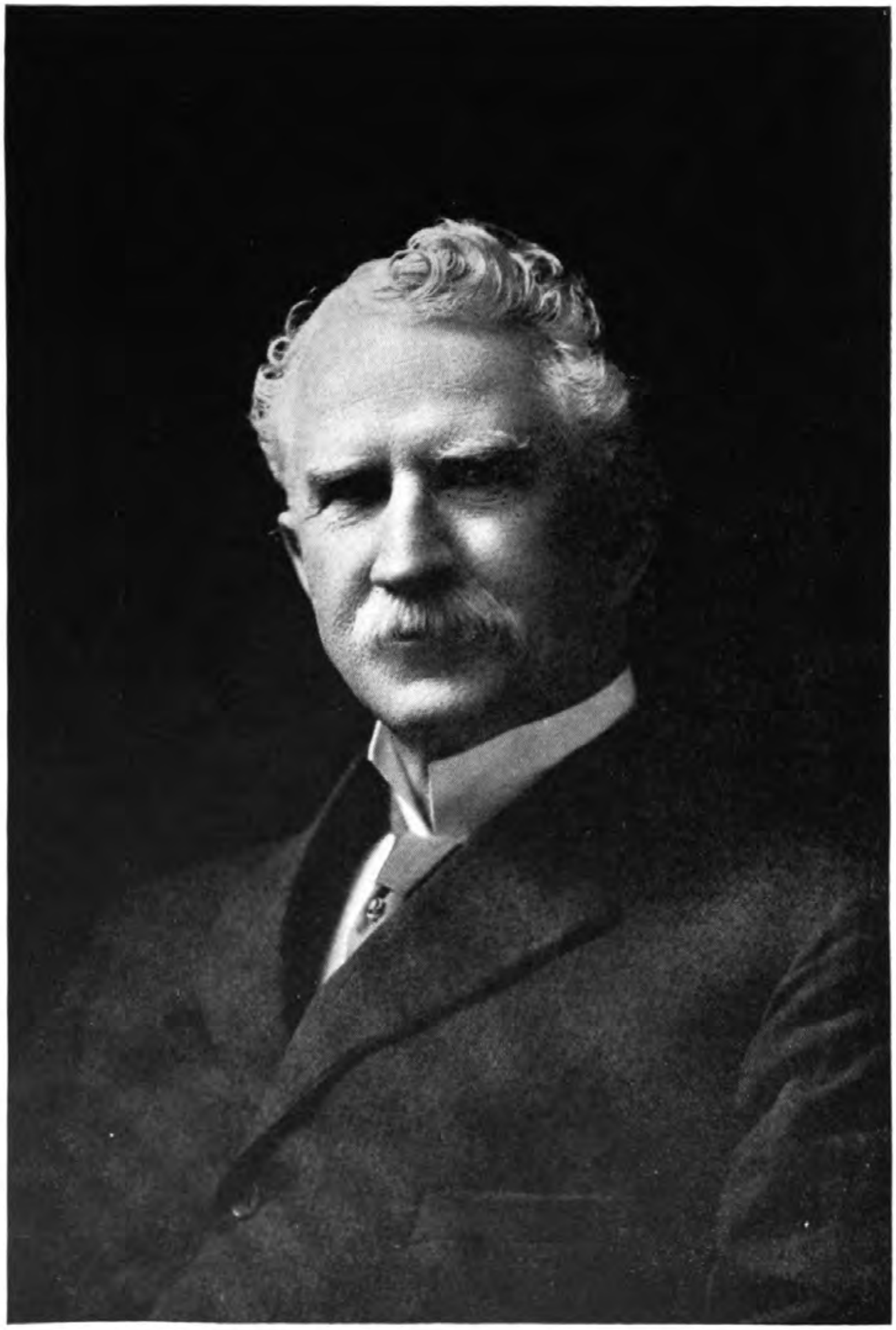
In 1918 he was appointed Dairy and Food Commissioner by Governor Marcus H. Holcomb to fill out the unexpired term caused by the death of Mr. Frank H. Stadtmueller and was successively appointed by Governor Everett J. Lake and Governor John Trumbull. He had just received his reappointment from Governor Trumbull for another term beginning May 1, 1930, but died on April 29. Mr. Holt proved that he was well qualified for his position as Dairy and Food Commissioner, by reason of his own broad and practical experience, and was thus able to wisely direct operations along those lines and advise concerning those methods which make for steady advancement in connection with the dairy and food industries of our state and nation.

Mr. Holt was the first president and manager of the Connecticut Milk Producers Association. I quote the following from one of the Association's publications: "Much of the credit for the survival of the Association during those early days is due to the indomitable will and courage of Mr. Holt. He remained until his death an active and loyal member of the Association. When the Connecticut Association of Dairy and Milk Inspectors was organized in 1926, Mr. Holt was made the first president of the organization. Five years ago, at a meeting in Denver, Colorado, he was elected president of the American Association of Dairy, Food and Drug Officials. Governor Trumbull, in 1928, appointed Mr. Holt Connecticut's delegate to the World's Dairy Congress, which was held in London, giving him an opportunity to visit his native land as an official representative of his adopted country."

I quote from another editorial of the Association: "He came to our shores a young man, a stranger; but of the type of which England boasts—a gentleman, a man with a Britisher's sense of true sportsmanship and fair play and with the characteristic tenaciousness of the bull-dog when he believed that he was right. For thirteen years after coming to America he travelled about trying life in widely separated places in our country and then decided to make New England his home. Connecticut is glad that he did. The memory of his life and accomplishments should always be an inspiration to Connecticut farmers.

Those with whom he came in contact did not always agree with him but they never justly questioned his integrity or purpose. We shall miss him."

The following extract from a tribute from the Connecticut Agricultural Experiment Station of New Haven expresses the feeling of many of his fellow workers: "Good sense, sound judgment, hard work and a kindly disposition, characterized the man and his administration. There can be no better testimonial to his worth than that he grew constantly in the esteem and confidence of his fellow officials and others with whom he came in contact in his public service, and that in the more private relationships of his home and his home community, he was held in respect and affection."



Dr. Charles J. C. O. Hastings

MEMOIR—DR. CHARLES J. C. O. HASTINGS

Dr. Charles J. C. O. Hastings, former medical officer of health of the city of Toronto, Canada, and an honorary member of the Association, died on January 17 after an illness of several weeks.

Dr. Hastings was born near Toronto in August, 1858, and the first fifteen years of his life were spent on the farm of his father, John Hastings, a native of northern Ireland. On completion of his studies at Markham High School and Hamilton Collegiate Institute, he attended the Ontario College of Pharmacy and after graduating established himself in business as a druggist. While engaged in this occupation he studied medicine at the University of Toronto and after receiving the degree of M. D. continued his medical training abroad. On his return, he began his career as a physician and carried on a private practice for twenty-four years.

In 1910, Dr. Hastings was appointed medical officer of health of Toronto and his work in this position won him wide recognition. Under his direction the city health department developed steadily from a modest beginning to its present proportions and now includes more than ten divisions engaged in the administration of public health services. His slogan on taking office is said to have been, "Pure milk, no slums, and medical inspection in the schools," and one of the most important of his achievements was the improvement in the sanitary quality of the local milk supply. He drew up regulations requiring inspecting herds and dairies, sanitary handling of milk, sterilization of utensils, and pasteurization, and despite opposition from many sources succeeded in putting them into effect. He also organized the first milk commission in Canada over twenty years ago and held the office of president until a short time before his death.

In commenting upon his work as medical officer of health a colleague said, "While he originated, he was ready to adopt anything that had proved its worth. He was . . . always pressing on . . . trying to perfect the great organization which he had built up."

Mr. Bowman offered and moved the adoption of the following resolution expressing appreciation to certain officials and others for courtesies extended during the meeting:

Inasmuch as the International Association of Dairy and Milk Inspectors is closing a most successful and instructive annual convention in the City of Cleveland, and

Whereas the success of this meeting was so materially contributed to by outside agencies,

Therefore, be it resolved

1 That the Association expresses its thanks to the officials of the State of Ohio and the City of Cleveland for their hospitality.

2 That the Association expresses its thanks to the following men who are not members of our Association but who have contributed valuable papers to the program:

Dr. Edmund K. Kline
Dr. H. E. Hasseltine
Mr. C. I. Cohee
Mr. C. K. Johns
Mr. Robert W. Balderston

3 That the Association expresses to International Association of Milk Dealers its appreciation of the courtesies and good wishes extended to this Association and its members.

4 That the Association conveys to the International Association of Ice Cream Manufacturers its congratulations upon the successful and instructive union meeting and that it is trusted that such joint meetings may be frequent.

5 That the Association conveys to the Statler Hotel management and staff its appreciation of the many courtesies extended and

Be it further resolved that the secretary of the Association spread this resolution upon the minutes and transmit a copy to each of the individuals and organizations concerned.

Resolution seconded and carried.

Mr. Kelly presented the report of the Committee on Revision of the Constitution and By-laws. At the suggestion of Mr. Irwin it was moved that the Secretary-Treasurer cause copies of the report to be mimeographed and sent to the members of the Association with the request that they send their comments and suggestions to Mr. Kelly and that the committee then prepare a proposed amendment to be submitted by the Secretary-Treasurer to the members for vote. Motion seconded and carried.

Mr. Palmer discussed the McNary Bill, U. S. Senate No. 4133, with special reference to the question as to what action, if any, should be taken by the Association on this bill. After general discussion it was decided that action by the Association was inadvisable.

Mr. Warner having been designated by the President to act temporarily as auditor in the place of Thomas Holt, deceased, Dr. Holford reported for the auditors that they had examined the books and records of the Secretary-Treasurer, found them correct and in good condition. It was moved that the report of the auditors be accepted and recorded. Motion seconded and carried.

The meeting then proceeded to the election of officers. Upon call for nominations to the office of President, Mr. Strauch moved the nomination of Dr. Richmond. Motion seconded. Mr. Bushong moved that the nominations be closed and that the Secretary be instructed to cast one ballot for Dr. Richmond as President. Motion seconded and carried. The Secretary-Treasurer reported that the ballot had been cast and that Dr. Richmond was elected. Mr. Estes moved that the Secretary-Treasurer be requested to communicate with Dr. Hastings, former health commissioner of Toronto, advising him of the election of

Dr. Richmond and extending to him the felicitations of the Association. Motion seconded and carried.

On call for nominations for Vice-President, Mr. Russell Palmer moved the nomination of Mr. Wm. B. Palmer for First Vice-President. Mr. Warner moved that the nominations be closed and that the Secretary be instructed to cast one ballot for Mr. Wm. B. Palmer for Vice-President. Motion seconded and carried. The Secretary stated that the ballot had been cast and that Mr. Palmer was elected.

On call for nominations for Second Vice-President, Mr. Shoults moved the nomination of Dr. Horatio N. Parker. Dr. Fisher moved that the nominations be closed and that the Secretary be instructed to cast one ballot for Dr. Parker. Motion seconded and carried. The Secretary reported that the ballot had been cast and that Dr. Parker was elected.

On call for nominations for Third Vice-President, Mr. Tiedeman moved the nomination of Paul F. Krueger. Seconded and carried. Mr. Shoults moved that the nominations be closed and that the Secretary be instructed to cast one ballot for Mr. Krueger. Motion seconded and carried. The Secretary reported that the ballot had been cast and that Mr. Krueger was elected.

On call for nominations for the office of Secretary-Treasurer, Dr. Grim moved the nomination of Dr. Brooks. Motion seconded and carried. Dr. Harding moved that the nominations be closed and the President be instructed to cast one ballot for Dr. Brooks. Motion seconded and carried. The President reported that the ballot had been cast and that Dr. Brooks was elected.

Mr. Kelly moved that the Association record its appreciation of the services rendered by the officers during the year. Motion seconded and carried.

On call for nominations for the offices of auditor, Mr. Estes moved the nomination of Dr. Holford and Mr. Warner. Motion seconded and carried. Dr. Harding moved that the nominations be closed and the Secretary be instructed to cast one vote for Dr. Holford and one for Mr. Warner. Motion seconded and carried. The Secretary reported that the votes had been cast and that Dr. Holford and Mr. Warner were elected.

Under the head of new business the Secretary read a list of places from which communications had been received with reference to the next annual meeting of the Association. Mr. Kelly moved that the selection of a meeting place for the next annual meeting be left to the Executive Committee with power to act. Motion seconded and carried.

There being no further business the meeting was adjourned.

REPORT OF COMMITTEE ON REVISION OF CONSTITUTION AND BY-LAWS

ERNEST KELLY, *Chairman*

This committee was appointed after last year's meeting to study the question of changes in the constitution and by-laws of the Association. For this purpose your committee has considered several proposals, which may be divided into four general groups, each of which has certain subdivisions. It is not deemed to be the function of this committee to advocate definite changes but to present to the Association a summary of these various proposals in a frank and concise manner so that the Association may take whatever definite action it sees fit. If this summary suggests definite action along one or more lines, your committee feels that the matter should be submitted to the entire membership of the Association as a whole for expression of opinion and the formulation of definite recommendations by a subsequent committee which will be based upon the decision of the entire Association. We feel that it would be unwise and improper for this committee to present any such definite recommendations, as these would be based only upon the opinions of the seven committee members. The propositions brought up are, briefly, as follows:

1 The constitution and by-laws should be left as they are at the present time.

2 An associate membership should be created, to which should be admitted all men connected with or interested in the dairy industry.

3 As at present, 60 days' notice of amendments must be sent out by the Secretary to all members, but amendments may be made by a two-thirds vote of those attending the meeting at which the question comes up.

4 A board of directors should be appointed to govern the Association, this board to consist of the ex-presidents of the Association.

The reaction of the committee members will be indicated and the bearing of each question on the present situation will be pointed out.

Proposition 1 is self-explanatory and would result in no change in the present method of membership or business routine of the Association. Two members of the committee favor this proposition; one suggests that it should be submitted to the membership; one does not feel strongly either way on the question but is inclined to include associate members; while three members believe that the constitution and by-laws should be changed.

Proposition 2, which involves an associate membership, has the approval of four members of the committee, the disapproval of two; and one member suggests that the question be submitted to the Association. If this proposition is put into effect there are several phases which should be considered. The first is whether or not associate members should pay the same dues as active members. Your committee sees no reason why such should not be the case, as they will have all privileges excepting voting, including the receipt of the annual report. The second problem is the disposal of present members who are now engaged in commercial work. Two of the committee members definitely recommend that such persons should be removed from active membership to associate membership. The balance of the committee is non-committal on this point or favors retention as active members of all those at present on the roll of the Association. One member of the committee expresses the opinion that where an official inspector is deriving any of his income through employment by the dairy industry, he should be rated as an associate member.

Another point in connection with this proposition is whether or not associate members, if such a class is formed, should have the privilege of the floor and whether a time limit should be set for their participation. If a class of associate members is formed, it is the general opinion of the committee that they should be given the privilege of the floor, as has been the case in connection with non-members in the past. Your committee has, however, a very definite opinion that a time limit for discussion should be set and rigidly enforced not only for possible associate members but for active members as well. Our programs are somewhat long-drawn-out and, while interesting, are often delayed unnecessarily by persons who speak repeatedly upon a given question and at some length. This matter may not be one for constitutional revision but may possibly be handled through executive authority vested in the presiding officer.

Proposition 3 involves the suggestion that a two-thirds vote of the attending members may be used to carry proposed amendments rather than a two-thirds vote of the entire membership as now required. Four members of the committee definitely express themselves as opposed to this amendment; two approve, one of them with the provision that non-attending members may vote by mail and that these votes be counted with votes taken at the annual meeting; one of the members suggests that this question be submitted to meeting for expression of opinion.

Proposition 4, creating a board of directors composed of ex-presidents, has the approval of one member (who proposed it) and the disapproval of 5 members, with no answer given by the seventh member. It is difficult to see just how such a board could operate in view of the present constitution and by-laws, which provide for an executive committee composed of the President, three Vice-Presidents, and the Secretary-Treasurer. If such a proposition were adopted, it would be necessary to abolish the present system of having an executive committee so constituted.

Among other propositions brought up is that there should be a nominating committee but the report of this committee should not preclude nominations from the floor. It is difficult to see where this suggestion would result in any change from conditions now existing, which call for nominations from the floor.

Another suggestion is that the Association should adhere to a policy of not adopting any specific standards. The reason advanced for this suggestion is that scientific knowledege, control procedure, and the industry itself are in a stage of flux and that it would be unwise to adopt definite standards which might prove to be embarrassing soon after adoption. This member suggests that the Association confine itself purely to the gathering and disseminating of information which will be helpful to the members and guests of the Association.

These, then, are the basic propositions that have been suggested by one or more members, and the committee wishes to submit this entire question to the Association at large with only a few unbiased remarks as to the reasons for some of the suggestions.

The creation of an associate membership has probably been actuated by a feeling that such a membership would increase the annual income of the Association, primarily, and that, secondarily, it would increase the attendance at the annual meetings.

The proposition that amendments may be made by a two-thirds vote of those attending the meeting has apparently been based on the assumption that amendments to the constitution could thus be more readily and easily made. This resolves itself purely into the question of whether or not the Association wishes a constitution and by-laws which can be quickly and fairly frequently amended by those members who happen to be at the annual meeting. There is a possibility, which is not a remote one, that at some annual meeting there will be a preponderance of members present who will favor some changes in the constitution that would not be acceptable to the majority of the entire membership.

As previously stated, your committee wishes to make no definite suggestions along these lines but to present to the Association a study of the proposals made. The committee feels very strongly that in case any or all of these propositions, or any other matters connected with the revision of the constitution and by-laws, should be submitted to the membership at large, they should be submitted as definite propositions acompanied simply by unbiased explanatory notes.

Program

WEDNESDAY, OCTOBER 22

8.00 P.M.

Address of Welcome
CHARLES A. NEAL, M. D.
Director of Health, State Department of Health, Columbus, Ohio

Address of Welcome
H. J. KNAPP
Health Commissioner, Department of Public Health and Welfare, Cleveland, Ohio

Response to Address of Welcome
A. R. B. RICHMOND, V. M. D.
First Vice-President, International Association of Dairy and Milk Inspectors, Toronto, Canada

Presidential Address
RALPH E. IRWIN
President, International Association of Dairy and Milk Inspectors, Harrisburg, Pa.

Report of Committee on Communicable Diseases Affecting Man—Their Relation to Public Milk Supplies
HORATIO N. PARKER, PH. D., *Chairman*
Jacksonville, Florida

The Colon Group of Bacteria in Milk
EDMUND K. KLINE, DR. P. H.
Director of Laboratory, Cattaraugus County Department of Health, Olean, N. Y.

Undulant Fever
H. E. HASSELTINE, M. D.
Surgeon, United States Public Health Service, Washington, D. C.

THURSDAY, OCTOBER 23

9.00 A.M.

Report of Committee on Milk Plant Practice
H. A. HARDING, PH. D., *Chairman*
Chief, Dairy Research Bureau, The Mathews Company, Detroit, Michigan

Report of Committee on Dairy and Milk Plant Equipment
GEORGE W. PUTNAM, *Chairman*
Research Engineer, The Creamery Package Manufacturing Co., Chicago, Ill.

Activities of the International Association of Milk Dealers of Interest to the Dairy and Milk Inspector
WILLIAM H. MARCUSSEN
Vice-President, Borden's Farm Products Co., Inc., New York City

Milk Cans and Milk Can Washing Equipment
WILLIAM B. PALMER
Executive Officer, Milk Inspection Association of the Oranges, Orange, N. J.

Some Bacteriological and Temperature Studies in Milk Plants
C. SIDNEY LEETE
Bureau of Milk Sanitation, State Department of Health, Albany, N. Y.

Observations on Effect of Thermophilic Bacteria in Pasteurized Milk
HARRY A. HARDING, PH. D.

and

ARCHIBALD R. WARD, B. S. A., D. V. M.
Dairy Research Bureau, The Mathews Company, Detroit, Michigan

A Survey of the New York State Milk and Cream Supply
W. D. TIEDEMAN
Chief, Bureau of Milk Sanitation, State Department of Health, Albany, N. Y.

THURSDAY, OCTOBER 23

2.00 P.M.

Joint Session with the Production and Laboratory Section of the International Association of Ice Cream Manufacturers
Hollender Hotel

A. R. B. RICHMOND, V. M. D., *Chairman*
First Vice-President, International Association of Dairy and Milk Inspectors

Cooperation Between the Ice Cream Manufacturers and the Official Inspectors
FRED RASMUSSEN
Executive Secretary, International Association of Ice Cream Manufacturers, Harrisburg, Pa.

Discussion Introduced by
R. S. CRAIG
Director, Bureau of Chemistry and Foods, City Health Department, Baltimore, Md.

The "What and How" of Ice Cream and Milk Plant Inspection
H. F. JUDKINS
Chairman, Research Committee, International Association of Ice Cream Manufacturers, Springfield, Mass.

Discussion Introduced by
ERNEST KELLY
Chief, Division of Market Milk Investigations, United States Department of Agriculture, Washington, D. C.

Judging the Quality of Milk and Cream by the Microscopic Count of Bacteria for the Milk Distributor and the Ice Cream Manufacturer
ROBERT S. BREED, PH. D.
Chief in Research, Division of Bacteriology, New York State Agricultural Experiment Station, Geneva, N. Y.

Discussion Introduced by
J. J. REGAN, V. M. D.
Director of Quality Control, Dairymen's League Co-Operative Association, Inc., New York City

FRIDAY, OCTOBER 24

9.00 A.M.

Report of Committee on the Sanitary Control of Ice Cream
RALPH E. IRWIN, *Chairman*
Chief, Bureau of Milk Control, State Department of Health, Harrisburg, Pa.

Report of Committee on Public Relations
GEORGE W. GRIM, V. M. D., *Chairman*
Milk Control Officer, Milk Control District No. 1, Ardmore, Pa.

Report of Committee on Dairy Farm Methods
THOMAS J. STRAUCH, *Chairman*
Chief Dairy Inspector, Bureau of Health, Richmond, Va.

Higher Milk Standards
ROY F. LESLIE, D. V. M.
Chief Meat and Dairy Inspector, Department of Public Health and Welfare, Cleveland, Ohio

Grade A Milk from Farm to Table
A. D. BURKE, B. S., M. S.
Head of Dairy Department, Alabama Polytechnic Institute, Auburn, Ala.

and

IRVEN M. COX
Assistant, Bureau of Dairy Inspection, Jefferson County Board of Health, Birmingham, Ala.

Farm Sterilization of Dairy Utensils with Hypochlorite
C. K. JOHNS, M. Sc.
Assistant Agricultural Bacteriologist, Dominion Experimental Farm, Ottawa, Canada

The Status of Flavors in Milk
C. L. ROADHOUSE
Head, Division of Dairy Industry, University of California, Davis, Cal.

Cooperation in Quality Improvement of Milk Supplies
C. I. COHEE
Secretary, Philadelphia Inter-State Dairy Council, Philadelphia, Pa.

FRIDAY, OCTOBER 24

2.00 P.M.

Report of Committee on Milk Ordinances
William B. Palmer, *Chairman*
Executive Officer, Milk Inspection Association of the Oranges, Orange, N. J.

Some Present Opportunities for the Dairy Industry
Robert W. Balderston
Manager of the National Dairy Council, Chicago, Ill.

A Modified Methylene Blue Reduction Test
C. K. Johns, M. Sc.
Assistant Agricultural Bacteriologist, Dominion Experimental Farm, Ottawa, Canada

Time and Temperature Test of Keeping Quality of Milk
H. G. Harding, Ph. D.
Akron Pure Milk Company, Akron, Ohio

Brief Notes on Laboratory Incubator Temperatures
Friend Lee Mickle, A.B., M.S.
Director of Laboratories, State Department of Health, Hartford, Conn.

FRIDAY, OCTOBER 24

3.30 P.M.

Business Session

Memoir, "Thomas Holt"
W. J. Warner
Commissioner, Dairy and Food Commission, State of Connecticut, Hartford, Conn.

Report of Committee on Resolutions
H. E. Bowman, *Chairman*
Inspector of Milk, Somerville, Mass.

Report of Committee on Revision of Constitution and By-laws
Ernest Kelly, *Chairman*
Chief, Division of Market Milk Investigations, United States Department of Agriculture

Report of Auditors
Election of Officers for 1930-1931

Wednesday, October 22
8.00 P.M.

ADDRESS OF WELCOME

CHARLES A. NEAL, M.D.

Director of Health of Ohio

It is with great pleasure that the Director of Health welcomes the International Association of Dairy and Milk Inspectors to Ohio. While it would seem that this pleasant duty should have been allotted to the Director of Agriculture because our existing statutes place all of the official state inspection of dairy and food products within his jurisdiction, we of the Department of Health are glad of this opportunity so that we may express to you our appreciation of the great assistance the members of your organization have given in the past, enabling us to formulate a well-rounded health program.

We workers in public health consider that nowhere have we more valiant and dependable allies in the fight against communicable disease, malnutrition, and other defects which take the toll of our citizenship, than in the men who are engaged in dairy and milk inspection.

The great advantages which the public gains through your work are too well known to all of you for me to dwell upon them here, and the assistance which you render to the public health organizations, both state and local, in the communities which you represent, are invaluable.

It is fitting and proper that an organization such as yours, international in scope, should meet to consider the activities in which you are engaged. A few decades ago the milk problems of Pittsburgh were of no consequence to Indianapolis, and those of Indianapolis of no concern to St. Louis, Detroit or Memphis. Today, with our rapid means of transportation and the opening of avenues of travel, especially by automobiles, the health conditions of one city are of vital concern to cities five hundred or a thousand miles away, and it is well that you should meet and discuss the methods used in the various localities, because it is possible now for a man to travel many miles from sunup to sundown, and he can, and rightfully does, expect that milk, the most common of our human foods, should be safe for his use when he arrives at his destination.

The establishments of uniform systems and of uniformity in the evaluation of milk and its by-products are quite essential in order that we may intelligently compare the findings of one city with those of another locality heretofore considered miles and miles away.

The education of the public in the consumption of milk and its products has been well demonstrated during our present economic depression, and while practically every other food has depreciated the records show but a slight decrease in the consumption of milk. Therefore, this mutual understanding and mutual protection is essential for the citizens of our entire American continent.

We in public health appreciate your efforts in the past, and I wish in their behalf to acknowledge to you our gratefulness for your cooperation in the protection of the public health, and especially in the prevention of such epidemics as are now recognized as a possibility of spread through milk supplies.

I sincerely trust that your convention will be a most profitable and pleasant one, and that sometime in the immediate future Ohio will again have the privilege of entertaining you.

RESPONSE TO ADDRESS OF WELCOME

Dr. A. R. B. Richmond, *First Vice-President*

Toronto, Ontario

I am deeply appreciative of the great compliment which has been paid me, in having my name associated with the response to the addresses of welcome so cordially extended to us by the gentlemen to whom we have just had the pleasure of listening.

As an Association, this is our first visit to Cleveland.

From my own impressions, I think it is—with perhaps the exception of Edinburgh, Scotland, my native city, and Toronto, the city of my adoption and from which I have just come—the finest city I have ever visited. For not including the city of Ottawa in this statement, I fully expect to be severely taken to task after the session.

Cleveland ranks very high among the convention cities of this continent, and the welcome and hospitality extended by its citizens to all visitors, is proverbial.

A great city of beautiful homes, with a public auditorium second to none on this continent; with wonderfully laid out streets and magnificent buildings so conveniently located, and with its highly developed public services, the great foresight and enterprise of its past and present administrators are reflected.

The accomplishments of the Department of Public Health and Welfare of Cleveland and of the State Department of Health need not be elaborated upon at this time. They are too well known to us all.

The control of the milk supply of the city is on a very high standard, which we wish were copied by many other municipalities, and great praise and congratulations are due the Health Commissioner and his efficient staff for their accomplishments in having awakened public opinion to the necessity for the legislation which they must have obtained in order that their ideas might be placed in practical and legal operation.

In the work of milk control, I am informed that great assistance has been had from "The Northern Ohio Better Milk Association," an organization which aims to operate for the benefit of the producer, distributor, consumer and all others interested in the dairy industry. The city of Cleveland is fortunate in having had the co-operation and assistance of such an organization. In this connection it is interesting to note that our friend, Dr. Roy F. Leslie, of the Cleveland Department of Public Health and Welfare, was first President of this Association when organized in 1924.

I am further informed that through the splendid cooperation of certain committees which are almost constantly working upon some of the many problems of dairy products control, the State of Ohio may in a short time establish a dairy building at the State University.

This is encouraging news and we sincerely hope present contemplation may become a realization.

As you are aware, Sirs, we are met here in convention for the consideration of matters pertaining to our work as officials of milk and milk products control.

We are here to gain at first hand, knowledge of what scientific and practical advancements have been made since our last time of meeting, and to hear what experiences others may have had in the discharge of their duties.

To hear what problems have been encountered and how they have been dealt with, and generally to engage in free and sociable discussion of a very wide subject.

From a perusal of the program of the meetings, it will be seen that papers and reports on subjects of vital interest to all health authorities are to be presented, and we are looking forward to one of the most enjoyable and instructive conferences we have ever held.

Incidentally I might mention that these papers will appear in the Annual Report of the Association which is broadcast throughout this continent, and even as far as the British Isles and Europe.

With so many items, including the address of our President, to be presented to us this evening, it would be unpardonable of me to take up any further time, than to say how happy we are to be here, how happy to have you gentlemen with us, and to extend to you on behalf of the International Association of Dairy and Milk Inspectors our most sincere thanks, for your kindly references to us, and the extremely hearty welcome you have extended.

We trust that you and members of your respective staffs may find it convenient to be with us at many of our meetings, that we may all meet again in the not too distant future, and that you may be spared for a very long time to carry on and further develop the splendid works in which you are engaged.

PRESIDENTIAL ADDRESS

Ralph E. Irwin, *President*

The Nineteenth Annual Convention of the International Association of Dairy and Milk Inspectors has been welcomed to the State of Ohio and to the city of Cleveland. Your greeting has been accepted by our First Vice President, Dr. A. R. B. Richmond. We also recognize the efforts in our behalf of Dr. Roy F. Leslie, a member of our organization and Chief of the Bureau of Foods and Dairy Inspection of our Convention city. It is now our privilege to take advantage of what you have offered so graciously. Certainly a more appropriate and convenient time and place could not be selected. Here we may not only enjoy our own Convention but each member may attend the Dairy Exposition and study every type of equipment in which he is interested. The International Association of Milk Dealers now in Convention in this hotel is sending a representative to voice its interest in our Association. The International Association of Ice Cream Manufacturers is holding its Annual Convention in a neighboring hotel. We are to meet in joint session with the Laboratory and Production Section of that Association.

Here in our own Convention we are gathered together as an International Association of Milk Control Officials. Such a gathering is an eloquent testimony of interdependence on one another. There may have been a time when it made little difference, if any, to a Control Official in Ohio what kind of milk was served in Ontario or in Florida. Not long ago travel conditions were such that there was remote possibility of a person in Chicago visiting in Richmond, Virginia. This is not true today. A city may have and enforce a stringent milk ordinance without protecting the milk supply of its own people. No longer do we have city walls or city gates. We live where—who knows? Since we do not recognize city or state laws in our daily travel what may we as officials of cities and states do to cooperate in furnishing uniform protection. Shall we depend for protection on inspection centralized in our National Government or shall we depend upon our National Government to give principles and information upon which efficient control may be established and maintained?

The varied nature of our daily task develops an interest in babies, little children, school children, adults, industrial groups and victims of disease such as malnutrition, tuberculosis, etc. The sole solution of the problem of health and happiness of these groups does not rest alone with this organization but I am proud to say we recognize our responsibility and are making a conscientious effort to play the influential part that comes to an Association of this character.

Within our own organization we have problems to solve. The creation and maintenance of an International Association like ours calls for definite things. First of all we must be true to our name "International." During the few months it was my privilege to serve you as Acting Secretary I was in correspondence with representatives of many nations. These neighbors of ours were seeking the assistance of an Association which, if true to name, should answer their questions. Are we internationally fulfilling our duty as a vital factor in the development of public health? Do those in attendance, the papers presented, the committee reports accepted and the discussions answer in the affirmative?

We are an International *Association*. We are representatives from many nations working together for a common purpose. Our constitution states that our purpose is—"to develop uniform and efficient inspection of dairy farms, milk establishments, milk and milk products and to place the inspection of the same in the hands of men who have a thorough knowledge of dairy work." Our President in 1928, Professor Ira V. Hiscock and our President in 1929, Mr. Howard R. Estes, noted the progress of our Association by comparing conditions in 1928 and 1929 with those when our Association was formed. Worthy progress was reported in the improvement of dairy cattle, cleanliness of milk and on the dairy farm, transportation of milk, efficiency in pasteurization, value of milk in the diet and the influence of economics in milk consumption.

The founders of our Association were far-sighted in preparing our constitution and by-laws. The terms used in setting forth the purpose of our Association are adequate today. Likewise our founders employed due precaution in selecting members. Nineteen years ago practically all Inspectors were government employees. Today the number of official Inspectors is but a fraction of those engaged by the producer and distributor usually termed "the industry." The purpose and largely the results of the official and the industrial inspector are the same. The destiny of both are dependent upon the quality of milk and milk products. Is it possible for a group of producers to employ a worthwhile inspector? Can we believe that a distributor or a group of distributors may employ an inspector who will improve the quality and safety of a milk supply? Should a government official have dealings with such inspectors? What is the future of these two groups? The reports of two committees will point the way, namely, the Committee on the Revision of the Constitution and By-laws and the Committee on Public Relations. These reports may be depended upon to encourage progress, stimulate growth and promote efficiency.

Our founders desired "to develop uniform and efficient inspection . . . . in the hands of men who have a thorough knowledge of dairy work." How are we to "develop" and "have a thorough knowledge"? If this means inspectors in general throughout our international territory, has not the time arrived when we should enlarge our membership, make our publications world-wide in distribution and become molders of a sound public opinion regarding that portion of public health to which we are devoted? Because the task is a difficult one shall we excuse ourselves for not attempting it?

Our Association should afford a common fund of knowledge to which all Nations may contribute and from which each may freely draw. Thus we may feel the thrill of discoveries that safeguard life and alleviate suffering. This promotes comradeship, hastens progress and allows us to fulfill the purpose of our organization.

We are writing a history of which we may be proud. Such men—comrades, friends as Jordan, Weld and Holt—cause us to pause in our deliberations that what we do now may be in accord with the ideals and attainments of our founders.

There are problems before us demanding immediate attention. For some of these a definite answer may be expected. Others are so dependent upon local conditions that only advice may be given. That rare quality or condition of mind or soul called "Common sense" must be depended upon now as in the past. I will only enumerate some of the problems.

Throughout the existence of our Association the problem of cooling milk on the dairy farm has been before us. Some progress has been made. This is a vexing problem, particularly in territory where little or no natural ice is available. A survey of over 60,000 milk producers in Pennsylvania and vicinity shows that the average daily production of milk is about 100 pounds. How much should we expect the producer of 100 pounds of milk to spend for cooling? The producer with 50° F. flowing water close at hand may be expected to provide proper facilities. What shall we require of the producer who has a dug well yielding water at 60° F. during the summer season when cooling is of most importance. Is the price of 100 pounds of milk to be such that ice may be purchased or artificial refrigeration may be provided? Are our cities to select the producer of not less than 500 pounds of milk as a source of their milk supply and allow the small producer to sell to a milk product plant or in a nearby village? Will morning and evening deliveries to cooling stations prove successful?

Does the age of milk affect its value as a food? If so, when and how?

Has the inspector sufficient measuring sticks at hand to determine the quality of milk without farm inspection?

Should the producer of milk for pasteurization be held responsible for the condition of the milk delivered from the dairy farm?

Milk plant equipment new in design is appearing rapidly. Should we, as control officials, insist on efficiency reports by representatives of our National Government before approving the installation or use of such equipment? Should we accept reports of efficiency from the manufacturer as sufficient evidence? Those of us visiting the Dairy Exposition now in this city find many pieces of equipment that were not shown at the Exposition held in Toronto last year. Who shall determine the efficiency of this new equipment?

Many are interested in what is termed "flash pasteurization of milk." What is flash pasteurization? We find equipment under such a name heating milk by electric current, steam, hot water, hot air and by spiritually endowed aluminum plates. So called flash equipment usually has a continuous flow and a holding period. Doubtless some definitions are needed.

These questions are placed before you at the beginning of our session for your consideration. We have always been alert to meet new conditions as they arise.

REPORT OF COMMITTEE ON COMMUNICABLE DISEASES AFFECTING MAN—THEIR RELATION TO PUBLIC MILK SUPPLIES

HORATIO NEWTON PARKER, *Chairman*

In presenting its report on communicable diseases that may be transmitted by milk, and their control, the Committee once more emphasizes the fact that milk is the best food we have and that it should be used freely. Discussion of the problem is necessary and should deter no one from using milk because while the total amount of sickness and death attributable to milk-borne disease is impressive, when considered to the total amount of milk used it is not alarming. Rather than begetting fear the facts brought out should make one realize that the greatest care is needed to produce and market safe milk, and should convince the consumer that he himself can be a factor in reducing the number of epidemics attributable to milk, by using only that milk which experience has shown to be safest, namely pasteurized milk.

The milk-borne outbreaks or epidemics of communicable disease in the United States, as reported by state and city health officers are published yearly by the U. S. Public Health Service. A summarized form of the report for 1929 is given in Table I. From Table I, it appears that in 4 epidemics it was not definitely known whether pasteurized or raw milk caused the epidemic, that in 2 epidemics pasteurized milk was responsible for the outbreak and in 46 of them raw milk was. In other words in the 48 epidemics where it is certain what milk was responsible, pasteurized milk caused 4% and raw milk 96%. Those investigating the epidemics due to pasteurized milk held in one case that the milk was inefficiently pasteurized and in the other that it was properly pasteurized but was put in bottles which were not properly sterilized.

Table I shows that typhoid fever caused nearly three times as many epidemics as did either scarlet fever or septic sore throat but that both of these diseases were responsible for more than double the number of cases that typhoid fever was, which indicates either less massive infection of the milk, or that the typhoid infected routes were small and not very many consumers were exposed to infection.

The report of the Public Health Service gives the population of 47 of the fifty cities where epidemics occurred and it appears that 19 or 40% had a population less than 10,000, thirty-four or 72% of less than 25,000, and forty-three or 91% of less than 50,000. That is, practically all of these epidemics occurred in small towns, presumably using mostly raw milk and not served by efficient, well equipped health departments. In the four cities, each with population of over 100,000, the epidemics were all due to raw milk. Serious epidemics due to infected milk do occur in large cities, as the Montreal typhoid epidemic of 1927 shows, but it seems that cities with efficient health departments, backed by adequate appropriations, and free from political interference, by bringing about the general adoption of pasteurization and by enforcing other protective measures secure for their citizens something like assured safety of their milk.

Besides the diseases listed in Table I, the report of the Public Health Service enumerates 116 cases of undulant fever as occurring in nine states.

It is to be remembered that for obvious reasons such reports as this of the Public Health Service cannot list the cases of tuberculosis that come from the use of raw milk infected with bovine tuberculosis. That such cases occur, particularly among children and adolescents, is well known. Also there are less well-defined ailments such as diarrhœas and those attended with vomiting that may be contracted by milk consumers from milk infected with microbes less definitely identified than those of the common major communicable diseases. Such infections may be derived from sick persons handling the milk, or from udder infections, or in the case of infants and young children from the consumption of dirty milk of high bacterial content. The Illinois State Department of Health attributes the development and extension of the pasteurization of milk as being a major factor in the marked decline of diarrhœa and enteritis among children of the state.

From the foregoing presentation of facts it may be concluded that while great progress has been made in the control of milk-borne infections, more has been accomplished in the larger cities than the smaller ones, principally through the activities of efficient health departments that are vigilant to use pasteurization and other control measures to protect their milk supplies. The greatest hope for further reduction of milk-borne disease lies in persuading the smaller cities to build up their health services and avail themselves of the protection pasteurization offers.

The American Child Health Association from replies to a questionnaire sent each provincial health authority in Canada lists, as occurring in 1929, four epidemics totaling 37 cases with 3 deaths.

Dr. S. J. Crumbine has compiled a list of milk-borne epidemics, as reported by the Provincial Health Authorities, that occurred in Canada in the 6 years from 1924 to 1929. This list is given in Table II.

Dr. G. H. Bigelow and Dr. F. C. Forsbeck have made a most interesting report on Milk-Borne Disease in Massachusetts that is worthy of careful study. Much might be quoted from their article but these two statements must suffice. "The rate of decrease of total cases spread by milk is greater than the decrease of outbreaks so spread. This suggests that fewer persons are exposed to each outbreak, and that therefore they tend to occur in a higher proportion of instances on smaller milk routes than formerly. This bears out the evidence that the smaller dealers less frequently protect their milk by pasteurization." "Since 1919 there has been an encouragingly marked increase in the proportion of milk pasteurized, in general being higher in the larger communities. On this more than any other single factor, must we depend for the eventual obliteration of milk-borne disease."

TABLE I

DISEASE	Number of Epidemics	No. of Cases	No. of Deaths	Case at Dairy	Carrier at Dairy	Milk: Pasteurized	Milk: Raw	Milk: Raw and Pasteurized	Milk: Not Stated
Typhoid	28	429	36	9	13	2	24	1	1
Paratyphoid B.	1	36	1		1		1		
Dysentery	1	8	0				1		
Food Poisoning	1	24	0		1		1		
Scarlet Fever	11	1052	2				9	1	1
Septic Sore Throat *	8	939	13	2	2		10		
TOTAL	50	2488	52	11	17	2	46	2	2

* In two epidemics infected cows were found at dairy.

TABLE II

CANADA

NUMBER OF MILK-BORNE EPIDEMICS, CASES AND DEATHS BY DISEASE AND YEAR DURING PAST SIX YEARS, 1924-1929
REPORTED BY PROVINCIAL HEALTH AUTHORITIES

Year	All Diseases			Scarlet Fever				Typhoid Fever			
	Epidemics	Cases	Deaths	No. of Provinces Reporting	Epidemics	Cases	Deaths	No. of Provinces Reporting	Epidemics	Cases	Deaths
Six Years	12	5,229	544	—	2	7	0	—	11	5,222	544
1929	4	37	3	0				4	4	37	3
1928	4	33	2	1	2	7	0	2	2	26	2
1927	2	5,110	537	0				2	2	5,110	537
1926	2	49	2	0				2	3	49	2
1925	0				0				0		
1924	0				0				0		

THE RELATION OF COMMUNICABLE DISEASE OF ANIMALS TO MAN

Probably the publication of two books has been most helpful to dairy inspectors who need to know about animal diseases in relation to the milk supply. One of them is by Thomas G. Hull, and is entitled "Diseases Transmitted from Animals to Man," and is published by C. C. Thomas of Springfield, Illinois. The other is by L. C. Bulmer, of the Jefferson County Board of Health, Birmingham, Alabama. Both of these texts should be in every milk control office.

UNDULANT FEVER

This disease has been the focus of much careful research work by the most competent of investigators. It has also excited intense public interest. Slowly the facts about this disease are being worked out. It has been established that it may be contracted from direct contact with diseased animals as by veterinarians, butchers, farmers and others, and also the disease may be taken by drinking milk from animals sick with certain types of infection of the disease. The disease has been made a reportable one by certain Health Departments and eventually others will follow their lead. Producers of certified milk and the highest type dairymen are ridding their herds of Brucella infected animals by using serological tests and segregation or slaughter of the reacting animals. The literature of Undulant Fever is too voluminous to attempt to summarize it in this brief report.

Tuberculosis

This disease is recognized as dangerous to milk consumers, and a menace to the financial stability of the dairy herd. Opposition to tuberculin testing of dairy herds has lost much of its vehemence and area testing is proceeding satisfactorily.

Anaplasmosis Marginale

This disease, while not so far as known transmissible to man, has excited interest in the Southeastern States because of its recent recognition and the fact that it may inflict considerable loss on the dairy farmer. The Committee is indebted to Dr. J. V. Knapp, State Veterinarian of Florida for the following description of the disease.

The disease is enzootic in Florida and probably throughout the Southeastern States. Kilborne and Smith in their pioneer studies of the cattle fever tick saw and described it but failed to recognize it as an entity, separate from tick fever.

It is probable that anaplasmosis has remained in this country for a good many years unrecognized until recently when large areas in the South have been freed of the cattle fever tick with which it has been formerly associated. It is probable also that our native cattle have acquired an immunity or rather a tolerance that protects them from high mortality.

The disease appears suddenly, associated with high temperature, loss of appetite, exhaustion, cessation of rumination and lactation, some of the animals showing evidence of pain by groaning if required to move. As the disease progresses a marked icteric condition develops. Positive diagnosis is made by examination of the blood, disclosing anapasma marginale. Postmortem examination reveals a marked icteric condition, gall bladder engorged and filled with flocculent bile, the liver icteric, somewhat swollen and congested. The blood is noticeably deficient in hemoglobin and petechiæ hemorrhages appear which are quite confusing. The feces are hard and often covered with mucus and stained with blood.

Anaplasmosis first came to our attention in Florida early in 1927, affecting the herd of Hon. H. S. Pennock, deceased, at Jupiter, Florida, and later in the herds of Messrs. M. A. Weaver and T. J. Knuth, of Boynton, Florida, being considered at the onset first as Texas fever and later as hemorrhagic septicemia. Mr. Pennock lost approximately 45 head of cattle, Mr. Weaver 40 and Mr. Knuth 3. This disease was unheard of to this department and unrecognized. Assistance was requested of the United States Bureau of Animal Industry and some four months following its appearance through blood inocculations in Washington the condition was recognized and diagnosis made. Our first treatment consisted of attempts to immunize infected and exposed herds through what is known as the incubation virus treatment previously used by the French Veterinarians in Algeria. This work was accomplished by Dr. A. D. Knowles, of West Palm Beach, representing this Department and the United States Bureau of Animal Industry. Attempts to immunize the cattle of Palm Beach County with the incubation virus treatment proved unsuccessful and later upon advice from Washington we used the sodium cacodylate intravenously which has proven the most successful and therefore continued to the present time.

In 1928 our records show that 200 head of cattle were affected in Palm Beach County belonging to the Loxahatchee Farms and innumerable small dairies in the vicinity of Lake Worth. Through the use of the sodium cacodylate treatment, less than two per cent of the affected animals died. In Broward County 60 head of cattle belonging to J. M. Bryan were affected and 50 head belonging to W. R. Goolsby. Thirty per cent of these animals died. The balance recovered and were later slaughtered. Dade County, 125 head were affected belonging to the Fairdale Dairy with two deaths. In the summer of that year some 6 or 8 small dairies in the northern part of Dade County were affected and despite treatment 30 cattle died. During 1929 the disease broke out again in the Fairdale Dairy in Dade County and among the dairy herds in vicinity of Lake Worth, Palm Beach County, where the disease was first noticed in 1928, with losses amounting to five per cent of the animals affected.

In Leon County the disease made its appearance in the Thomas Dairy five miles north of Tallahassee three months ago, visibly affecting 6 or 7 cows, 4 of which had died, the others recovering through treatment.

Reports coming to this office indicate that anaplasmosis has occurred and been definitely diagnosed through blood smears on the East Coast, in Lake County, Pinellas County and Leon County, and in the Jacksonville Health Department, in Duval County. It probably occurs throughout the State unobserved and unrecognized.

At the present time Dr. D. A. Sanders of the Research Department, University of Florida, is stationed in West Palm Beach for the purpose of determining the intermediate host of anaplasmosis. Dr. A. D. Knowles of

West Balm Beach is assisting in this work, employed by the United States Department of Animal Industry. In July, 1930, Dr. C. W. Rees, in charge of the zoological investigations at the New Iberia Station, Jeanerette, Louisiana, reports the transmission experimentally from infected to healthy animals of anaplasmosis by the brown dog tick, rhipicephalus sanguineus. Investigations are also being carried on in Kansas and Colorado where this variety and other ticks common to the coastal plain section are not noted but where anaplasmosis has been observed and which would point to the fact that there are probably other if not numerous carriers.

In conclusion your committee feels that the influence of this Association can best be exerted in the control of the dissemination of communicable disease by the agency of infected milk, by advocating the upbuilding of strong health departments, and by arguing pasteurization as the best preventative of epidemics of milk-borne disease.

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THE COLON GROUP OF BACTERIA IN MILK

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Members of the colon aerogenes group of bacteria frequently appear in all classes and all kinds of milk, sometimes in large numbers, frequently not in appreciable numbers. Where there is a marked variation in the bacterial flora of such an important foodstuff as milk, it is of greatest importance to determine, if possible, if this variation has any sanitary significance.

OCCURRENCE OF THE GROUP

A common and convenient method of determining the presence of this group is to enumerate as members all lactose fermenting organisms appearing as "colon" colonies on Endo's or a similar differential media. If we assume, for the moment, that all such colonies do represent members of the group then we find them scattered throughout all grades of milk and all classes of such grades as determined by total counts. The first table shows this for prepasteurized, grade A raw, certified and pasteurized milks.

TABLE I

CORRELATION OF AGAR PLATE COUNTS WITH ENDO PLATE COUNTS

Class of Milk	Number of Samples	Agar Plate Counts	Endo Plate Counts: under 10	10 to 100	100 to 1,000	1,000 to 10,000	over 10,000
		under 10,000	16	13	5		
Prepasteurized		10,000 to 100.000	12	17	17	4	
raw	185	100,000 to 500,000	3	4	12	15	4
		500,000 to 1,000,000	2	3	15	13	1
milk		over 1,000,000		1	18	7	3
Grade "A"		under 10,000	42	12	3		
raw	104	10,000 to 100,000	21	8	6	1	
milk		over 100,000	4		5	2	
Certified raw	98	under 10,000	60	8			
milk		over 10,000	23	3	4		
Pasteurized		under 10,000	50	5	2		
milk	190	10,000 to 100,000	95	17	2		
		over 100,000	17		1	1	

From the Laboratories of the Jefferson County Board of Health, Birmingham, Alabama and the Cattaraugus County Department of Health, Olean, New York.

As to the kind of bacteria causing these "colon" reactions on Endo plates, we have concluded from comparative studies of bacteria isolated from bovine feces, from hay and grain and from milk that some of the bacteria from milk correspond exactly in all reactions to bacteria from bovine feces and others correspond exactly to bacteria from hay and grain, as shown in tables II and III.

TABLE II

REACTIONS OF COLON SECTION OF COLON-AEROGENESE GROUP

+ Methyl red — Voges Proskeur | + Glucose + Lactose | — Citrate media (2) — Uric acid media (3)

Per cent of cultures showing positive reaction

Species		B. Neopolitanus				B. Communior				B. Coli Esch.				B. Acidi Lactici		
Source *		F.	G.	M.		F.	G.	M.		F.	G.	M.		F.	G.	M.
No. cultures		20	2	7		7	0	5		11	0	5		9	1	3
Adonite	—?	5	0	0	—?	0		20	—?	54		0	±	0	0	0
Cellobiose		0	0	14		0		0		0		0		0	0	0
Dulcite	—?	95	50	71	—?	85		80	—?	27		100	±	22	0	67
Glycerole		75	50	71		43		100		100		100		89	100	67
Inosite	—	0	0	0	—	0		0	—	0		0	—	0	0	0
Mannite	+	100	100	100	+	100		100	+	100		100	+	100	100	67
Raffinose	+	95	100	86	+	85		100	—	9		20	+	22	100	33
Saccharose	+	100	100	100	+	100		100	—	0		0	—	0	0	0
Salicin	+	100	100	100	—	15		0	+	100		100	—	0	0	33
Sorbite		100	100	100		100		100		100		100		100	100	100
Starch	—	60	0	14	—	15		40	—	27		20	—	0	0	0
Indol	+?	90	100	100	+?	85		80		100		100	+?	100	100	100

* Columns headed F. represent cultures from bovine feces
Columns headed G. represent cultures from hay and grain
Columns headed M. represent cultures from milk
Symbols preceding these columns representing the reactions according to Winslow, Kligler and Rothberg (1)

+ denotes fermentation with the production of acid and gas.

TABLE III

REACTIONS OF AEROGENES SECTION OF COLON-AEROGENES GROUP

— Methyl red	+ Glucose	+ Citrate media (2)
+ Voges Proskeur	+ Lactose	+ Uric acid media (3)

Per cent of cultures showing positive reaction

Species		B. Cloacae				B. Aerogenes		
Source *		F.	G.	M.		F.	G.	M.
No. cultures		0	19	15		0	49	35
Adonite	—?		5	7	±		27	88
Cellobiose			95	100			98	97
Dulcite	—?		21	13	±		29	74
Glycerole	—?		0	7	+		100	100
Inosite	±		21	0	±		96	91
Mannite	+		100	100	±		100	100
Raffinose	+		90	100	+		96	100
Saccharose	+		90	100	+		94	100
Salicin	+		68	93	+		92	100
Sorbite			74	100			98	97
Starch	—?		10	33	+?		73	49
Indol			21	20			0	49

* See footnotes to Table II

Many of these organisms can be definitely classified as belonging to a particular species of the group but in all of our studies we frequently met bacteria that could not be definitely assigned to the closely prescribed limits of an individual species. These forms we have called intermediates and the reactions shown in table IV are illustrative of the various kinds of intermediate organisms encountered in one of our series.

TABLE IV

REACTIONS OF INTERMEDIATE SECTION OF COLON-AEROGENES GROUP

	+ Glucose			+ Lactose			
Methyl red	+	+	+	−	+	+	−
Voges-Pros.	−	−	−	+	+	+	−
Citrate (2)	+	−	+	−	−	+	+
Uric acid (3)	−	+	+	+	+	+	+
No. cultures	6	5	16	1	3	1	1
Feces	6						
Grain		1			3		1
Milk		4	16	1		1	
Per cent of cultures showing positive reaction							
Adonite	0	20	69	100	0	0	0
Cellobiose	0	40	81	100	100	100	100
Dulcite	100	80	31	100	0	0	0
Glycerole	100	80	81	100	0	100	0
Inosite	0	0	50	100	33	100	0
Mannite	100	100	100	100	100	100	100
Raffinose	83	40	94	100	0	0	0
Saccharose	83	40	87	100	0	100	0
Salicin	100	60	75	100	67	0	0
Sorbite	100	80	94	100	0	0	0
Starch	17	0	56	100	0	0	0
Indol	100	60	44	0	0	0	0

See footnotes to Table II

Bacteriologically we have met these same intermediates in many different natural habitats and so apparently have other workers as shown in table V.

TABLE V

CLASSIFICATION OF MEMBERS OF THE COLON-AEROGENES GROUP

Author	Material	Colon	Aerogenes	Intermed.
Rogers, Clark and Davis (4)	Milk	59	57	
Rogers, Clark and Evans (5)	Bovine feces	149	1	
Rogers, Clark and Evans (6)	Hay and Grain	8	151	7
Rogers, Clark and Lubs (7)	Human and animal feces	131	40 *	
Koser (8)	Human and animal feces	76	107	
Koser (8)	Soil	7	11	40
Koser (9)	Human and animal feces	107	9	2
Koser (9)	Soil (uncultivated)	2	34	36
Berrier, McCrady and Lafrenier (10)	Human feces	196		1
Johnson and Levine (11)	Soil	30	132	22
Rogers (12)	Water	54	80	
Koser (13)	Water	84	41	72
Perry and Monfort (14)	Water	227	61	104
Havens (15)	Water	25	194	54
Hunter (16)	Silage	23	87	
Present studies	Bovine feces	47	0	6
	Hay and grain	3	68	5
	Milk	20	50	22

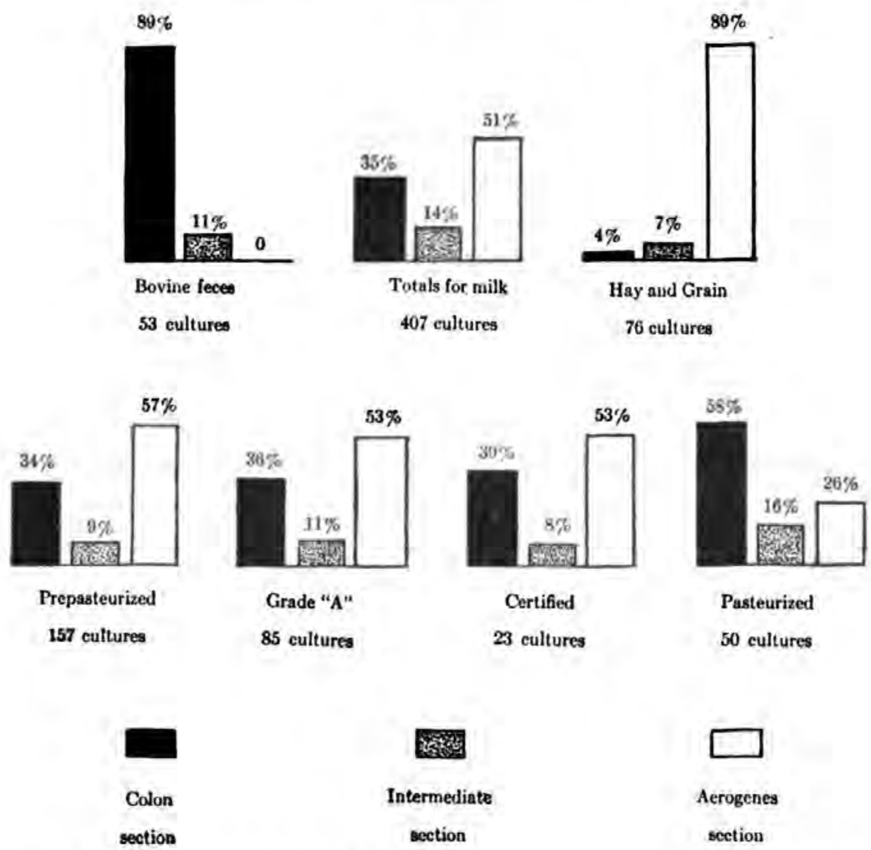
* Using special enrichment methods favorable to aerogenes

We have concluded that in practical work we must divide the colon aerogenes group into three rather than two sections, colon, intermediate and aerogenes. We have developed a rather simple series of tests for making this division and show in chart I the results of a series of type differentiations.

CHART I

Summary of Culture Studies

Section Differentiation



About one-third of the colon aerogenes group in milk are of the colon type and these do not seem to predominate in any one class of milk although present in a slightly higher percentage in pasteurized milk.

We have found another type of bacteria giving more or less typical "colon" reactions on Endo's media which are not included in the above summary, namely, an organism that gives a good "colon" reaction on the media but does not possess the ability to ferment sugars with the production of gas, producing only acid. We are inclined to the opinion that these organisms are really members of the colon group which may have become modified through the influence of an unfavorable environment. We have met these same organisms in a study of natural water supplies and in laboratory studies of the effect of an unnatural environment on members of the colon group. They give all of the reactions of the colon aerogenes group except gas production, fermenting the same sugars with the production of acid. We have five times during our studies encountered such an organism which either lost or acquired the ability to produce gas while under laboratory observation. Sometimes these acid-forming but non-gas-producing organisms appear in quite large numbers as shown in table VI covering a special study of six pasteurizing plants.

TABLE VI

ATYPICAL MEMBERS OF THE COLON-AEROGENES GROUP IN MILK

	Raw Milk		Pasteurized Milk	
Samples	88		95	
Cultures	260		65	
Gas formers	174		25	
colon		45		7
aerogenes		116		18
intermediate		13		0
Acid formers	86		40	
colon		25		29
aerogenes		58		3
intermediate		3		8

From all of the above we may conclude, we believe, that the lactose fermenting bacteria appearing on Endo plates prepared from milk are really members of the colon aerogenes group of bacteria and that they are in the main the same kinds of bacteria that appear in bovine feces or in hay and grain.

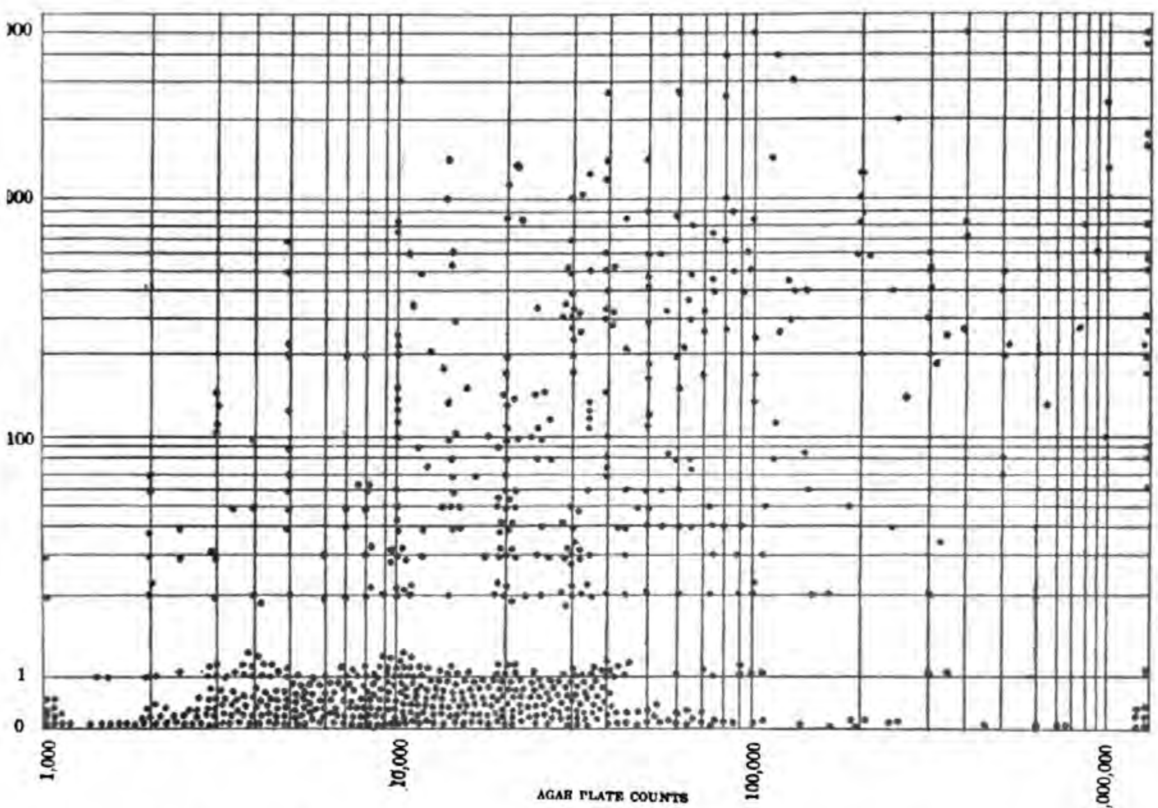
SIGNIFICANCE OF THE GROUP

Since appreciable numbers of Endo "colon" colonies can be demonstrated in some milk and not in other it would seem important to determine if they measure the same factors that are measured by the total number of bacteria present. For this purpose we present first our chart II which shows the distribution of such counts on a random series of raw milk samples examined in the Cattaraugus County Laboratory over a six-month period.

CHART II

CORRELATION OF AGAR PLATE COUNTS WITH ENDO PLATE COUNTS IN RAW MILK

Cattaraugus County



It would seem from this chart that there is very little correlation, the difference being largely a concentration around the line of negative Endo plates. However it is possible to determine mathematically the correlation existing between two such sets of figures and this we have done for the various groups as shown in table VII.

TABLE VII

CORRELATION OF AGAR PLATE COUNTS AND ENDO PLATE COUNTS

RAW MILK

Classification by Agar plate counts	Correlation coefficients
under 10,000	.046 ± .0463
10,000 to 25,000	.049 ± .0455
25,000 to 100,000	.230 ± .0473
over 100,000	.165 ± .0720

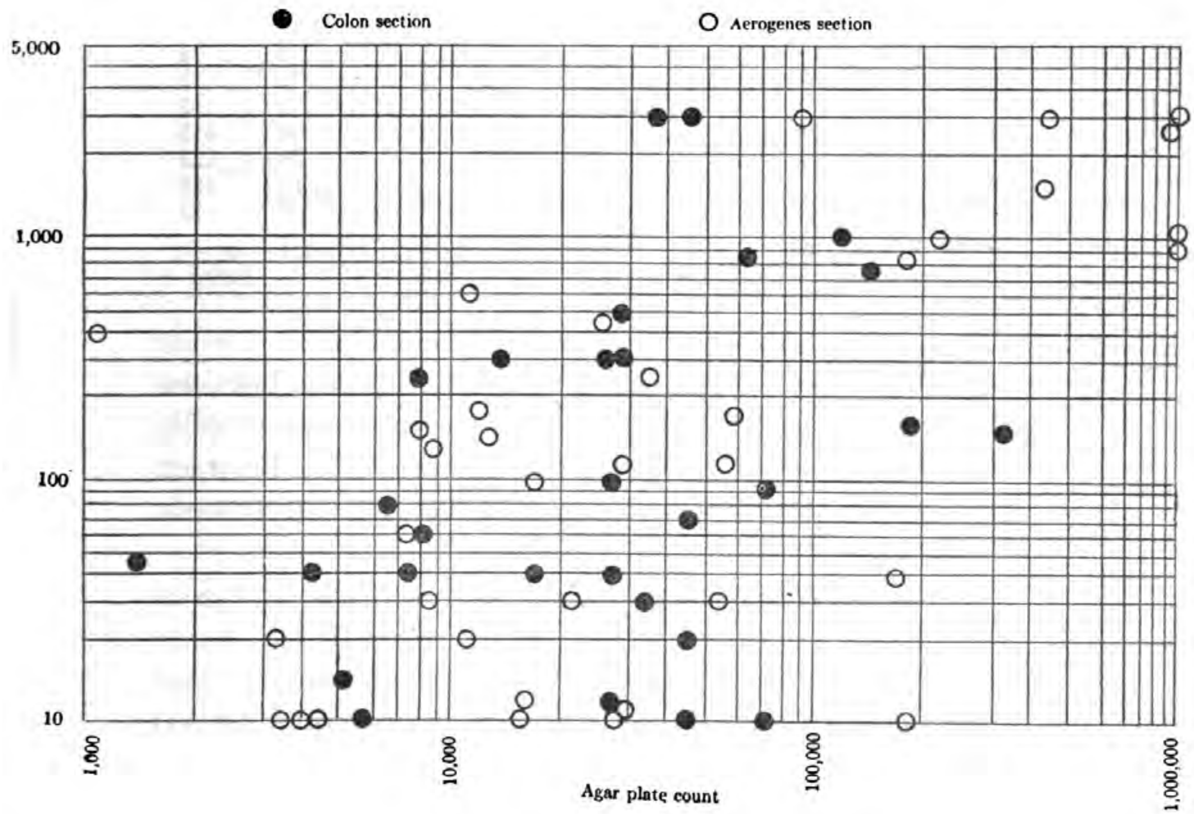
We conclude from the figures shown in table VII that in low count milk there is very little correlation between Endo count and total count while in higher count milk the correlation is slight but of little significance.

That there is no correlation between either total counts or Endo counts as compared with the type of bacteria of the group present is shown in chart III which represents prepasteurized raw milk. Charts representing other grades of raw milk and also pasteurized milk have been prepared and show the same random distribution.

CHART III

The Colon Aerogenes Group in Milk

Prepasteurized Raw Milk



Either the colon type or the aerogenes type of the group may appear in either high or low count milk and in all classes of milk. Milks showing more than one type are shown in Table VIII.

TABLE VIII

DETERMINATION OF TYPES OF COLON-AEROGENES BACTERIA IN MILK

	Prepasteurized	Grade "A"	Certified	Pasteurized	Totals
Number of samples	105	104	98	102	409
Colon-aerogenes group	66	37	15	18	136
Colon section	29	19	7	9	64
Aerogenes section	46	21	7	9	83
Intermediate section	9	8	2	4	23
Colon and aerogenes	11	4	1	3	19
Colon and intermediate	2	2	0	0	4
Aerogenes and intermediate	3	1	0	1	5
All three sections	3	2	0	0	5
Number of cultures	157	85	23	50	315
Colon section	54	31	9	29	123
Aerogenes section	89	45	12	13	159
Intermediate section	14	9	2	8	33

Colon section: Methyl red +, Uric acid −, Inosite −, Indol + or −.
Aerogenes sec.: Methyl red −, Uric acid +, Inosite + or −, Indol + or −.

Having shown that there is no correlation between Endo count and total count, especially in low count milk, let us next consider if there can be a correlation between Endo count and class of milk, continuing to study only low count milks.

We have available Endo plate counts made on Certified milks over a two year period using .01 cc. Endo plates. 1889 samples were examined in this time and 92 per cent of those having counts of less than 10,000 bacteria failed to show "colon" colonies while 73 per cent of the remainder were also colon free. Now it happens that during this two year period there was one Certified dairy that began to "bootleg" milk from unlicensed producers to increase its supply. During this period only 80 per cent of the low count milk and only 10 per cent of the moderate count milk was free from "colon" colonies. Certainly in this case the combination of total count and Endo count formed a better picture of the supply than did total counts alone. The figures of this interesting series are presented in table IX.

TABLE IX

CORRELATION OF AGAR PLATE COUNTS WITH ENDO PLATE COUNTS

A SPECIAL STUDY OF CERTIFIED MILK

Classification by plate counts	Routine samples Certified milk Two year study (Per cent)	Certified milk with permit withdrawn (Per cent)
Under 10,000		
Endo under 100	92	80
Endo over 100	8	20
Over 10,000		
Endo under 100	73	10
Endo over 100	27	90
Totals		
Endo under 100	89	38
Endo over 100	11	62

We next present for consideration two charts which show the Endo counts on different classes of milk all of which show a low total count. These represent milks sold in Birmingham, Ala., and seem to definitely show that the better the grade of milk the lower the Endo count regardless of total count. Chart IV shows milks of less than 10,000 total count and Chart V shows milks of between 10,000 and 50,000 total count.

CHART IV

Correlation of Agar Plate Counts with Endo Plate Counts

Raw Milk—Under 10,000

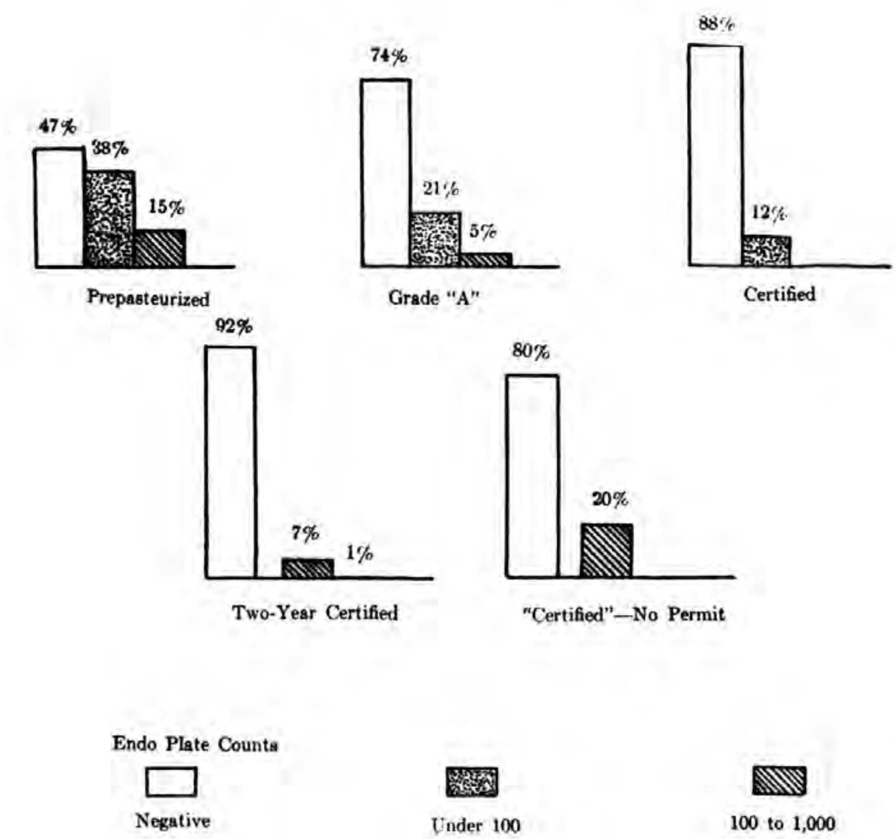
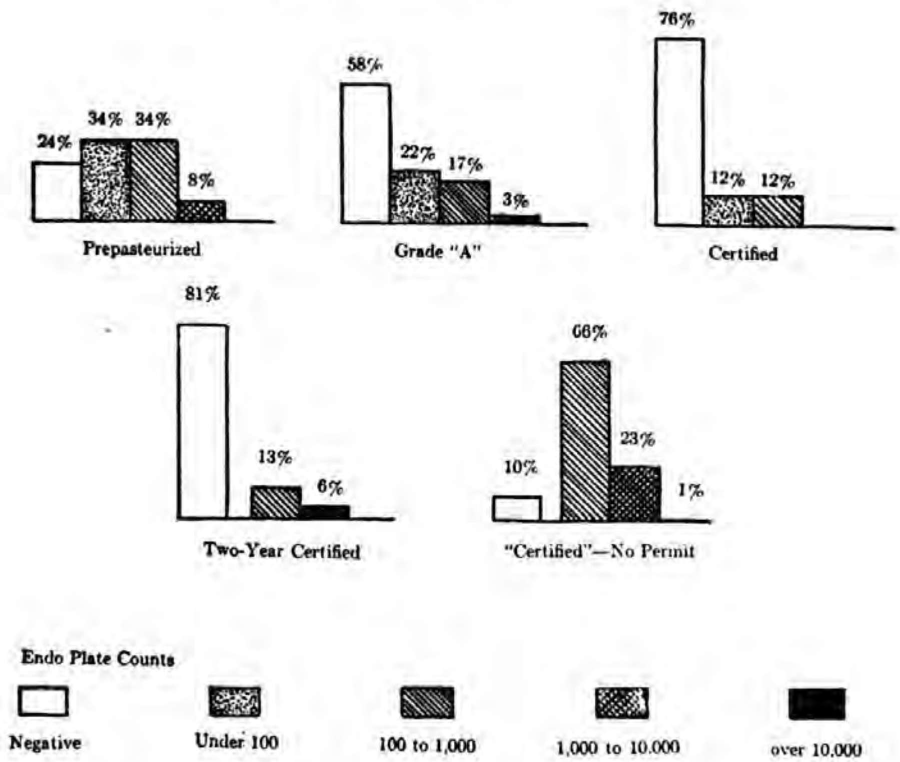


CHART V

Correlation of Agar Plate Counts with Endo Plate Counts

Raw Milk—10,000 to 50,000



The milks shown in the two last charts were all produced in Jefferson County, Ala., and we have no numerical scores to indicate the cleanliness of the farms producing the various classes of milk. The Jefferson County Board of Health has adopted a system of minimum requirements for its various dairy producers and each dairy producing a certain class of milk must meet these requirements, most of which deal with sanitation and cleanliness of the dairy. Certainly the more of these requirements of cleanliness that are met by the dairy the lower the Endo count of that dairy's milk regardless of the total count.

Discussion

We have seen that the Endo count in raw milk means in general the presence of members of the colon aerogenes group of bacteria. The members of this group in milk are of the same type as the bacteria of the group found in bovine feces and in hay and grains. The number of these bacteria is not correlated to the total number of bacteria present in low count milk and therefore their presence measure some factor or factors that are not measured by the total count variations in low count milk. However the number of colon group organisms present is correlated with the type of dairy farm as measured by the ability of that farm to obtain a permit to produce milk of a high or low grade.

We have at hand a plausible explanation of these facts if we accept the theoretical explanation that the presence of colon group organisms in milk results from the addition to the milk of either bovine feces or hay and grain.

The factor causing the presence of the group in low count milk can then be assumed to be the addition to the milk of small quantities of bovine feces or hay and grain incapable either because of the size of the contamination or because of the temperature at which the milk is kept of raising the total count to the point of producing high count milk.

We believe then that in the ultimate analysis this factor measures cleanliness and care on the dairy farm and that therefore the Endo plate count can be taken as a measure of care and cleanliness on the dairy farm, especially in low count milk.

Whether the bacteria be of the colon or aerogenes (fecal or non-fecal) sections of the group appears to be immaterial except in special instances, as the appearance of either section indicates carelessness on the farm and conversely the absence or degree of absence indicates the degree of care exercised by the producer.

Type studies however can be of great value in regulatory attempts to trace the source of contamination.

The colon group in pasteurized milk is another and a longer story which we cannot discuss tonight. I hope that further studies on this problem can be presented in a few years.

Conclusions

If the Endo count does measure the cleanliness of the dairy farm we have available an important adjunct to milk inspection. The inspector has heretofore been obliged to take the producer's word for much that happened in the inspector's absence. If by the colon group count the laboratory can detect dirty and careless methods, as we believe it can, then the inspector is provided with an important weapon to measure the cleanliness of a farm between inspections. It will also be possible to detect milk produced by insanitary methods and yet held within the bacterial limits of low count milk by the use of low temperatures for cooling and storing.

The campaign for clean and safe milk is one in which we are all vitally interested. To separate it into its component parts, safety must be regarded as of greatest importance—Pasteurization—Tuberculin tested herds—Mastitis free herds—Abortus free herds—are successive goals for the production of an absolutely safe milk. For the production of clean milk we also have a series of goals—the production of milk free from visible dirt—satisfactory from the standpoint of keeping qualities—of low bacterial content as measured by direct microscopic or plate counts—are well known procedures. I contend that the next goal to be reached in our better classes of milk is to produce a milk free from bacteria of the colon group.

References

Tables II, III and IV.

1 Studies on the Classification of the Colon Typhoid Group of Bacteria with Special Reference to their Fermentive Reactions.
Winslow, C.-E.A., Kligler, I. J. and Rothberg, W. Jour. Bact. 4-429-1919.

2 Utilization of Salts of Organic Acids by the Colon Aerogenes Group.
Koser, S. A. Jour. Bact. 8-493-1923.

We have used a modified media as follows:

2	gms. Ammonium Chloride	(Prepared by neutralizing standard hydrochloric acid solution with ammonium hydroxide and boiling off excess of ammonia.)
.2	gms. Magnesium sulphate	
.4	gms. Buffer mixture of PH 7.0 *	
5	gms. Sodium Chloride	
5	c.c. Brom thymol blue (1.5% alcoholic solution)	
2	gms. Sodium Citrate	
1000	c.c. Distilled water	

3 The Employment of Uric Acid Synthetic Medium for the Differentiation of B. Coli and B. Aerogenes.
Koser, S. A. Jour. Inf. Dis. 23-377-1918.

We have used a modified media as follows:

.5	gms. Uric acid
5.0	gms. Sodium Chloride
.2	gms. Magnesium Sulphate
.1	gms. Calcium Chloride
1.0	gms. Dibasic potassium phosphate
1.5	gms. Dextrose
30.	c.c. Glycerine
10.	c.c. Brom thymol blue (1.5% alcoholic solution)
1000	c.c. Distilled water

Table V.

4 The Colon Group of Bacteria.
Rogers, Clark and Davis. Jour. Inf. Dis. 14-411-1914.

5 The Characteristics of Bacteria of the Colon Type found in Bovine Feces.
Rogers, Clark and Evans. Jour. Inf. Dis. 15-99-1914.

6 The Characteristics of Bacteria of the Colon Type Occurring on Grains.
Rogers, Clark and Evans. Jour. Inf. Dis. 17-137-1915.

7 The Characteristics of Bacteria of the Colon Type occurring in Human Feces.
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8 Cellobiose Fermentation of the Colon Aerogenes Group.
Koser, S. A. Jour. Inf. Dis. 38-506-1926.

* a mixture of 37% 2/3 molal monobasic potassium phosphate and 63% 2/3 molal dibasic sodium phosphate will contain .4 gm. buffer salts in 3.7 c.c.

9 Correlation of Citrate Utilization by Members of the Colon Aerogenes Group with other Differential Characteristics and with Habitat.
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10 Berrier, McCredy and Lafrenier.
Cited by Perry and Monfort (14).

11 Characteristics of Colon Like Organisms from the Soil.
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12 The Occurrence of Different Types of the Colon Aerogenes Group in Water.
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14 Some Atypical Colon Aerogenes Forms Isolated from Natural Waters.
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15 Havens, Leon C.—Personal communication.

16 The Colon Aerogenes Group from Silage.
Hunter, O. W. Jour. Bact. 2-635-1917.

UNDULANT FEVER

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Since Zammit in 1905 almost accidentally discovered that Maltese milch-goats were naturally infected with *Micrococcus melitensis,* now known as *Brucella melitensis,* and the almost immediate demonstration of the organism in goats' milk by Horrocks, the association of undulant fever with the milk supply has been almost universal. Only in the past three or four years have we begun to realize that some cases of the disease are not the result of milk-borne infection. We now possess sufficient knowledge of the disease to show that milk is only *one* of the methods of transmission of the disease.

In the early days of medical knowledge, the infectious diseases formed a group which contained comparatively few distinct clinical pictures. Since then keen observation has from time to time led to the recognition of groups of cases that differ from others, a splitting off of a newly recognized entity. A century ago the name "typhus fever" was applied to the conditions which we now know as typhus and typhoid fevers. With the coming of bacteriology the recognition of the various infectious diseases received a great impetus through the discovery and study of the causal organisms of diseases.

The discovery of new bacteria was pursued with such zeal that in some cases the newly found organism was considered a new species, and assumed to have certain characteristics that were peculiar to that organism only. Later it was found that the bacteria were associated in groups, the members of certain groups showing a resemblance in many but not all characteristics, like the family resemblance seen in the human species.

In 1918, Evans made a comparative study of the organism causing Malta fever and that causing infectious abortion of cattle, and found a very close resemblance in all common characteristics, including ordinary agglutination tests. This suggested the possibility that the infectious abortion organism might be the cause of some of the peculiar febrile disturbances occasionally seen in man. In 1924 the first case of undulant fever attributed to the *abortus* organism was reported by Keefer. Since then the cases recognized in the United States have increased rapidly and much field and laboratory research on this disease has been carried on.

Without attempting to review the finding of many workers in many fields, the following epidemiologic investigation carried on by the United States Public Health Service will be briefly reported. The investigation was carried on in Iowa by A. A. Surgeon A. V. Hardy and his associates, under State and Federal cooperation, and by myself in other states. Nearly 500 cases were investigated and in 435 the data were sufficiently complete to permit them to be classified under three groups as follows:

(a) Those having no contact with livestock, or carcasses.
(b) Those having contact with livestock, carcasses, or by-products.
(c) Those having contact with livestock on the farm.

The first group was composed largely of urban residents and the preponderance of evidence indicated that they contracted their infection through the ingestion of raw dairy products. This group may be conveniently called the milk group and contained 198 cases of undulant fever.

The second group was composed chiefly of urban residents who were employed in the meat industry or closely related vocations, and may be referred to as the meat group. It contained 44 individuals.

The third group was almost entirely composed of farmers and members of their family, veterinarians, or livestock dealers, and may be referred to as the farm group. This group contained 193 cases. They had repeated contact with domestic farm animals and, in many cases, they used milk from animals on their own farms. There is no reliable way of ascertaining the relative importance of ingestion of infected milk and of contact with the infected animals as a causal factor in this group. From the distribution of the cases between the sexes we are inclined to attribute the majority to contact infection, (184 males, 9 females), especially when contrasted with the sex incidence in the milk group. The milk used by the farm group was almost without exception raw milk.

In the meat group the disease is attributed to contact infection, either with living or slaughtered animals. With a single exception all of the 44 cases were males. The one female worked in a packing plant making sausage casings. All of the group came in contact with pork, or pork products. Twenty-three of the individuals in the group used pasteurized milk, 8 raw milk, 2 part raw and part pasteurized, and 3 canned milk.

The milk group, which is of greatest interest to this association, consisted of 198 cases of which 103 were males, 95 females. The information obtained showed that 178 used raw milk as a regular supply, and 20 used part raw and part pasteurized. In some cases it was possible to trace the infection to an infected family cow. It was not usual to find cases grouped on any one milk supply, though in Waycross, Georgia, 9 out of the 11 cases occurring in 1929 were investigated and 8 of these gave a history of using raw milk from the same dairy, and none had any significant contact with livestock.

In the herds supplying milk to cases in this group the presence of Brucella infection in the herd was proven in 39 cases by serological tests or cultural studies; 3 others gave an agglutination test that classed them as suspicious. In 10 others a definite history of the infection in the herd was obtained. This number seems small but it should be remembered that many cases knew nothing about undulant fever and its relation to domestic animals, while in others the herd owners declined to allow testing of their animals. As the knowledge of undulant fever becomes more widely disseminated the determination of Brucella infection in milk producing herds will become a more common procedure.

At the present time we hear much about the different types of Brucella and their relation to the disease in man. While it is desirable that we have all the scientific knowledge available as to different types or species, such differentiation seems of little importance in the prevention of disease. None of us would think of arguing that infection carried by milk was unimportant because it happened to be proven a paratyphoid instead of the typhoid organism.

The isolation of all three varieties of Brucella from human cases have been recorded. Similarly the findings of all three types in cows has been reported. Therefore, any Brucella-infected milk-producing animal must be considered, a potential, if not an actual, danger to man.

Whether the use of the milk-serum agglutination test will enable us to determine whether a cow is actually shedding Brucella in the milk is a problem still to be determined.

I have heard arguments to the effect that infectious abortion does not affect the human species because abortion does not occur in pregnant women. Such persons overlook the fact that about 90% of the bovine species are females and that these animals are generally in a state of pregnancy at least half of their life time. About 75% of the infection in the human species is in males; the female of the human species has a period at each end of life when pregnancy is impossible; and while in the reproductive period is pregnant only a small portion of the time. Therefore, there is little wonder that abortion in women is not frequently associated with undulant fever infection. However, Madsen reports that 7 out of 8 pregnant women suffering from undulant fever, aborted, and in 2 the *Brucella abortus* was isolated from the placenta.

Incidentally it might be stated that Madsen reports 40% of the fever in Denmark as milk-borne and 60% resulting from contact. Our figures are 45% and 55% respectively.

There is one point in relation to milk infection and its bearing on undulant fever that I wish to emphasize. As dairy and milk inspectors you have been taught that strict cleanliness is essential in the production of good milk and in the prevention of some of the infectious diseases that gain entrance to milk. With this teaching I heartily agree. But unless you have cows that are free from Brucella infection, no amount of inspection, cleanliness and sterilization of utensils will have any effect on reducing the number of Brucella organisms in the milk. They are there as a result of the disease of the udder.

In 1897, Hughes wrote a splendid monograph on undulant fever, based upon his years of experience with the disease in Malta. In many respects it is a model work, yet through his failure to picture the malady as a disease of the milk-producing animal, he dismisses milk-borne infection with the following paragraph:

"The question of milk-supply is intimately connected with that of water, most infections carried by milk being communicated by means of contaminated water fraudulently or purposely added, or used for cleaning vessels, etc. Besides this the writer has known undulant fever attack families who used only Swiss condensed milk, regiments in which no other milk was allowed in barracks, and families whose milk-supply was always milked from goats on their own premises, into their own vessels, under reliable supervision. He has met with no fact that would favour a causal connection between milk-supply and this fever. In instances where milk contamination has undoubtedly caused localised outbreaks of enteric fever, undulant fever has not shown increased prevalence in the same area."

I have no desire to criticise the work of this author, but use this quotation in order that we may profit by another's mistake. He apparently refers to some cases contracted from contact with infected animals and was unduly influenced by these cases in his deductions.

Therefore, the prevention of milk-borne undulant fever depends upon two possible lines of activity: (1) Rendering harmless the infection that may be in the milk by processes that have proven efficient, of which pasteurization is the most effective and practical one that we have at this time; (2) the control and ultimate eradication of the Brucella infection from the herds furnishing milk.

Regarding the effectiveness of pasteurization, I am a firm believer in this procedure as the most effective insurance against all milk-borne infectious disease. The way that undulant fever, when not explainable by contact infection, picks out the users of raw milk is a fact that many of you have doubtless noted. In cities that have 90 to 100% of their milk pasteurized, undulant fever is almost unknown. In those having a part of their supply pasteurized, as in Waycross, Georgia, it is seen more strikingly, by reason of there being a group that uses pasteurized milk. In Waycross approximately half of the milk was pasteurized prior to October 15, 1929. During the preceding part of 1929, 11 cases of undulant fever occurred in the city. In January, 1930, I investigated 9 of these 11 cases. All 9 used raw milk and 8 used raw milk from the same dairy. Pasteurization will remain our chief fortress of defense against milk-borne undulant fever until the infection is detected and eliminated from dairy herds.

In the eradication of the infection from our domestic animals lies the ideal prevention of undulant fever. The medical Milk Commissions of California require all herds that produce certified milk to be free of animals that give a positive reaction to the abortus agglutination test. This requirement should make the incidence of undulant fever in consumers of such milk practically *nil*.

The same procedure may be extended to all herds with good prospects of success, if I may judge from the reports of competent veterinary authorities. From the standpoint of the health officers, this procedure is desirable in that it prevents the acquiring of undulant fever through contact with animals as well as that transmitted by milk. The undertaking is one of colossal magnitude but from reports already made, it appears practicable. The economic loss attributable to Brucella infection of livestock is so enormous as to make eradicative measures desirable without considering human infection.

In Bulletin No. 50, the California State Department of Public Health warn us against considering cases of undulant fever as due to milk unless at least one of the following conditions are fulfilled:

1 Laboratory data obtained as to shedding of organism in the milk.
2 The extent of infection in the herd as determined by agglutination tests.
3 Positive results from direct inoculation of guinea pigs with centrifugalized specimens of pooled milk samples.
4 A history of recent abortions in the herd.
5 A history of the use of live organism abortus vaccine in the herd.

It is not always practicable for the health officers to make an exhaustive investigation of each and every case, but the members of this association are in position to assist the health authorities very materially and at the same time give advice to the milk producers and dealers that may save them financial loss and prevent illness among consumers. The attitude of a few officials in food inspection work is to take no action unless there is a violation of law or regulation that gives promise of obtaining a conviction in court. The giving of advice or making suggestions is not part of their program. In my limited experience in food control work, I found that many were glad to have us suggest improvements and such suggestions were put into effect without further action. I believe that milk producers and dealers are also willing to receive information and suggestions, particularly when the reason therefor is explained to them.

In closing may I ask the best efforts of the members of this association in the prevention of illness among milk consumers and of economic loss to producers by advocating measures designed to control, or eradicate, Brucella infection from farm animals.

Thursday, October 23
9.00 A.M.

REPORT OF COMMITTEE ON MILK PLANT PRACTICE

H. A. HARDING, PH. D., *Chairman*

The practices which are followed in milk plants are being modified steadily on account of the various problems which are being more clearly recognized. It is the aim of your Committee to record developments but it is frequently impracticable to do so until some progress has been made in understanding or in controlling plant difficulties.

THERMOPHILES

As early as 1923 it began to be recognized that there were bacterial forms which were able to grow in the pasteurizer at pasteurizing temperatures.

It was shown by various students that these forms were present in certified milk and in other kinds of raw milk. Accordingly, there is the constant seeding of the pasteurizing machinery with these forms from the raw milk.

It was determined that these forms develop to some extent in the milk heating apparatus when this is separate from the holder and that such multiplication takes place readily in the holder during the 30 minutes or more when the milk is at pasteurizing temperature. It has also been shown that such growth may take place in milk filters at least under some conditions.

Apparently with the passage of the milk over the cooler the growth of the heat loving bacteria stops.

The presence of thermophilic bacteria in pasteurized milk is generally accepted but there seems to be a marked difference of opinion among inspectors and even among your Committee members regarding most other features. Some still feel that these bacteria are rarely present in any considerable numbers except as the result of carelessness and of poor plant management. Others feel that they are practically always present in comparatively large numbers, particularly toward the end of the operations of the day.

There seems to be quite as little agreement regarding the methods to be employed in controlling the development of these bacteria in the pasteurized milk. Some feel that they can be practically banished while others consider them like the lactic flora, of which they may well be considered a part, in that they can be controlled more or less successfully but not removed.

There seems to be substantial agreement that the repasteurization of dairy products in the milk pasteurizing machinery should be avoided at least until the milk pasteurization of the day is finished. Otherwise, the seeding of the machinery will contribute to the number of thermophiles in the pasteurized milk.

It also seems agreed that the use of pasteurized milk and pasteurized cream in the standardization of raw milk should be avoided since this leads to the development of large numbers of thermophiles in the pasteurized milk.

In some of the larger milk plants the experiment has been tried of installing sufficient extra holders so that after being used for some hours the holder can be cleaned and scalded before receiving more hot milk. This is still in the experimental stage but the reports from various plants seem encouraging. In some of the medium sized plants the experiment has been tried of rinsing and scalding the holders with rather favorable results. The process can be carried out with less delay to operations than was thought possible.

There is no evidence that these thermophilic bacteria produce any human disease but there is considerable evidence that they may exert an unfavorable influence upon the flavor and upon the keeping quality of the finished product. It is recommended that each milk inspector familiarize himself with the thermophile problem in his own territory.

Metals and Flavors in Pasteurized Milk

There has somewhat recently appeared the results of a number of studies of the effect of different metals upon the flavor of milk. These experiments have been conducted under a variety of conditions some of which were rather widely removed from those which surround sweet milk.

Among the metals which are being used in the construction of milk handling machinery copper appears to be the only one which is under suspicion of producing metallic flavors with the exception of the iron in rusty milk cans.

Even in the case of exposed iron and copper it seems evident that there must be a considerable exposure before noticeable flavors are produced. The practice of condemning very rusty milk cans seems to have a satisfactory foundation. The extent to which copper is exposed before it becomes subject to condemnation is more open to question. For many years one of the large Boston plants used a horizontal milk cooler of untinned copper with no determinable effect upon the flavor of the milk. Exposure of copper in the presence of hot milk is undoubtedly more apt to produce metallic flavors.

Protection of Pasteurized Milk from Contamination

The production of 64 cases of typhoid fever in San Francisco as the result of a typhoid carrier operating the bottler in a pasteurization plant emphasizes the necessity

of giving more consideration to the protection of the milk after pasteurization.

Mr. Heffernan reports that during the past summer he visited 53 pasteurizing plants in ten states and his observations regarding the precautions which are taken to ensure healthy employees may be summarized as follows:

Number Plants	*Practice Reported*
40	Health Certificates obtained once a year
9	Health Certificates obtained twice a year
2	Health Certificates obtained once a month
2	No Health Certificates at all
12	Workers' urine and faeces examined for typhoid
41	Workers' urine and faeces *not* examined at all
5	Workers' nose and throat cultured for diphtheria and septic sore throat
48	Workers nose and throat *not* examined for diphtheria and septic sore throat
6	Plants out of 53 had records of reexamination of worker who had returned to work after being sick.

Some states and more municipalities require covers on milk coolers with the object of protecting the milk from contamination from workmen and from flies. In a majority of instances these covers are made in sections which are put into place by hand. Inspectors find difficulty in having these covers in place in all cases and the sections often become bent and unsightly. The most favorable reports are in connection with cooler covers which are mounted on rollers so that they may be rolled out for cleaning and then easily returned to form a box inclosing the cooler.

The washing process necessarily brings the workmen into intimate contact with the milk handling machinery. In order to fit this for the handling of milk it is desirable to scald the apparatus before it is used and preferably shortly before it is used.

The proper scalding of the cooler is made difficult by the presence of brine in the lower portion. It is reported that in many plants in New York and to a less extent in other parts of the country the brine line is so installed that the brine may be removed from the cooler during the scalding process. Proper scalding of the cooler is an important part of making the cooler and the bottler sanitary.

Bottle Washers

The older type of bottle washer where the cases of bottles were exposed to sprays of hot washing powder and finally to steam has been largely replaced by the type where the bottles are successively filled with and emptied of caustic and other washing solutions. This plan usually involves the immediate filling of the bottle with cold milk. The construction of many of the smaller machines of this soaker type is such that the bottles cannot be heated highly and cooled successfully before reaching the filler. As a result such bottles are commonly washed without sufficient heat treatment to ensure the destruction of pathogenic germs which may be occasionally present.

This lack of heat treatment is commonly supplemented by the application of some chlorine. In this connection it is well to remember that the germs of tuberculosis are very resistant to chlorine and that the resistance of a number of the other pathogenic forms has not been determined. An increased amount of attention should be given by the milk inspectors to the problem of bottle washing.

REPORT OF COMMITTEE ON DAIRY AND MILK PLANT EQUIPMENT

George W. Putnam, *Chairman*

Nineteen hundred and thirty has seen greatly increased use of the chromium nickel steel alloys such as Allegheny Metal and Enduro KA2 for dairy equipment of all description particularly jacketed and insulated tanks, vat linings, weigh cans, and covering for various dairy equipment. Just recently tubing, polished inside and out, has been made available for tubular heaters, regenerators, coolers and sanitary piping.

Detailed studies of the efficiency of the various operating steps in can washer machines have been stimulated in the past year with resulting improvement in many machines. Improvements have been made to secure more perfect washing, sterilizing and drying of milk cans of even the worst type, such as returned wholesale cans.

The publication this last year of the report entitled "Comparative Study of Cream Volume of Milk" covering a very comprehensive survey of eleven milk plants by the Laboratory Methods Committee of the International Association of Milk Dealers contains data influencing the design of equipment to prevent noticeable injury to the cream line, as well as several points relating to plant operating methods. The following conclusions and recommendations are quoted from this report as being of importance in connection with milk plant equipment design and selection:

"From Summary of Cream Volume Investigations"

4. Prolonged holding of milk at pasteurization temperature lowers cream volume.
5. The Internal Tubular Type of Cooler causes loss of cream volume as compared with the Tubular Surface Type Cooler. This loss, in a series of 72 tests, averaged 8 per cent."

A REMARKABLE
NEW HEATING
SYSTEM

The BARRETT PASTEURIZER

ALLEGHENY METAL LINED

THE new BARRETT PASTEURIZER is receiving the plaudits of dairymen countrywide. With its new heating system, so radically different from present types, dairymen are experiencing a new conception of rapid temperature rise with a temperature maintenance that is unbelievable.

Better milk, quicker pasteurization and lower production costs are just a few of the many advantages it offers you.

In addition to the outstanding heating system BARRETT PASTEURIZERS are lined with Stainless Allegheny Metal which will neither chip, peel nor tarnish—and will keep its immaculate appearance indefinitely.

Write for the interesting details of the BARRETT PASTEURIZER today—no obligation.

FORT WAYNE DAIRY EQUIPMENT CO.

Manufacturers of Dairy Equipment

Winter Street and Wabash R. R. - - Fort Wayne, Ind.

From "Recommendations for Reducing to a Minimum Loss of Cream Volume caused by Handling, Transportation, and Processing of Milk"

"3. Heat milk rapidly to such temperature as will insure 142 degrees F. in holder.
4. Control pasteurizing temperature accurately and positively at 142 degrees F. for 30 minutes.
5. Empty rapidly on completion of holding time.
6. Cool rapidly to below 40° F. with minimum of agitation and delay in bottling.

In connection with the subject of external surface cooling, it is of further interest to note that milk to milk regenerators have been made available in the last year which make it possible to cool the hot pasteurized milk on the outside by regenerative cooling while drawing the raw milk through the inside of the regenerator tubes under a pressure less than atmospheric, so as to conform to milk regulations requiring the pasteurized milk to be under greater pressure than the raw milk as a safeguard against leakage of raw to pasteurized milk.

ACTIVITIES OF THE INTERNATIONAL ASSOCIATION OF MILK DEALERS OF INTEREST TO THE DAIRY AND MILK INSPECTOR

W. H. Marcussen
Vice-President, Borden's Farm Products Co., Inc., New York City

The International Association of Milk Dealers came into existence in a very natural way. In the first decade of the present century, our country was in the midst of a period of extremely rapid growth. Villages grew into towns, towns to cities and cities to great metropolises and, with them, the business of milk production and distribution grew to meet the increased consumer demand. The merchandising problems of the milk dealer multiplied in number and became more and more complex in nature. The milk distributing industry had reached that point in its development when there was a distinct need for

mutual discussion of its problems, particularly those of merchandising, business ethics, producer relationship, transportation, etc. Men from one section of the country wanted to learn from those from another section how the problems that are peculiar to the milk industry were being successfully met. No common forum had heretofore existed at which dealers could present their experiences and learn the experiences of others.

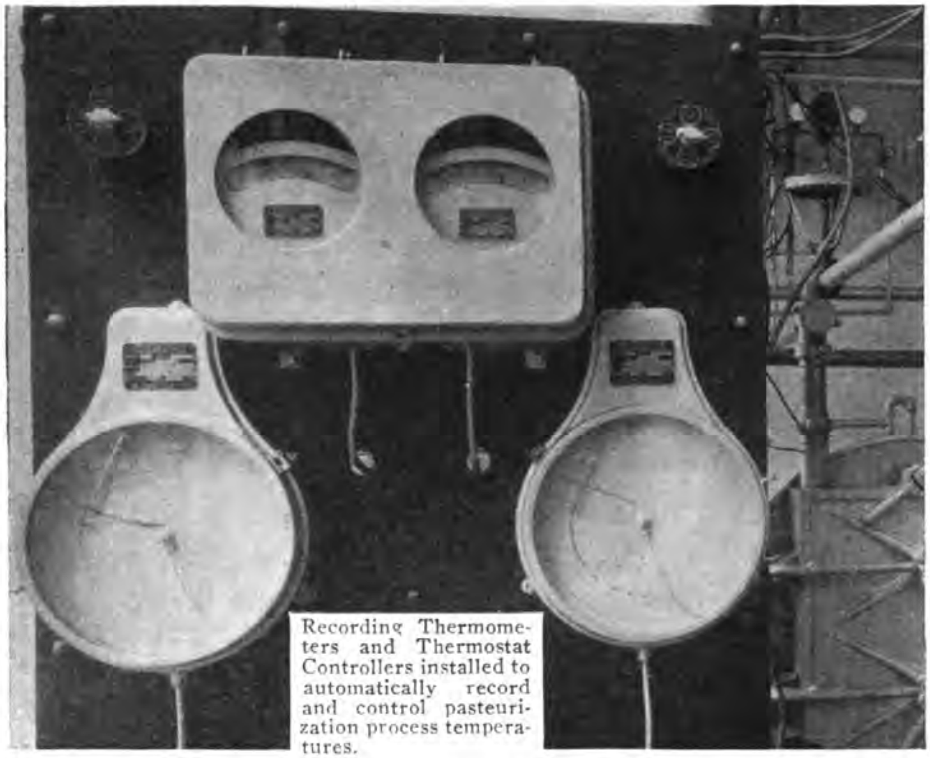
As a result in 1908, twenty-two years ago, the International Association of Milk Dealers was organized. Its first convention was held at Chicago, in October of that year. Each year since 1908, the International Association of Milk Dealers has met in annual convention. During the earlier years of the association, problems running through the entire range of the industry were discussed in a common meeting. The industry had not specialized to the extent that it has today. The men in the industry were to a great extent "all around men," familiar with and interested in all phases of the business. The trend toward specialization, however, made it impractical to continue general meetings, accordingly, the association began to divide itself into sections, so that today the three-day convention includes meetings of the Production, Laboratory, Plant, Sales and Advertising and Controllers Sections. In these sections the technical problems of each of these distinct fields are discussed, either by well qualified men from within the distributing industry itself, or by authorities on that particular subject, from the official or university field. In the Production, Laboratory and Plant Sections, the same subjects and, in some instances, the same speakers that appear on your program are often found on their programs.

Those in the distributing industry today fully appreciate that the problems and sanitation, inspection, production and the many other public health factors that eventually result in clean, safe and wholesome public milk supplies, all of which are so much a part of your convention, are not solely problems of the milk inspector and public health officer but that these are fundamental and vital to the entire dairy industry and, *as such,* are the dealers' problems as much as those of the inspector and health officer. Perhaps the greatest individual guarantee that the milk distribution industry can give to its public and to you, the representatives of that public, is that of the purity of its product. This is a pledge that the modern milk dealer gives, a responsibility and an obligation that he is willing and eager to assume.

In addition to the responsibilities of safe guarding the quality of his product, so that the public may receive safe and wholesome milk, the dealer has many other responsibilities that are more strictly economic in nature. In a broad way these may be classified as:

1 The dealer's responsibility to the consuming public so that a safe and wholesome milk may be distributed at a reasonable selling price.
2 The dealer's responsibility to the producer, so that the producer may receive for his product a fair price that will encourage continued production of safe, clean milk.

While both of these dealer responsibilities are fundamentally economic, both have a distinct public health aspect. To this group it is unnecessary for me to state that increased consumption of milk results in improved health in the individual and the public as a whole. Increased consumption of milk is most easily obtained with milk selling at a relatively low price. To maintain a low selling price and, at the same time, make a return to the producer that will warrant his continued production and particularly to accomplish this in an era of rapidly rising labor and material costs, has taxed to its utmost the ingenuity and resourcefulness of the dealer and his organization.



Recording Thermometers and Thermostat Controllers installed to automatically record and control pasteurization process temperatures.

Efficiency in the major operations, constant effort, study and analysis toward the elimination of waste in every phase of the industry, is recognized as absolutely essential, if the modern milk dealer is to be successful in fulfilling the obligations and responsibilities that modern conditions dictate that he must assume. Probably no other business finds itself confronted with as many responsibilities. Permit me to point out some of these responsibilities, simply to illustrate how each plays a part in providing subject matter for discussion in the dealers' meeting:

1 The responsibility of the dealer in meeting the constantly higher standards for quality and safety in milk and milk products.

2 The responsibility of the dealer to the consumer (as previously pointed out) so that the consumer may be provided with high quality safe milk at a reasonable price.

3 The responsibility of the dealer to the producer, so that the producer will receive a fair price for the milk that he is producing under the more exacting modern regulations.

4 The responsibility of the dealer to the hundreds of thousands of employees in the milk distributing industry so that they may enjoy reasonable working conditions and wage scales.

5 The responsibility of the dealers' organizations to the many stockholders, who have invested their capital in the real property and equipment that make the distribution of milk possible, so that these stockholders may receive a fair return on their investments. This responsibility is considered by some as the least important. However, it does have a distinct place in the picture, for capital is absolutely necessary to provide the facilities that the modern milk distributing business requires.

Every paper, every discussion, that is presented at the meetings of the Dealers' Association, is designed to enable the industry to meet this multiple responsibility.

The Dealers' Association has found that substantial progress toward the solution of individual problems can best be made through continued and thorough study by committees of technically trained men, who are specialists in their particular field. The accomplishments of the following committees should prove of interest to the dairy and milk inspector:

Standardization of Equipment Committee

As the name of this Committee implies, its attention has been directed toward improving and standardizing dairy equipment. The personnel of this committee includes the best qualified dairy engineers in the employ of the milk distributing industry. The Standardization Committee has been fortunate in having the co-operation and guidance of the Bureau of Standardization of the United States Department of Commerce. The assistance of the Federal Bureau has been of great help to the Standardization Committee. During the eight years that this committee has functioned it has accomplished the following:

Sanitary Pipe and Fittings, both in the United States and Canada. The utmost tact and diplomacy had to be exercised to bring harmoniously together, the dairy machinery manufacturers and unify their efforts with the committee's wishes.

The Standardization of Sizes and Threads of Thermometers wherever they fit into sanitary pipe and fittings, or into machines where thermometers are required.

The Standardization of the Spud through which the thermometers are inserted into coil vats, and glass lined tanks. This was a difficult piece of work, when taken into consideration that it involved some of the manufacturers conceding their patent rights.

Milk Bottles. Simplification and elimination of sizes of bottles. There were originally twelve different sizes and shapes of quart bottles. This is now reduced to three with a recommendation to two. Fourteen different sizes and shapes of pint bottles have been reduced to two, with a recommendation to reduce to one. Fourteen different sizes of half pint bottles have been reduced to one standard size. Originally there were ten different sizes and shapes of fourth pint bottles; the committee has made a recommendation for the complete elimination of this size.

Milk Caps. It was reported by one large cap manufacturer that he originally carried ten dies of different sizes of milk caps. These are now reduced to three sizes.

Milk Cans. With the cooperation of the milk can manufacturers, ninety per cent. of the cans manufactured today are made in only two sizes of necks, namely 6⅛" and 7½" diameter.

Dairy Machinery. Each year the Standardization Committee has studied dairy machinery from the standpoint of sanitation and mechanical efficiency. This is accomplished in a visit by the Committee to the Dairy Exhibition, after which conferences are held with the mechanical engineers of the machinery manufacturers.

Pasteurizing Equipment. The Standardization of Equipment Committee has made a very exhaustive study of pasteurizing apparatus. The industry has been guided to a large extent in its recent purchases of pasteurizing equipment by the recommendations of this Committee. These accomplishments and many others that are not here recorded have resulted from this important Committee's work. Its contribution to milk dealers, dairy equipment manufacturers and to all those interested in sanitary and economical processing of milk, are of immeasurable value.

Laboratory Methods Committee

Laboratory control is a potent factor in the successful production, processing and marketing of milk and milk products. The Dealers' Association appreciates the importance of laboratory control measures and has actively encouraged their application among its member companies.

Five technically trained men comprise the Laboratory Methods Committee and this group convenes several times a year with the executive secretary to consider matters of importance from the laboratory standpoint.

During the present year this committee has been concerned with the launching of two major projects—the abstracting service and the laboratory directors handbook. The abstracting service is to be carried on in co-operation with the International Association of Ice Cream Manufacturers and will cover in excess of forty scientific publications, including the more important foreign journals. The "Laboratory Directors Handbook" is to contain methods of laboratory procedure and laboratory equipment recommended by the Association. These projects are under way at the present time. Among other important matters this committee is working on a brochure on pasteurization designed to present that process in its proper light, recommendations for milk plant laboratories and laboratory equipment, also a study of bacteriological incubators in co-operation with Dr. R. S. Breed of the New York State Agricultural Experiment Station.

During 1928 and 1929, the Laboratory Methods Committee investigated and supervised a rather extensive

study on the creaming ability of Pasteurized milk. This work has been prepared in bulletin form and has been widely acclaimed as an outstanding contribution to the technical knowledge of the Dairy Industry. The execution of this project required such a vast amount of preparation that little else was attempted during the period by the committee with the exception of a report on "The Relation of the Milk Dealer to Acidophilus Milk," in 1928, and a report on "The Significance of B. coli in Milk," during 1929.

During 1927, the Laboratory Methods Committee reported on recommendations for uniform procedure in the matter of making sediment tests and of testing milk cans and bottles for efficiency of sterilization.

Milk Buying Plans Committee

This Committee was appointed for the sole purpose of studying and providing detailed information of the various milk buying plans in use throughout the country. The Committee has regularly reported to the Association and thereby provided information that has been helpful in creating discussion at the annual meeting of the various buying methods in use. It is not the idea of the International Dealers' Association to establish a uniform plan of buying milk, nor is it at all likely that one will develop, when there are so many conditions to be met and so many practices available. No single plan is adaptable to all territories; each territory has its peculiar problems that must be dealt with in an individual way. Each market is under the necessity of developing its own method, as circumstances indicate and require. The industry at large, however, has, through the work of this committee, been able to secure the fullest information on this important subject, so that each dealer may individually adopt, through the knowledge that he has gained through this committee, a plan that will best fit his needs, satisfy his producers, and secure for his community, milk of proper quality and quantity.

Agricultural Colleges Committee

This Committee has carried on a co-operative program of mutual helpfulness by joint meetings between faculty members of dairy colleges and the committee. For several years, the Association has supported special fellowships at leading colleges, these fellowships being devoted to research by a graduate student on a dairy subject. At present the Association is supporting, to the extent of $1,200 per year, a fellowship on the part of a graduate student, seeking his doctor's degree, at the University of Illinois. This student is devoting his entire time to a research project, his subject being "Factors Affecting the Marketability of Fluid Milk."

Bottle Loss and Breakage Committee

The control of bottle loss and bottle breakage is one of the outstanding problems of the milk distributing industry. A committee of the Dealers' Association has devoted several years of intensive study to this important problem. As a result of this work, the committee has been able to recommend to the industry certain tests that may be used by bottle manufacturers and dealers to establish the mechanical strength of the milk bottles. This has enabled dealers to create a more definite purchasing policy for new stocks of bottles. Other studies on the part of the committee have uncovered operating practices in milk plants that are largely responsible for heavy breakage and to point out the ways and means of eliminating those hazards in plant practice. The committee, in its last report, after studying the bottle loss situation in many of the leading cities of the United States have presented to the Association the most complete information ever assembled on that subject. This report not only gives the bottle loss experience in these large cities, but it also indicates how certain cities have been able to minimize bottle losses by deposit plans, extra compensation to drivers, bottle recovery campaigns, etc. Through the information that these studies have brought to light, substantial progress should be made in the next few years in minimizing bottle loss.

Advertising Exchange Committee

Until recently each milk distributing company was dependent upon its own resources for its advertising material, such as posters, show cards, bill boards, newspaper set up, etc. This meant that the initial cost of the preparation of this advertising material, which is usually very high, was carried individually. High costs also limited the quality of the advertising display and the result was that many companies were using ineffective posters, bill boards, etc., while many of the smaller companies were unable to support any advertising.

After a careful study of this problem, the Advertising Exchange Committee recommended an advertising exchange service, to be located at the central office of the Association, this to function under the immediate leadership of a graduate in agricultural journalism. Briefly, this service makes use of the material already extant in the industry and, by exchange, makes it available to dealer members, at a cost considerably less than the usual initial costs for original advertising display. This not only tends to the elimination of waste in advertising, but it also places high class material in the hands of the various members throughout the country at a very low cost. Furthermore, advertising material furnished by the service is material that has been tested and proven effective in other cities before it is made available to the Association members. This service has, therefore, placed in the hands of even the very small dealer the opportunity to secure dignified, attractive advertising material, so that the industry as a whole, at a moderate cost, can more efficiently help to stimulate the increased consumption of milk.

The Final Safeguard

SANITARY regulations which begin at the farm often end at the milk bottle. Seal-Kap protection begins at the milk bottle and ends only when the last drop of milk has been poured.

Thus, Seal-Kaps are the final safeguard against contamination of milk—from the farm to the family table. Seal-Kaps protect milk not only during delivery and on doorstep, but also in kitchen and icebox during all the time the milk is being used.

And housewives like Seal-Kaps because they are so convenient—off with a simple twist of the fingers, and on again with a snap, making a tight reseal which keeps out odors and prevents spilling if the bottle tips over.

Seal-Kaps are *one-piece cover-all caps,* thoroughly sterilized, impregnated with a pure refined wax, packed in dust-proof containers. Easy to attach. Low cost cappers. Samples will be gladly sent to anyone interested.

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American Seal-Kap Corporation

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Sales Manual Committee

Through the work of the Sales Manual Committee, a very attractive Sales Manual for the route salesman has been made available to the entire industry. This manual will better educate the route salesman for the performance of his duties. It is designed in particular to fortify him with a substantial knowledge of the products that he is selling, so that he can intelligently discuss them with his customers. The fundamentals of the sanitary production of milk on the farm, plant processing, pasteurization, the nutritive value of milk, etc., are presented in the manual in so simple a manner that they can be readily assimilated by anyone of average intelligence. When one considers that the route salesman constitutes the daily immediate contact with the consuming public, the beneficial value of a better educated representative is immeasurable.

Many other activities and accomplishments on the part of the Dealers' Association might be enumerated. The limited time, however, does not permit of further detail.

In closing permit me to repeat that the dealer appreciates the responsibility he assumes, in carrying to the public that product, the quality of which, you, as members of the Inspectors' Association are so zealously safeguarding. The dealer is ever anxious to perform his vocation more efficiently.

The International Association of Milk Dealers has the highest regard and admiration for the accomplishments of *your* Association. It considers your Association as the outstanding leader in all that typifies progress in the dairy sanitation field.

The International Association of Milk Dealers sends you greetings and wishes to leave with you the thought that its own ideals and ambitions are the same as yours, namely, the continued progress, in all of its phases, of the Dairy Industry.

MILK CANS AND CAN WASHING

William B. Palmer
Executive Officer, Milk Inspection Association
of the Oranges, N. J.

It is obvious that in the past milk cans and can washing have received insufficient official attention, although these are exceedingly important factors in the production and distribution of milk and milk products of satisfactory quality both as to cleanliness and absence of bacterial contamination.

For the past three years the writer has given study to the problem and, although, progress has been made through co-operation by milk dealers and equipment manufacturers, the results obtained must be considered only a beginning. For the purpose of presenting the findings of the study made, the remedial action taken and the results obtained the subject will be discussed under the two general headings of (a) milk cans and (b) can washing and equipment.

Milk Cans

When considering milk cans it is also necessary to include milk products containers, particularly sweet milk products such as cream, skimmed milk, condensed skimmed milk and ice cream cans.

There are two general types of milk cans in use, i.e., cans with "umbrella-type" covers and those with "plug-type" covers. These vary in capacities from 20 quarts to 60 quarts. Most all have detachable covers but some have covers attached to the cans by chains or other device, particularly those with plug-type covers, which complicates the matter of efficient cleaning, particularly by machine. Ice cream containers are usually of 2 and 5 gallon capacity and differ from milk cans in that they are constructed with straight sides without shoulders and have flanged-edge covers which fit over the outside of the cans. Their construction should lend to easier cleaning.

It has been observed that where any interest had been taken by milk dealers and equipment manufacturers in cans and containers attention had been directed primarily to the interior only, with little or no attention to exterior, and any attempt to inspect or maintain acceptable conditions and containers had been more or less superficial. To some it may seem rather surprising that such has been the practice, but, nevertheless, experience has shown such conditions to prevail with many concerns. This may partly be explained by lack of official recognition of the prevailing conditions and practices. What has been true with cans certainly would not be tolerated with milk bottles, which can readily be explained.

Important Can Conditions

Cans must be considered from the standpoint of construction, state of repair and sanitation. As to construction some of the more important features are properly flushed inside seams, smooth interior surfaces, properly fitting covers, and rolled wired edges of cans and covers flushed with solder. Rebuilt and retinned cans present added difficulties due to excessive amounts of tin used in refinishing of cans resulting in rough and sometimes porous surfaces, but this can readily be prevented by the factory. The bottom flange of cans could be drilled to permit drainage of washing solution and rinse water while cans are inverted for washing, thus contamination of washed containers from this source could be eliminated.

Maintaining cans and covers in good repair requires constant vigilance. Containers and covers with rusted surfaces, broken seams, worn edges, bent and broken collars should be eliminated. Resoldered seams are frequently unsatisfactory due to rough finish and recesses making cleaning practically impossible. Vent holes punched in milk and cream can covers are objectionable and should not be tolerated, for through these the products are subjected to contamination.

Sanitation of containers must include both interior and exterior surfaces of cans and covers. To be acceptable they should be free of "foreign" matter and be dry. It has not been uncommon to find milk plants utilizing cans coated on the exterior with a film of dried washing solution, grease, dirt and other material which frequently necessitates use of strong abrasives or mineral wool for removal. The condition is the result of any or all of the following: (1) lack of washing and rinsing, (2) use of improper washing solutions which are not "free-rinsing," (3) lack of proper temperatures and control during the various stages of cleaning, rinsing and steaming operations. Water supply may have some influence, especially a hard water, some plants requiring water softening equipment. It has been satisfactorily demonstrated that by application of proper methods, equipment and practices that it is possible and practicable to secure without difficulty cans which are clean internally and externally and which are dry and do not show evidence of moisture after standing several hours with covers on. Such cans do not have the stagnant odor invariably noted in wet or moist cans. Rust is prevented and the containers within a short period appear as new because of the brightened surfaces. If cans contain moisture, particularly after delivery from a washing machine, a few drops of phenolphthalein applied will indicate the presence or absence of washing solution. This is important, and if present, particularly in ice cream cans, light colored ice cream becomes discolored or "spotted" where the product is in contact with the can.

Can Washing and Equipment

Generally speaking, there are two methods of can washing designated as "hand washing" and "machine washing." Hand washing is usually accomplished by brushing the cans in a vat of tepid water containing varying amounts of "dairy washing powder," then rinsing, steaming and sometimes drying with one of several types of mechanically or hand operated machines. Machine washing is usually attempted with one of several types of machines intended to complete the entire process of pre-rinse, washing, rinsing, steaming and drying.

Both of the described methods have in the past been found to be more or less unsatisfactory, chiefly because of the design, condition, maintenance and functioning of machine equipment.

In small milk plants employing hand washing method cans after washing are inverted over a spray pipe first delivering water and then steam by means of hand valves on the pipe lines. Others use triple-pedal operated machine with spray jet, first delivering cold water, followed by hot water and then steam. With both of these spray pipe systems the cans are not subjected to adequate hot water and steam treatment as the cans must be handled during the operation and no means are provided for drying the cans by blowers or other process. In moderate size plants rotary and "tunnel-type" machines are usually used to complete the work after hand washing. Practically all of these are improperly designed to deliver an acceptable container. Observation will show that it has been in all of the above methods the practice in the rinsing and steaming operation to neglect the exterior of cans and covers.

In the large milk plants machines are utilized for the complete process of can washing and are motor driven, passing the cans through the various stages of operation, with some replacing can covers. The machines are equipped with a series of spray jets or nozzles arranged so that the cans center over them as they advance inverted through the machines. A cold water jet rinses the cans before they enter the machine. A pump supplies hot washing solution from a tank to the first set of jets; another pump supplies hot rinse water from a second tank to the next set of jets; steam is delivered through jets direct from the steam line and air blowers are operated by turbine, the air pressing through a radiator.

Upon investigating these types of machines it was observed that practically all failed to function properly. The chief difficulty was improper design and the problem was further complicated by lack of knowledge of the equipment and inattention to machine condition and results obtained. Few, if any, were found which provided for washing and rinsing the exterior of cans.

Because of the fact that satisfactory equipment was not readily obtainable it became necessary to endeavor to correct existing machines and to secure the co-operation of the milk dealers and machine manufacturers. All concerned willingly assisted in attempt to solve the problem by redesigning equipment on the market and by developing new machines. Some machines in use were decidedly improved by installing vertical and horizontal spray pipes for outside washing and rinsing, adjusting pump pressures on wash and rinse sections to approximately 35 pounds pressure and adjusting temperatures and control of the washing solutions and rinse water and redesigning air intakes by extending the air pipes to the outside of the building and enclosing the suction end in an air filtering box. This was possible with many of the machines but others were of a type which did not permit many of the features to be installed. To put the machines in good operating condition, even after additions and alterations, they were operated with a muriatic acid solution of about two to three per cent strength to thoroughly remove all deposits from washing solutions and hard water from the pipes, jets and fittings. Occasional treatment of this sort will keep the machines in good condition for proper functioning.

After repeated experiments and construction of several machines the following suggested specifications were prepared as it was found that machines embodying the features enumerated and operated according to the temperatures specified gave satisfactory results.

Suggested Specifications for Can Washing Machines

Capacity: 7 or 8 cans per minute.

1. *Pre-rinse Section:*
   - (a) Fresh milk cans and covers:
     Cold water rinse—rinse water to waste after use.

     Rinsing jet to be placed on water line and operated by can tripping valve or by other device.
   - (b) Milk products cans and covers:
     Two (2) sections may be necessary.
     Warm water rinse at about 110-120° F. to be used for pre-rinse and water to waste after use.

     Rinsing spray jet is placed on water line which is connected with steam line by a "mixing T" or similar device.

     Spray jet is operated by the can tripping the valve or by other means.
   - (c) Rinsing must be sufficient to deliver cans and covers to washing section in proper condition for washing.

2. *Washing Sections:*

   Equip with two washing sections in duplicate. Both units to be designed to properly wash entire inner and outer surface of cans and covers. This may be accomplished with multi-spray or special jet for interior of containers with branched piping drilled with 1/16″ holes about 1″ apart and staggered to wash exterior surfaces. "Spray pots" may be used for washing interior and exterior covers.

   Both washing units to be supplied from one solution tank.

   Solution to be maintained at constant strength, and to be "free-rinsing."

   Solution to be about 150-160° F.

   Washing units to be operated on at least 35 pounds per square inch pressure.

3. *First Rinsing Section:*

   Single unit rinsing section supplied with clean water at a temperature equal to that of the washing solution. This rinse water to waste or drain back to solution tank, provided solution strength is maintained as overflow drain must be installed.

4. *Second Rinsing Section:*

   Single or double unit rinsing section supplied with clean water at, at least, 180° F. This water to drain back to rinse water tank and may be reused, provided fresh water is constantly added and temperature maintained and overflow drain installed.

   Rinsing section units No. 3 and 4 to be of same design as washing section units and operated on a like pressure.

5. *Control:*

Washing solution and rinsing water to be controlled by thermostats, and accurate thermometers with 1° F. to each scale division to be installed on each section at a convenient place.

Pumps:

Two pumps are required: One (1) on solution tank and one (1) on rinse water tank. Centrifugal pumps operated with one (1) double end motor may be used.

Mechanism to be controlled as to maximum speed.

6. *Steaming Sections:*

Equip with one (1) or two (2) steaming jets to be operated by container tripping the valve or by other device.

High pressure dry steam to be delivered.

7. * *Drying Sections:*

Equip with two (2) hot air blower sections, air to be of sufficient volume and temperature to deliver a perfectly dry container.

Air intake pipe for blowers to be extended to exterior of building and intake end to be enclosed in an air filter box, and located so as to be protected from storm.

8. *Piping and Fittings:*

Brass piping and fittings are evidently the most satisfactory and are preferable to iron or steel. Washing and rinsing units should be made with screw joints and caps to be set "hand tight" for operation. All units should

* A final cold air blower section is employed on some machines with the claim that same eliminates moisture from condensation or "sweating" in the hot cans in atmospheric temperature. However, when operating temperatures are progressively increased up to steaming sections this condition is not noted.

be connected to main supply pipes with a union easily accessible. This arrangement makes possible daily disassembling for cleaning.

9. *Tanks:*
   Solution and rinse water tanks shall be so constructed and installed as to prevent contamination of rinse water with washing solution or weakening of washing solution by drainage from one to the other.

Suggested Specifications for Rinsing, Steaming and Drying Machine for Use With "Hand Washed" Cans

Construction of machine of this type should embody the following specifications as enumerated above for "*Can Washing Machine*":

1. *Pre-rinsing Section:*
   Water to be 120-130° F. and to waste after use.
4. *Second Rinsing Section:*
5. *Control:*
   Thermostat and thermometer for water tank.
   Pump:
   Pump to be operated at 25-30 pounds per square inch.
6. *Steaming Section:*
7. *Drying Section:*
8. *Piping and Fittings:*

The above specifications have been studied by various can washing machine manufacturers and many of the suggestions have been incorporated in machines now on the market. Further study is being given this subject by these people and advancement is being made. Some are giving special attention to machines for ice cream plants.

It will be observed from the above specifications that drastic changes have been suggested but nevertheless these have all been found to be necessary. It is important to select equipment on sturdiness of construction, and results obtained. In the past it has been the practice to sell and purchase on competitive price basis rather than on the merits of the equipment. This has been one of the reasons for cheaply designed machines which did not function properly.

Through the co-operation of all concerned and the results obtained and the continued experiments being carried out the investigation has proven to be of value to all concerned.

SOME BACTERIOLOGICAL AND TEMPERATURE STUDIES IN MILK PLANTS

C. Sidney Leete

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From the standpoint of milk inspection, each milk plant must be considered as a separate unit. Each plant has its own individual characteristics yet there are factors which study has shown are common to all plants and as a result certain definite rules, methods and suggestions for procedure in inspection work can be laid down. Also, due to these same factors, studies made of individual plants can be grouped together and treated as a whole.

Several years ago bacteriological and temperature studies in approximately 100 milk pasteurizing plants were made by the Bureau of Dairy Industry, United States Department of Agriculture. Mr. L. H. Burgwald and the author under the direction of Mr. Ernest Kelly of that department, carried on the study. The plants studied were located in 10 states and the District of Columbia. The plants were not "hand picked" but in a sense, were studied as they came. Large, medium and small size plants and what may be conveniently termed good, fair and poor plants from a sanitary standpoint were studied during the investigation. Various types of equipment, as well as varied methods in plant practices were, of course, encountered. In other words, the plants in which the work was done were representative of conditions in the area covered.

At each plant, studies were made on 5 consecutive days. It was believed that this procedure would procure a fair average picture of each plant and that if an exceptional or out of the ordinary day's run was encountered, the average for 5 days would not be unduly affected. "Standard Methods" were employed in making plate counts and every effort was made to have results comparable. To this end all media were made in the Bureau of Dairy Industry laboratories and but two men did all the plating throughout the study. At each plant, daily samples of milk were taken as the milk went through the plant. A sample of raw milk was the first taken. Insofar as possible, this milk was followed through the plant. A study of the data shows that there were but 5 points at which samples were secured which were common to all plants. These samples were:

1 Raw milk prior to pasteurization.
At times this sample was secured directly from the pasteurizer and in other instances from the storage or receiving tank.
2 Pasteurized milk after holding just prior to cooling.
Here again the exact place of sampling varied. This particular sample was taken either from the pasteurizer or as near the pasteurizer outlet as possible.
3 The third sample was taken from the bottom of the cooler.
4 The fourth sample was taken from a filled bottle.
5 The fifth from the same bottle after it had been held in storage for 24 hours.

Four hundred and eighty-one samples were procured at each of the points indicated and a study of the average of these samples shows that there was a progressive, yet fairly constant, increase in bacterial count as the milk moved from the pasteurizer through the plant and out of storage. The average count of raw milk was 1,050,000. After pasteurization it had decreased to 28,600 or a 97.3 per cent decrease. At the bottom of the cooler, the count had increased approximately 14 per cent, the average count being 32,600. A further increase of 13 per cent was found in the bottled milk. The bacterial count was 36,800. The count increased to 39,500 or approximately 7.5 per cent during the 24 hour storage. The total increase in count from the time the milk left the pasteurizer until it was taken out of storage after 24 hours was 10,900 or 38 per cent.

Inspectors, from a practical standpoint, can very well see that there is no point in the milk plant which they can overlook or slight. Each process is important from a viewpoint of securing and maintaining low bacterial counts. Under ordinary circumstances, it would be falling down on the job to put particular emphasis upon proper cleaning and sterilization or cooling equipment without a similar emphasis being placed on the treatment of the bottle filler, bottles and proper storage facilities. Just in the way of emphasis to bring out the fact that each part of the pasteurizing plant, including coolers, fillers and storage has an important bearing upon the bacterial count of the finished product, I will repeat the average bacterial counts as found in this study.

Raw milk	1,050,000 per c. c.			
Pasteurized milk	28,600 per c. c.	—decrease	97.2	per cent.
At bottom of cooler	32,600 per c. c.	— increase	14	per cent.
Bottled milk	36,800 per c. c.	— increase	13	per cent.
Bottled milk from storage	39,500 per c. c.	— increase	7.5	per cent.
Total Increase	10,900 per c. c.	— increase	38	per cent.

Most of us have met with the so-called "pin point" colonies in our inspection work and during this study 41 samples showed this type of colonies on the pasteurized milk. No effort was made to further identify these colonies. A study similar to that given above, but dealing only with samples showing "pin points" gives entirely opposite results. As the milk passed from the pasteurizer over the cooler into the bottle and later from 24 hour storage, the bacteria count decreased. The total per cent decrease being 21.6 per cent with the greatest decrease, 18.6 per cent occurring during the storage. The following is a summary of the study of these pin point samples:

Raw milk	1,622,000
Pasteurized milk	106,600—decrease 93.4 per cent.
Bottom of cooler	103,700—decrease 2.9 per cent.
From bottle	102,900—decrease .77 per cent.
From storage	83,700—decrease 18.6 per cent.
Total	22,900—decrease 21.6 per cent.

In connection with the bacterial studies, certain temperature studies were also made and from the data obtained it is believed that a more thorough study of temperatures should be made both by milk plant operators and milk inspectors.

Recording thermometers with 24 hour charts, together with maximum-minimum thermometers were used. The samples referred to as "storage samples" were immediately after being bottled placed on the recording thermometer thus obtaining accurate air storage temperatures for these samples. The temperatures of the samples were approximately 50° F. or below at the time they were placed in storage. Fifty-five samples were in cold rooms, the average temperature for 5 days being below 40° F. These samples showed a decrease in bacterial count of 2,163 per c.c. Twenty-seven and two-tenths per cent of these samples showed an increase. When the average temperature for 5 days was between 40 and less than 45° F., the decrease was 587 per c.c. for 135 samples. Thirty-seven per cent showed increases. Fifty-five samples were stored at temperatures above 45° F., the highest average temperature being 50.8° F. Seventy-three and eight-tenths per cent of these samples showed an increase in bacterial count. The average increase was 15,688. From these figures we are led to believe that storage temperatures have a most important bearing upon the final bacterial count and that careful study should be made of the effect of storage temperatures upon the bacterial count in milk.

At various points in storage rooms maximum-minimum thermometers were placed and read at the end of 24 hours. The points of location of these thermometers were selected, not with the idea of finding even temperatures, but for the purpose of finding extremes. In this connection "dead pockets," doors and chutes were chosen for the location of the instruments. However, these locations were where milk was or might be stored. Temperatures thus procured were obtained in 29 plants. The average variation for the period studied (the average for each plant being 4.89 days) were at the three different points 12.5° F., 12.7° F., and 13.7° F. Six plants showed an average variation of over 20 degrees Fahrenheit. In contrast to these plants, there was one plant which varied on the average for 5 days at 3 different points 6.4°, 6°, and 4.2°.

It may be of interest to know that at one plant a variation of 32° at one point during 24 hours was recorded. A high temperature of 72° being reached, while in other parts of this same room the highest temperatures were in the low fifties. It is conceivable and very possible that such a "dead spot" or "pocket" may cause serious trouble to milk plant operators. Proper circulation of air would overcome such spots or pockets. A small fan installed in a storage room has been the means of equalizing temperatures throughout the room.

In studying recording charts in storage rooms, it is interesting to see that even though the average temperature in some rooms is well below 50° F. that the temperature for a more or less prolonged period is above that figure. A few instances will suffice to show that care should be taken in studying and controlling storage temperatures.

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The improved PERFECTION PULL and HINGE CAP completes the work of protection which begins under your careful inspection. It prevents contamination after the milk bottle is opened, by eliminating the danger of ever leaving the bottle uncovered. (Note how it enables the milk to be poured without removing the cap.) Safeguards purity and wholesomeness until the last drop is used! A month's supply for trial in your own household gladly sent on request.

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Manufacturers of . . . PERFECTION PULL . . .
PERFECTION HOOD . . . PERFECTION STANDARD

Room	Average Hourly Temperature	Hours Above 50° F.
A	48.1	5.5
B	45.3	5.25
C	44.1	5
D	45.8	8
E	46.9	7
F	48.6	7
G	50.3	11¾

The foregoing discussion has taken into consideration, in a brief way, some of the points brought out during this study. A more detailed account of the work will be given in a publication soon to be issued by the United States Department of Agriculture, Bureau of Dairy Industry. These studies have shown that for the proper control of milk pasteurizing plants, no one point met with in pasteurizing and subsequent handling can be overlooked or slighted if milk of low bacterial count is to result. Cooling, bottling and storing are all important. The investigation has also shown that careful study should be made of storage room temperatures. Recording thermometers with 24 hour charts, together with maximum-minimum thermometers placed at various points in the room seem to be a practical and worthwhile way for studying storage temperatures and it is believed that this phase of milk plant operation and control has not received the careful study which, due to its importance, it deserves.

OBSERVATIONS ON EFFECTS OF THERMOPHILIC BACTERIA IN PASTEURIZED MILK

Harry A. Harding, Ph.D.

and

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During the past eight years we have been striving to bring home to our colleagues the fact that milk is commonly supplied with bacteria which grow abundantly in

the pasteurizing machinery and which are very common in pasteurized milk. At first the strangeness of this idea caused it to be met with skepticism. However, this has gradually given place to an acknowledgment that there are such bacteria. On the other hand, it is still commonly held that these bacteria are to be found in some other state and are rarely present in large numbers, that whenever they are abundant some one is at fault and when the plant is handled properly they will disappear.

Nevertheless, with very few exceptions we have found them present in considerable numbers in the pasteurized product in every plant examined during recent years. Wherever the plant is large enough to be in operation five or more hours the numbers present in the pasteurized milk at the close of operations commonly amount to more than a million per cubic centimeter.

There seems to be the best of evidence that the presence of these amounts of bacterial life does not have any sanitary significance. However, in many cases these bacteria do exert an influence upon the commercial attractiveness of the milk and this leads to the necessity of keeping them under control. In this paper the attempt is made to present some indication of their presence and action.

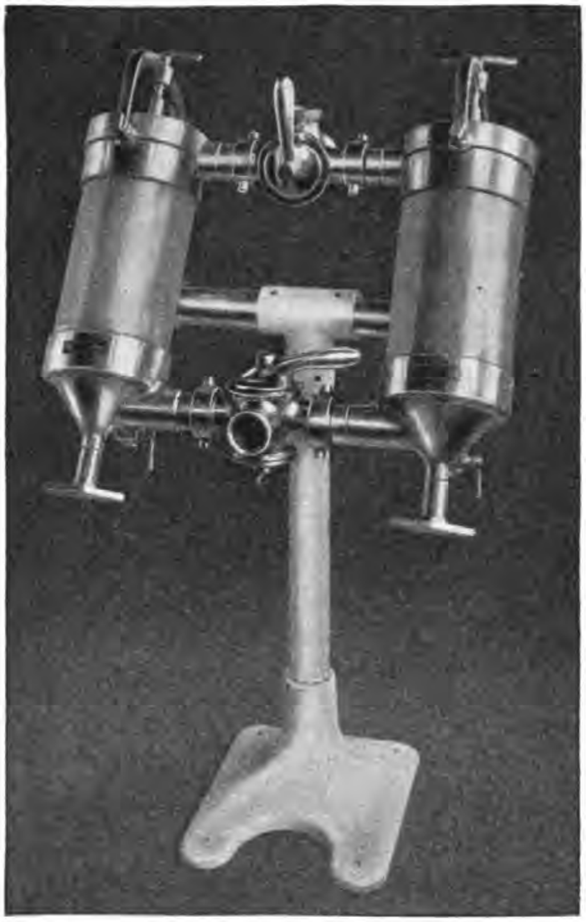
TABLE 1

SHORTENING OF REDUCTION TIME WHILE IN HOLDER AT PASTEURIZING TEMPERATURE

Coil Vats—Massachusetts Plant

Holding Time	Reduction Time Before	Reduction Time After	Shortening of Reduction Time	Shortening Per Minute Of Holding
Minutes	Minutes	Minutes	Minutes	Minutes
30	457	283	174	5.80
30	255	235	20	.67
30	39	15	14	.46
40	283	181	102	2.55
115	37	5	32	.278
91	255	133	122	1.34
39	39	15	24	.615

ECONOMY TWIN FILTER



The Economy Twin Filter is really two complete filters mounted on a single stand with a sanitary three-way valve at the inlet and another at the outlet.

By means of these valves the flow of milk can be either evenly divided between the two barrels or the entire flow put through one barrel.

To change the bags it is merely necessary to put the whole flow through one barrel while the bag is changed in the second barrel. By repeating the process, the bag in the first barrel can likewise be changed. Thus, both filter bags can be changed as often as necessary without ever holding up the flow of milk through the equipment.

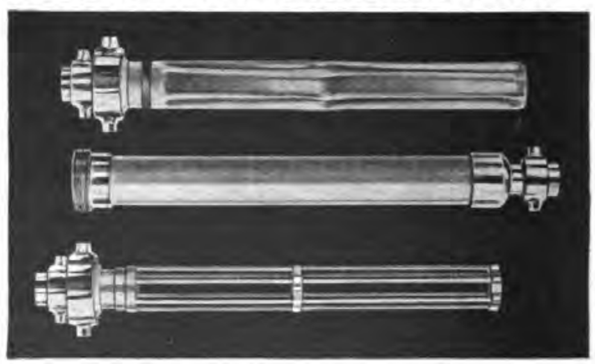
The construction of the Economy Twin Filter permits the use of exceptionally large filter bags. In fact, the Economy Twin Filters have a larger filtering surface area per thousand pounds of rated capacity than any other filter on the market.

Made in four sizes—8,000—12,000—16,000 and 20,000 lbs. per hour. Strictly sanitary, easy to clean, and moderately priced. Be sure to get complete details.

ECONOMY SANITARY PIPE LINE FILTER

The Economy Pipe Line Filters are strongly built of Standard Sanitary Fittings and Tinned Copper Tubing. Their construction is similar to that of the Twin Filter, with a resultant maximum area of filtering surface in a minimum of space.

Economy Pipe Line Filters are made in three sizes—1,800—3,000 and 6,000 lbs. per hour. Furnished complete with all fittings necessary for installation and with 25 extra filter bags.



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Glass Lined Tanks—Connecticut Plant

Holding Time	Reduction Time		Shortening of Reduction Time	Shortening Per Minute Of Holding
	Before	After		
Minutes	Minutes	Minutes	Minutes	Minutes
30	116	75	41	1.36
30	65	28	37	1.23
30	80	57	23	.76
30	63	35	28	.93
30	78	54	24	.80
30	53	21	32	1.06
30	268	221	47	1.57
30	87	71	16	.53
30	240	223	17	.56
30	136	105	31	1.03
30	120	60	60	2.00
30	138	60	70	2.33
30	267	210	57	1.90
30	62	23	39	1.30
30	203	169	34	1.13
30	151	137	14	.46
44	116	74	42	.95
53	120	37	83	1.56
60	80	22	58	.97
60	268	179	89	1.48
76	65	13	52	.68

Electric Flash Pasteurizers—Pennsylvania Plant

Minutes of Operation	Beginning	End	Shortening of Reduction Time Minutes	Shortening Per Minute of Operation
80	270	250	20	.25
140	280	232	48	.34

Their Reducing Effect Upon Hot Methylene Blue Test

In the seventeenth annual report of this Association, in a paper by ourselves with Dr. H. G. Harding, attention was called to the fact that when the methylene blue reductase test is applied to pasteurized milk and the test is conducted at 145° F. it becomes at least a rough indicator of the activity of thermophilic bacteria. Such a test of pasteurized milk in which thermophilic bacteria are absent, or present in very small numbers, may not reduce in several hours. On the other hand, pasteurized milk in which they are active in large numbers may reduce in five minutes or even less.

In order to emphasize the practically universal presence of thermophilic bacteria in numbers sufficient to affect the reduction time of pasteurized milk, we are presenting in the following table observations from three widely separated plants. These are not selected observations but include all of the comparisons which are available for these plants.

The very act of pasteurization as it is ordinarily conducted requires the holding of the milk at 142° F. or above for 30 minutes. Observations of the time required for reduction of hot methylene blue of the milk as it is brought to the pasteurizing temperature and again of the same milk at the end of the 30 minute holding period furnish one set of comparisons. Since some time is required to empty pocket holders and the emptying process is not always begun at the close of the 30 minute holding period, a comparison between the reduction time of the milk at the time it came to pasteurizing temperature with the same milk as the vat is being emptied offers a measurement of the influence of a longer period of holding. The data follow in Table 1.

It will be noted that a part of the data comes from a plant in Massachusetts. In this plant the pasteurization takes place in two coil vats, the milk being heated and held in these.

In the case of the data from Connecticut, the milk was heated in a continuous barrel heater and held in three glass lined holders.

The data from Pennsylvania were obtained from two electric flash pasteurizers operated at 162° F. the period of operation of each machine being 80 and 140 minutes respectively.

It will be noted that the reduction time at 145° F. for the milk as it was heated to pasteurizing temperature varied from 457 minutes to 37 minutes. Likewise, the reduction time after pasteurization varied from 283 minutes to 5 minutes.

The table is presented primarily to show that in every case the reduction time of the milk which has been held at pasteurizing temperature for 30 minutes or more is shortened and that the longer the holding the more pronounced the shortening.

In order to facilitate comparison of this effect in the case of different lots of milk there is introduced into the table a column showing the shortening of the reduction time per minute of holding. It will be seen that the numbers in this column vary rather widely indicating that other factors than the mere time of holding exert considerable influence upon the rate of shortening of the reduction time.

Their Influence Upon the Acidity of the Milk

In 1923 Hungerford and Harding reported a study of the effect upon the acidity when samples of pasteurized milk were held at 145° F. for some hours. In some cases the acidity fell for a time suggesting that some of the thermophilic bacteria reduced the acidity of the milk. However, in all cases the acidity later rose showing that acid forming bacteria were present in such pasteurized milk.

Where samples of milk are held at 145° F. for twenty-four hours curdling from acid formation commonly occurs. Approximately fifty per cent of a considerable number of samples of certified milk held at 145° F. have curdled with an acid curd within twenty-four hours.

In the instances which have been observed in the milk plants where the development of thermophiles was excessive, increase in the acidity of the milk was demonstrable by the ordinary titration method.

In the case of the sample from Massachusetts given in the tabulation with a holding time of 115 minutes, the acidity had changed from .17 at the beginning of the heating process to .26 when the reduction time had been reduced to 5 minutes. When it is remembered that this development of acidity took place in a coil vat which had been filled for the second time that day and after the milk had been held but an hour and twenty-five minutes beyond the pasteurizing period it will be seen that thermophilic bacteria can be a serious problem in connection with the acidity of pasteurized milk.

In plants which are handled according to what is considered the best plant practice, development of titratable increases in acidity usually accompanies runs of six hours or more.

Their Influence Upon Flavor of Milk

It has long been observed that as the acidity of milk rose the milk lost its original fresh taste and became somewhat flat. As the titratable acidity rises from .20 to .25 the milk gradually takes on disagreeable flavors by degrees coming to a condition where they are nauseating. At about .3 to .4 per cent of titratable acidity, there begins to be a distinct taste of acidity.

We have repeatedly observed instances where the acidity of the milk pasteurized at the end of a run of 10 or more hours had been so increased that it could be detected by taste.

We have come upon at least one instance where the milk served at a school was so changed in acidity that some of the children drinking it became nauseated.

We have repeatedly come upon instances where heating the milk in connection with culinary operations led to curdling and this condition was found to be due to increased acidity as a result of the development of these thermophilic bacteria. In all these cases change in the flavor accompanied this development of acidity.

Particularly in connection with the larger plants but also frequently in the medium sized ones the damage to flavor due to the growth of thermophilic bacteria is one of the serious plant problems.

As was stated at the beginning of this paper, the object of this presentation is to bring home to every milk inspector the fact that thermophilic bacteria are present and active in the product of practically every pasteurizing plant in your city. While they do not present a health problem they are a serious factor in providing a milk supply which will please the public and stimulate the consumption of more milk. They are particularly troublesome in that they destroy the fresh attractive flavor which is desired.

From what has been learned regarding thermophilic bacteria in milk during the past eight years it seems plain that it is futile to talk of banishing them from the milk supply. They are merely a part of the group of acid bacteria with which we have been familiar. Like the better known members of the group they will undoubtedly continue to be present in our pasteurized milk supplies. Since they do not present a sanitary problem it is merely necessary that we control them to such a point that they will not injure the commercial qualities of the pasteurized milk.

A SURVEY OF THE NEW YORK STATE MILK AND CREAM SUPPLY

W. D. Tiedeman

Chief, Bureau of Milk Sanitation

New York State Department of Health

The New York State Department of Health is this year engaged in making an intensive survey of the milk and cream supply of the state in accordance with a law passed by the last legislature. This law carried with it an appropriation and provided that the state commissioner of health make an investigation, study and survey within and without the state to determine, among other things, the following: (a) the present sources of supply of milk and cream for household consumption and

for manufacturing purposes and the amount produced by such sources; (b) the adequacy of existing state and municipal machinery for the enforcement of sanitary regulations and the extent to which impurities have escaped detection and prevention; (c) the proper state or local agencies or combination of agencies to be entrusted with the duties and responsibilities of effective sanitary control and inspection of milk and cream in its various local and state-wide phases; (d) the probable cost to the state of adequately enforcing the rules and regulations of the commissioner and the public health council; and (e) such other relative or pertinent information as the commissioner may deem necessary.

Although economic considerations as well as health considerations influenced the passage of this law, it is perhaps a recognition of the principle that the protection of health is sound economics. As a result of the survey it is hoped that means will be developed (1) to get more uniformly good inspection throughout the state and near-by areas under inspection comprising the so-called "New York Milk Shed" from which the state must necessarily draw its milk and cream for fluid consumption; (2) to prevent the sale for fluid consumption of so-called "bootleg" milk and cream from uninspected sources; (3) to prevent the diversion into fluid milk and cream channels of milk and cream from uninspected sources purchased for manufacturing purposes and (4) to gradually raise the standards of cream used in the manufacture of ice cream.

The magnitude of the problem of making a state-wide survey was at first rather appalling. Fairly complete information was available concerning the milk supply under the inspection of New York City health authorities coming from sources under close inspection in a definite milk shed. This supply totals about 3,000,000 quarts daily. To get information concerning the quantity, quality and sources of the milk supply of the remainder of New York State under the inspection of approximately 875 different health officers, and probably equal in quantity to the New York City supply, is a much more complex problem. To add to the complexity of this problem, fluid cream roughly estimated at about 75,000 quarts daily was being received from sources many of which were not under inspection.

In undertaking this survey the Department added eleven men to its existing staff of five men on milk work and constructed two laboratories on wheels fully equipped for making official plate counts and Breed counts, and secured seven automobiles. In addition several inspectors have been employed on a part-time basis for sampling shipments of cream from distant sources at the principal points of entry.

The survey now under way includes the following:

1 A statistical study of quantities of milk and cream received and sold by the various plants, large and small, throughout the state.

2 An investigation of the activities of the 875 health officers in the state with particular reference to the extent to which they are performing specific duties which the sanitary code places on them.

3 Sampling and recording shipments of cream received from distant points not under regular inspection.

4 An investigation of the principal distant sources of cream supply including inspections of pasteurizing plants, receiving stations and a representative number of dairies and also the examination by the Breed method of samples of producers' milk.

5 An investigation of the local milk and cream supplies of a representative number of New York State municipalities by laboratory field parties using mobile laboratories.

The basic data for the statistical survey are being obtained by our survey parties in the places surveyed and in other places by our fifteen district state health officers, by reports of plant operators secured by correspondence, and from the statistical data routinely collected by the State Department of Agriculture and Markets. It is expected that this information will show the available quantities of milk and cream for fluid consumption, the demand for such milk and cream, also the amount of milk and cream used for manufacturing purposes and the sources from which it is obtained, and that a system of reporting quantities may be developed whereby diversions of large amounts of cream for manufacturing purposes into fluid channels may be detected.

The activities of local health officers are being investigated by the fifteen district state health officers. The data collected to date show that many health officers of small communities are neglecting important phases of milk control work. This is not surprising since practically all the health officers in villages and towns are part-time officials with little, if any, training in milk control work and, except in a few instances, without expert assistance. There are, however, many instances in which health officers of smaller communities have made a hobby of milk control which has resulted in giving some of these small municipalities as good or better milk supplies than some of the large cities. It appears that full-time inspection by county authorities may be the answer to this problem. The law provides that the state may pay half the cost of such county milk inspection whether in connection with a county health unit or not.

The work of sampling shipments of cream for manufacturing purposes received from distant sources is being carried on by part-time inspectors at the several points of entry. Essential data are being recorded concerning each shipment, a Breed smear made from every fifth can and a sample from each shipment sent to the laboratory for an official plate count.

The investigation of distant sources of cream supply has been carried on by a single man traveling by automobile and carrying with him a kit for making Breed smears. He inspects plants and dairies and collects smears of producers' milk.

The investigation of local milk supplies constitutes the major part of the survey. This work includes the inspection of pasteurizing plants, raw bottling plants and a representative number of dairies serving each municipality, and also the making of official plate counts of samples of bottled milk and cream collected on the street and the making of Breed counts of producers' milk as delivered to plants. It has been necessary to limit the work to what can be done with the force available during the course of a year. In order to secure and average the results of several examinations at different seasons the extent of the surveys has been limited to what can be accomplished in four months with a view to repeating the surveys three times during the course of a year. However, due to the loss of considerable time in organizing the new staff and securing necessary equipment, and a contemplated slowing up of field work during the severe winter weather, it will be possible to repeat the surveys only twice during the year.

It has been arranged to survey the milk supplies of definite municipalities rather than of definite areas. A schedule has been arranged whereby the mobile laboratories are stationed at certain centers of population for periods of from one to three weeks and the milk supplies of municipalities within a fifteen or twenty mile radius are surveyed from these centers. The municipalities listed for survey total 160 varying in size from a few hundred population to half a million and having an aggregate population of about 2,750,000 representing 58 per cent of the population of the state outside of New York City. It is believed that the results will be fairly representative of the milk supply of this portion of the state.

Each laboratory party consists of four men having three automobiles with them in addition to the laboratory bus. The amount of laboratory work that can be done is largely governed by the number of samples that can be collected which is the reason for having parties of this size. The usual procedure is for all four men to collect each morning either street samples of bottled milk and cream for official plate count or Breed smears of producers' milk as delivered to plants. In the afternoons two of the men work in the laboratory and the other two inspect plants and farms.

The effort is made to inspect and collect Breed smears at all pasteurizing and bottling plants, to inspect all farms up to 40 in municipalities of less than 10,000 population, 50 farms in municipalities of from 10,000 to 150,000 and 100 farms for cities of over 150,000 population. We cannot afford to spend the extra time necessary to get every plant and every sample but it is believed that large enough numbers are obtained to be representative.

It is rather early to discuss results of the survey. There are, however, certain general observations that can be made at this time. In the first place, a survey of what we believe to be average milk supplies will certainly open one's eyes with respect to the possibilities for further improvements. Comparisons show that the quality of milk in different places varies considerably. Particularly good results when obtained can generally be traced to the particular interest and enthusiasm of some health officer or milk inspector or to the consistent effort of some plant operator.

Comparisons of large numbers of dairy inspections by various members of our staff show marked tendencies for the personal element to enter into reports. Certain persons tend to stress certain items of sanitation while others stress other items. We also note either a surprising ignorance on the part of plant operators or tendency to answer questions carelessly. In one city where the health department has made a special effort to make physical examinations of milk handlers including laboratory examinations, the majority of operators claimed no credit for having had these examinations made.

There also appears to be a tendency for our bacteriologists to get higher counts than some local laboratories are accustomed to get. In other places we are checking fairly closely low counts obtained by local laboratories. This is as might be expected and every effort is being made to check our work. Breed counts are being reported in four groups covering a wide range. Group 1 includes counts under 100,000, group 2 counts between 100,000 and 300,000, group 3 counts between 300,000 and 1,000,000 and group 4 includes all counts over 1,000,000.

We find that much of the milk delivered to plants is running higher in count than the sanitary code permits. This may be accounted for by the fact that very little laboratory work has been done to check the quality of milk delivered to plants. Many official plate counts upon street samples of both raw and pasteurized milk and cream are also above the maximum prescribed in the sanitary code. In general, however, pasteurization has been found to be effective and the percentage of milk pasteurized relatively high.

There will probably be much more to be said before the survey is completed. We believe that the general effect is going to be good, that milk control work will be stimulated, the general quality of milk improved, and the percentage of pasteurized milk used increased. One fairly large city has already requested the department to lend a representative to assist them in starting a general clean-up among the dairies and plants.

Thursday, October 23

2:00 P.M.

JOINT MEETING

INTERNATIONAL ASSOCIATION OF DAIRY AND MILK INSPECTORS

WITH

PRODUCTION AND LABORATORY SECTION INTERNATIONAL ASSOCIATION OF ICE CREAM MANUFACTURERS

A. R. B. RICHMOND, V.M.D., *Chairman*

The Joint Session, International Association of Dairy and Milk Inspectors with Production and Laboratory Section, International Association of Ice Cream Manufacturers, was called to order by Mr. A. R. B. Richmond, who acted as chairman, in the ballroom of the Hollender Hotel, Cleveland, Ohio, October 23, 1930, at 2 o'clock P.M.

MR. RASMUSSEN: Gentlemen, this joint meeting today is really an innovation in our industry. I think it is the first time in the history of the industry that we have ever had a joint meeting with some other association. It is rather a coincidence, perhaps, that both of these associations should be international associations and that each of the two associations should have members from Canada, our neighbors to the north.

It is, to me, a very fitting union of these two groups, because their interests are very much in common. It is my pleasure at this time to present to you the chairman of this meeting, a man from across the border, the First Vice-President of the International Association of Dairy and Milk Inspectors.

It gives me pleasure to present to you Mr. A. R. B. Richmond, of Toronto, Canada.

THE CHAIRMAN: Gentlemen, I should first like to thank those who have been responsible for giving me the privilege and great pleasure of acting as chairman of this joint meeting this afternoon.

There never was a time in the history of the world, at least in as far as our present civilization goes, when one man was more dependent upon another. We are all absolutely interdependent and one has only to attempt to pursue an independent course in his work or in his life, in any of his activities, to realize almost at once how very dependent he is upon his fellow man. What applies to the individual must necessarily apply to bodies of men such as our associations, and it is a very fitting and desirable thing, and I hope it will be continued in the years to come, that we may cooperate in the way we are doing this afternoon, in discussing subjects in which we both have a common interest.

We have a very extensive and what promises to be a very interesting program ahead of us and it would be out of place for me to take up any further time. So I will call upon Mr. Fred Rasmussen, of the International Association of Ice Cream Manufacturers to present his paper, "Cooperation Between the Ice Cream Manufacturers and the Official Inspectors."

COOPERATION BETWEEN THE ICE CREAM MANUFACTURERS AND THE OFFICIAL INSPECTORS

FRED RASMUSSEN
Executive Secretary, International Association of Ice Cream Manufacturers
Harrisburg, Pa.

To Mr. Irwin, Chairman of the Program Committee of the International Association of Dairy and Milk Inspectors, is due the credit for taking the first step to bring about this joint session.

The members of the International Association of Ice Cream Manufacturers welcome the opportunity to meet with the regulatory officials of the Dairy and Milk industries because their interests are in common. You, as regulatory officials, are charged by laws and regulations with the responsibility of protecting the public against milk-borne diseases and insanitary dairy products. We, as manufacturers and distributors of a perishable food, have the same responsibility.

Recognize Responsibility

A progressive ice cream manufacturer not ony recognizes his public responsibility, but as he has a large investment in plant and equipment and a well-established business, he cannot afford to ignore the possibility of a spread of milk-borne diseases through his product, or the danger to the public from insanitary conditions. To protect his investment and his reputation there must be a constant check upon the products and the methods of handling these products. To these manufacturers, personally, belongs the credit for the development of efficient factory practices and sanitary control of our product. They do not need official sanitary regulations. Many progressive manufacturers have established sanitary regulations of their own, the compliance with which they check every day.

Although there are comparatively few manufacturers who would sell an unsafe product, it is nevertheless necessary to have laws and regulations which apply to all in order to protect the industry and the public against the mistakes of a few.

Ignorance and desire for personal gain as a menace to public health are seen in all food industries. Because of the presence of these human factors in all industries com-

prising a large number of units, it has become necessary to have official sanitary health regulations governing the manufacture and sale of dairy and other food products.

During the early history of sanitary regulations, mistakes were frequently made because of lack of cooperation between regulatory officials and industry. It was common for those in authority by themselves to work out what theoretically or in their judgment constituted suitable regulations, get them adopted, and then proceed to enforce them. Their attitude frequently was that of the dictator backed by the police power of the municipality or of the state. The opinion of the industry was given little or no consideration. Let it be understood, however, that this early condition cannot be blamed entirely upon regulatory officials; industry must share at least half of this responsibility for it wanted to be left alone and to be as free as possible from all regulations. Consequently, regulatory officials were looked upon with suspicion and they received little encouragement or cooperation from the industry.

Closer Cooperation

Today, there is a complete change in the attitude of food producers and distributors toward legislation. In the early days, public officials frequently had to originate legislation and practically force its enactment. Today, progressive manufacturers seek the aid of regulatory officials in the fostering of sound legislation. Food legislation has largely passed from being a political contest to cooperation between public officials and progressive food manufacturers with the initiative frequently coming from the manufacturers. As a result, laws are being developed which give the maximum protection to the public.

A great change has also taken place in the enforcement of laws and regulations. Food inspection has passed from being purely a police job to one of education and a progressive inspection force today does not measure its success by the number of prosecutions, but by obtaining compliance with the law with the minimum of prosecutions.

The working out of a sanitary code for ice cream is a good example of the new cooperation between industry and regulatory officials. Each association for some time had a committee working independently in trying to outline sanitary regulations for ice cream. It was logical, therefore, that their efforts should be combined as undoubtedly each group would have specific information to contribute in the development of a satisfactory code. It was a pleasure to be in constant contact with the work of these committees. At no time in the deliberations of the code was there any difference of opinion of those representing the two groups on any fundamental principles involved in making a sanitary code for ice cream for the protection of public health. To my knowledge, it is one of the finest examples of cooperation between two groups which might easily be supposed to have different viewpoints.

This code has been widely distributed among regulatory officials and we have received many complimentary letters from such officials. It must be recognized, however, that a code is of no value unless it is adopted and made applicable to all the ice cream sold. Sanitary regulations should apply equally to all ice cream sold to the public, whether from wholesale or retail plants.

There is no reliable data on the amount of ice cream manufactured and sold by retailers. The only absolute figures which have come to our attention are from the State of California, where all retailers, such as hotels, restaurants and others who manufacture and sell ice cream, must take out a license the same as do wholesale ice cream manufacturers. In California the retail manufacturers represented 10.3 per cent of the total production in 1929.

As most of you are aware, there have come into the market during the last two years unit freezers, especially designed for large retail stores. Very extravagant claims are made as to the value of these freezers. Some of these units are finding a place in the retail establishment, if not permanently, at least for a while.

In many states and cities the same supervision is not given to retailers that is given to wholesale manufacturers. Frequently reports are made of wholesale manufacturers of composition and bacterial content of ice cream but no similar reports are made of retail manufacturers. An inspection service which does not supervise ten to fifteen per cent of the output of an industry cannot give the health protection to the public which is desired, especially considering that the ten to fifteen per cent of which no supervision is made seldom have the facilities for properly taking care of both the raw materials and finished product as are found in the wholesale plants. Most wholesale manufacturing plants have laboratories for constant checking, which is out of the question for retail manufacturers to maintain because of excessive cost in relation to output.

Wholesale manufacturers of ice cream are anxious to work with regulatory officials in placing the industry on the highest possible plane. They will gladly submit to regulatory control but when they do this, they will expect that a similar control will be exercised wherever ice cream is manufactured and sold.

Frozen Custard Legislation

In nearly all states, laws and regulations prescribe the amount of milk fat and milk solids which ice cream must contain. The ice cream industry today in many places is faced with unfair competition from the sale of so-called "frozen custards" or "frozen fluff." The product is made of condensed milk, sugar and flavor, testing $1\frac{1}{2}$ to 4 per cent butterfat, around 16 per cent sugar and 22 to 26 per cent total solids. In some cases a small amount of egg products are included. This product contains practically the same constituents as ice cream and is in resemblance of ice cream, both in its manufacture and character, except it has a lower content of milk solids. It is made in unit freezers at point of sale, as in ball parks, amusement parks and other places where concessions are sold, where it is difficult if not impossible to maintain proper sanitary control. It is an unfair competition for ice cream manufacturers because, being able to produce a product which in fact is ice cream with a low milk solids and fat content, they can pay a higher price for concessions than ice cream manufacturers, who must conform to specific laws and sanitary regulations. That it is unfair competition is recognized by law in several states, like New Hampshire, Pennsylvania, Michigan and others. In these states the manufacturers of custards, or others using a coined name for a product sold in resemblance of ice cream, are required to take out a license and comply with the ice cream law of the state as regards milk solids. It would seem fair that where no legislation is found to protect the public against this imitation product, that dairy and milk inspectors interest themselves in getting these manufacturers under proper supervision and control.

The Bootleg Ice Cream Problem

Another subject which might well receive consideration by regulatory officials is that of bootleg ice cream. "Bootleg ice cream" is a term applied to ice cream sold by a manufacturer to a retail dealer who receives equipment and service and sells an advertised brand of cream of another manufacturer. A retail dealer will buy part of his ice cream from the so-called "bootlegger" at a lower price than he pays for the advertised brand of ice cream. It can be bought at a lower price because, as a rule, the quality is not as good and because the manufacturer who sells it furnishes no equipment and service to the dealers. The retail dealer continues to carry the name of the advertised brand of ice cream, both inside and outside his store. As it is customary for a store to carry only one brand of ice cream, people naturally expect that when purchasing ice cream in a store carrying the sign of a well-advertised brand of ice cream that they will receive this brand of ice cream. If they do not receive it they have been deceived.

It is, of course, impossible for regulatory officials to determine whether a dealer is selling two different kinds of ice cream but the proper cooperation between ice cream manufacturers and regulatory officials will make it possible to curb this evil.

Our Association is desirous of cooperating with all regulatory officials for the improvement in the quality of all ice cream sold to the public. We can do a great deal to help in as far as our own membership is concerned. We are helpless, except in a general way, as regards manufacturers outside of our organization. Upon the regulatory officials falls the responsibility for dealing with this group, both for the protection of the public and for the protection of ice cream manufacturers against unfair competition.

Ice cream has become an essential food product. Its high nutritive value and health protective value are universally recognized. The quality of all commercial ice cream has been constantly improved. We desire to keep the industry on a high plane and to make a safe product readily available to all.

THE CHAIRMAN: The discussion of the paper will be introduced by Mr. F. A. Korff, Assistant Director of the Bureau of Chemistry and Foods, Baltimore Health Department, in the absence of Mr. R. S. Craig.

DISCUSSION

Mr. F. A. Korff: I am reading this paper in the absence of Mr. Craig:

In being requested by Mr. Irwin to open a discussion of the subject of Mr. Rasmussen's paper, I feel singularly gratified since cooperation between the ice cream manufacturer and the health inspector has meant so much to the latter in Baltimore. It would not be going too far to state that such advance as we have been able to make in Baltimore in ice cream sanitation [and with due modesty, I know no other city where such rapid and extensive progress has been made] could not have been accomplished except through the most whole-hearted and perhaps unprecedented cooperation of our local ice cream industry.

Mr. Rasmussen has so well covered the subject in a broad general way that there remains only a few points that I can bring out from the point of view of the Health Officer or, as he has designated it, the official inspector.

Nutritive Value of Ice Cream. First, I feel that while the proper emphasis has been placed upon the possibility of the spread of ice cream-borne infections and the danger to the public therefrom, it occurs to me that the subject of the *nutritive value* of ice cream as a point of co-operation between health officials and the industry has not, as yet, been generally recognized.

As a dairy product, ice cream is entitled to the same consideration in regard to its nutritive properties as milk. There are, of course, limitations in the application in its feeding which should be observed, but, in general the nutritive advantages are identical.

The question of per capita milk consumption has occupied the attention of our Health Department for a matter of over two years. During this time an estimate of the exact quantity of fluid milk consumed in the City of Baltimore has been made by our staff. This study was instigated after the appearance in literature of statements regarding the quantities of milk consumed in other localities which we had reason to challenge. In brief, our investigation disclosed the fact that the people of Baltimore are drinking less than one half the recommended quantity of fluid milk per person per day. It is familiar to all of you that the leading authorities on nutrition have recommended the drinking of not less than a pint by the adult and a quart of milk by the growing child each day. You are also doubtless acquainted with the reasons set forth by such experts in recommending this per diem consumption of milk.

It is also generally held by our nutritional authorities that the consumption of milk in other forms is also highly desirable and that, if fluid milk is not drunk in sufficient quantities other milk products may be advantageously fed. Thus, in our city, we have two ways of increasing the quantity of milk consumed, one by fluid milk itself; the other in the form of milk products, including, of course, ice cream.

Educating the Consumer. It may be legitimately asked, why should a Health Department take an active interest in promoting the increased consumption of milk and dairy products. The answer includes at least two considerations: First, I am not inclined to the view that the duties of the food control official are necessarily circumscribed by seeking chemical adulteration or bacterial contamination, and that the best method of *preventing* disease consists solely of maintaining a vigilance over the possible sources of infection. I believe his duties also embrace in no small part the education of the public in matters pertaining to the conservation of its health through proper dietary and nutritional considerations. The prevalence of malnutrition itself, particularly among children will at once occur to the health officer of experience, as will likewise the need for extended dietary instruction in this field.

Further, a population whose diet is properly balanced is more likely, it has been held, to escape infection, even after exposure, to one in which the dietary is faulty. As a special instance, there appears to be a connection between certain types of respiratory diseases and calcium and phosphorus metabolism. An extension of this view would possibly include resistance to other infections. In general, therefore, there appears to be ample medical foundation for future emphasis by the health officer upon the nutritional aspects of public health.

I might add, as a corollary, to this first point that civic or economic considerations alone should tend to foster increasing attention to diet and nutrition. While deaths from infectious diseases represent, in terms of money, a great economic loss, this is slight in comparison to the loss of time and other factors involved in the so-called minor illnesses. The cost to the nation for the common respiratory infections, generally classified under the term "colds," is enormous, running into several hundred millions of dollars annually. As a department of the civic government it is within the power of the health officer to evaluate and to urge civic measures to correct this loss.

As a second point of consideration it has occurred to me as a purely business or commercial matter, that the greatest return for money expended in the administration of public health may be obtained by securing the interest and co-operation of those whom we are engaged to regulate and control and inspect. There appears to be a curious lack of financial feeling on the part of the many health officers with whom I am acquainted. Perhaps this is a result of the fact that they have had so little dealing with financial matters, either in the form of salary or appropriation, that their failure is excusable.

However, it is within the grasp of every food administration, I believe, to utilize the support and interest of the food industries by capitalizing upon *their* interest in securing the endorsement of the health officer.

In short, I accept my position as a health officer or food control administrator, as primarily a business one, my business being public health. I believe it is good business to demonstrate to the industry the power of service which Health Departments may, through official channels, be to them. It makes for a more economical, more harmonious and generally progressive administration than one which limits itself merely to the enforcement of regulations.

When there exists a matter which is of great interest to both industry and to public health, I see no reason why the health officer should not be as energetic as possible in behalf of the industry—particularly, as I have endeavored to point out, a more than commensurate return in behalf of public health is obtained.

The problem of increasing milk (and I include ice cream) consumption, I should regard, in the light of the newer knowledge of nutrition, as a public health one. It is, quite naturally, of deep commercial interest to the industry. Personally, I am glad to exchange, in the interests of public health, the support of the industry in matters of quality and sanitation for such educational efforts and publicity as we might legitimately undertake. Upon the above basis, that is, in the light of purely business methods, I find it of greatest importance to cooperate with food industries, and from experience, the ice cream industry.

Quality of Raw Materials. There is another topic which has been of great interest to us in a provincial way in Baltimore but which is, I strongly feel, of national importance to the ice cream industry. This relates to the quality of raw materials used in the manufacture of ice cream. With the promulgation of information relating to the nutritional value of ice cream confronting both health officials and the ice cream industry, the health officer may not righteously go to his public with any propaganda of this nature until he is quite definitely satisfied himself, of the quality of raw materials as well as the safety of the finished product. The problem of maintaining an adequate source of high quality raw materials, I appreciate is a difficult one for the ice cream manufacturer. We have had sufficient difficulty in Baltimore in trying to secure enough cream within the immediate inspection distance of the city to appreciate the national implications of this problem. Nevertheless, it *is* a problem and will remain such until effective steps are taken by the national industry and in general by health officers to correct many of the abuses now prevalent. Baltimore, for example, lies between two cities, neither of which officially pays but passing attention to the source and quality of cream used in the manufacture of ice cream. Your industry has made vast and commendable strides in sanitation within recent years. Fine plants have been erected, laboratory control has been established to check the bacterial safety of your finished product, and enormous sums have been expended in advertising the sanitation that prevails in your business. Yet, the subject of raw materials has received no study and development appropriate to its importance, either as an integral part of the national ice cream business or to that end which, in my judgment, will long satisfy the demands of the health officer or an inquiring public. As an item of constructive criticism on co-operation, I respectfully refer the attention of the industry to this topic.

If I may be permitted to discuss another topic alluded to by Mr. Rasmussen (and I do this in an effort to cooperate with the industry at large), I believe that it is a mistake to attempt to improve the sanitary status of the ice cream industry as a whole by attacking smaller manufacturers. When it is appreciated that it has not been more than a decade or so ago that the wholesale manufacturers were likewise subject to some question (certainly some of them at least), it is scarcely to be expected that the smaller ice cream manufacturers would make the same tremendously rapid sanitary improvements within the same period of time as the larger manufacturers. The public needs education to appreciate the sanitary differences which exist between the products manufactured by the smaller dealers and that of the larger manufacturers. The proper administration of public health lies, in my judgment, not in harsh, autocratic, dictatorial methods, methods which any food industry should decry, but in sane, sensible progress along educational lines which keeps step with a demand created in the mind of the public for sanitation. It is neither practical nor desirable to suddenly descend upon every manufacturer of ice cream because he does not at once see the business advantage of conforming to certain standards of sanitation which must appear to him, as an individual, and in instances, as arbitrary and discriminatory. I hold, of course, no brief for any manufacturer who does not use every possible sanitary precaution in the manufacture of his product which is required for safety. I speak for those smaller manufacturers who are as deeply interested in sanitation as the larger manufacturers but who have made slower progress in this respect. Would it not be better to assume an attitude of paternalism toward these dealers and in the meantime to develop the sanitary status of the organized larger manufacturers until the disparities in sanitation between the smaller and larger dealers become more apparent to health officers and the public alike.

I allude to the subject of concertedly attacking the smaller manufacturer, not necessarily because I defend his sanitary (or in some cases insanitary) procedure, but because this method may do the industry at large considerable harm through restricting the sale of ice cream by creating in the mind of the public some doubt as to the quality of ice cream in general. In Baltimore where our co-operation has become highly developed and where a campaign is being prepared to increase the consumption of both fluid milk and ice cream, we are necessarily observant in making corrections in the plants of smaller manufacturers not to create in the minds of the public by drastic action that there is a general hazard in eating ice cream. We are careful also not to foster the usual public feeling of prejudice against the more prosperous larger manufacturer by concerted or untimely action against the smaller dealers. Sanitary progress in the plants of the smaller manufacturers in Baltimore has been slow, but in the light of the foregoing considerations, thus far satisfactory. By persuasion, in most cases and drastic action with those with whom no other impression seems lasting, the smaller manufacturers are pledged to extensive improvements within the near future; this I may add largely upon our interest in their commercial welfare through promised propaganda for increasing the consumption of their product.

Not unrelated to the topic of smaller manufacturers, and directly connected with an increased consumption of ice cream is the matter of taste and texture. I know from somewhat extensive experience that there is a class of people, the minority to be sure, but nevertheless constituting the at least 10% referred to by Mr. Rasmussen, who prefer the taste of ice cream made by the smaller ice cream manufacturer. I have often wondered whether any research work had been done by the industry itself to ascertain definitely what texture and flavor the public prefers. As a correlated suggestion, I believe that research work should be done upon the digestibility of ice cream, not necessarily to ascertain its degree of assimilation but rather its ease of digestion. The comparatively recent researches into the value of soft curd milk is suggestive of an inquiry which might be made by the ice cream industry. Consider the value to both public health and the industry if it could be definitely proved that the ease of digestion of ice cream is comparable or similar to soft curd milk. By research such an ice cream might even be developed. There appears to be a very definite place in the diet for soft curd milk and under any circumstance it seems preferable to the ordinary unselected variety of cow's milk.

I have alluded to investigations of the taste, texture and digestibility of ice cream in anticipation of the use to which such findings might be put in approaching the problem of increasing the consumption of milk and milk products from still another angle.

Lastly, there remains another, and to my mind, a very important, consideration which I feel that the industry as a whole should entertain. I refer to the manner in which the health officer, or official inspector should be supported by the food industries in the organization and remuneration of such staffs and the stability of these positions. It is appreciated that the ice cream industry is lending a most commendable moral support to the official inspector by continued progress in sanitation. With one type, it is apt to leave him happily, but erroneously, satisfied that the ultimate to be desired in sanitation has been reached, and that his full duty has been accomplished. Such limited support, with another type, serves to emphasize the handicaps peculiar to public service which restrain him from utilizing fully the opportunities of the situation.

For one thing, the industry has been drawing upon the ranks of the health officers by offers of more lucrative, more stable, and ambitious positions. It is quite human and natural for men to accept positions of greater remuneration and offering, as it appears to them, greater opportunities for the exercise of their powers. But with co-operation so essential to the industry, it seems to me that the food and related industries should recognize that in the course of time they will so seriously deplete the ranks of efficient health officers or milk inspectors as to seriously impair the value of this support. Moreover, it is the prominent, personable type of official that you are drawing to your ranks. I do not say that the industries are tempting the best organizers in public health fields, nor the best executives. There are many fine administrators in the ranks of official inspectors today whose vision is sufficiently broad and extensive to accept the co-operation extended by the industries, and who are able to utilize this to the greatest economic and public health benefit in the community which they serve. These men, I maintain, it is as important to keep in their positions as it is to attract them to commercial life.

It is no less important, of course, that they be given, in a sense, the same choice of assistants, freedom of action and remuneration as would exist in business circles.

I think that if the International Association of Ice Cream Manufacturers regards this topic with searching consideration it will undoubtedly prove of benefit to the industry itself and certainly to public health. I conclude these rather long topics of discussion of Mr. Rasmussen's paper, reiterating that I modestly offer them in full appreciation of the splendid co-operation which now exists between the industry and the official inspector as determined by long experience in the City of Baltimore.

The Chairman: I have now very much pleasure in calling upon Mr. H. F. Judkins, Springfield, Massachusetts, Chairman of the Research Committee, International Association of Ice Cream Manufacturers, for his paper, "The 'What and How' of Ice Cream and Milk Plant Inspection."

THE "WHAT AND HOW" OF ICE CREAM AND MILK PLANT INSPECTION

H. F. JUDKINS

Chairman, Research Committee, International Association of Ice Cream Manufacturers, Springfield, Mass.

PRESENT STATUS OF INSPECTION WORK IN THE AVERAGE CITY

In discussing this section of the paper, I fully realize that the status of inspection work in some cities is what might be called very much better than it is in other cities, therefore, I am speaking of an average city. Since none of you will of course admit that you live in an "average" city, my remarks certainly cannot hurt anyone's feelings. I think we will all agree, in speaking of inspection for the milk and ice cream industries, that the work actually divides itself into three main headings:

1 Inspection of the source of supply of raw materials.
2 Inspection of the manufacturing and handling plant.
3 Inspection of the retail outlet.

In most cities, the time and funds devoted to inspection work are limited. With the above mentioned three fields to cover, a real problem arises for the inspection department to decide how they can use their time and funds to the best advantage.

Inspection of the source of supply can easily take all of the time and funds and then some, due to the large number of small units to be inspected. It has been my observation that in many cities more emphasis has been placed on this phase than on either of the other two, with results, which to my mind, are frequently not commensurate with the effort put forth.

When it comes to plant inspection, unquestionably up to the present time, more time and effort has been spent with the milk plants than with the ice cream plants. Again, I believe, there is room for much improvement in the type of milk and ice cream plant inspection that really produces the desired result, namely, a sanitary plant with things done "according to Hoyle."

Retail outlets, meaning, of course, those dispensing milk, ice cream, etc., certainly do not come in for their share of constructive inspection. I have frequently wondered why it is that the conditions prevailing around the soda fountain located in most any city, on Mulberry Street, are commonly absolutely contrary to the city's regulations and also diametrically opposite to conditions prevailing at a fountain located on that same city's Fifth Avenue. I used to think that it was because inspection was confined to those dealers that the inspection service felt were financially able to conform to orders, whereas "any old thing" was allowed to go on in the poorer section. I am persuaded now that the difference of conditions in these two sections of a city are not due to inspection work, but primarily due to the habits of the people living in the two sections. The dealer on Fifth Avenue knows that he has got to have everything spick-and-span for his trade, whereas, the dealer on Mulberry Street knows that his trade is not that particular. When we analyze this, however, how ridiculous it is for this condition to exist, assuming of course, that the conditions maintained in the Fifth Avenue store are absolutely necessary, and so specified in the regulations, to protect the public health.

Referring to regulations and ordinances, it is undoubtedly wise in approving the same to include items which it is known are good and right for the public welfare even though it is known that funds are not available for the direct enforcement of these items. There are always some people who will observe a regulation if they know it exists, without being forced to do so. On the other hand, it seems ridiculous to sometimes find very important items in a set of regulations that are almost never enforced. One of the best examples of this that has come to my attention is the case of a city ordinance stating that Grade A pasteurized milk should not contain more than 100,000 bacteria per c. c. prior to pasteurization and yet milk which has been pasteurized and sold as Grade A has been coming into that city for no one knows how long, at a count ranging from one-half million to four million per c.c. Another point about our ordinances and regulations is the antiquated state in which we sometimes find them. Our knowledge concerning the manufacturing and handling of dairy products certainly changes rapidly and it certainly keeps one stepping, so to speak, to keep regulations up to date.

I am afraid my remarks thus far may have sounded too pessimistic. I certainly don't want to be classed as a pessimist in discussing this question, but rather a sort of dissatisfied optimist. The fact that very considerable improvement in inspection work has been made during the last few years cannot help but give us an optimistic outlook on this work.

Causes and Remedies for the Present Situation

As intimated above, lack of funds, is of course recognized as a main underlying cause of the present state of inspection work. And now, I am forced to speak very frankly and say that because of lack of funds an insufficient supply of men well qualified for this work have not been attracted to it. A good deal is said about politics being to blame, but the plain facts are that men well trained for this inspection work are relatively scarce, and they can command better wages, either in the teaching, investigational, or commercial fields. Many of our larger cities, of course, have realized that more could be accomplished by employing one well-trained and reasonably high salaried executive to direct the work of others of less training, working at lower salaries. Of course, more funds will come gradually, but in the meantime, I believe, that one way various State Inspector Associations can improve the work of their members is by holding reasonably frequent sectional meetings, the programs of which are of a real instructional nature. In addition to having a speaker, who perhaps has done some outstanding piece of work in some phase of inspection, there should be ample time allowed for round table discussions on the part of the members. When a group of men are together, all working along the same line, it is surprising what one can get out of them, if they can be made to "loosen-up" and tell each other something about their particular "bag of tricks." Time should be allowed at these meetings for what might be called a laboratory period, whereby the group in charge of a proper leader would visit a farm, plant, or store, especially for the purpose of instruction in actually inspecting that establishment.

Groups of inspectors might also find it well to co-operate with the Agricultural Colleges in the various states, where short courses for inspectors can be held. When I was located at the Massachusetts Agricultural College, we held such a course, which so far as I know, was the first course of its kind ever held, nor have I heard of one being held since. As I recall it, we had in the neighborhood of fifteen inspectors taking the course, and I certainly feel that I was not alone in feeling that the course was very much worth while. In short, the more training the inspector can get, the better job he is sure to be able to do, and the more respect his work is bound to command with the result that more funds are a natural consequence.

Characteristics of the Inspector's Clientele

As previously stated, one of the inspector's clientele are the farmers where the milk and cream is produced.

What are some of the things to face in this phase of the work? First, we have a large number of small units which require a lot of time. Second, we have a wide variety of human nature to deal with. There is practically every nationality, the co-operator and the non-co-operator, men who really know very little about sanitary production and are willing to admit it, men who know very little about sanitary production and are not willing to admit it, and finally a minority who really know how to produce and handle milk and practice what they preach. The condition of the pocketbook has a great deal to do with the good that the inspector can actually accomplish, and generally, faster progress can be made with the man who receives some premium for his effort. On the other hand, when there is plenty of milk, the farmer is in dire need of a market, he is also apt to be more open to suggestion than when his milk is in great demand. Even with this group of people, it has been my experience that there is a much larger group than we suppose who are willing and ready to respond, if the reasons *why* things are wanted so and so are explained to them, and if, in addition to this, they are not simply told to conform, but told *how* to conform to requirements. In other words, the inspection service that is able to educate their clientele into their way of doing things is the service that is bound to make the most progress.

The second clientele consists of the plant operators, and I think that I can say without conceit that no one understands better than I, what their trials and tribulations are. I wonder if inspectors generally realize the real problem involved in getting things done in a plant according to their specifications. The problem is purely one of lack of sufficient education on the part of the plant employee. During my five years' work in the commercial field, this has been the problem closest to my heart. A study of the situation reveals the fact that the arbitrary posting of rules generally does not get the desired results. As a result of a rather prolonged study, we are now preparing a job specification for every distinct job in each one of our plants. These job specifications will be distributed to our employees, and meeting after meeting will be held at each plant at which the working of these specifications will be discussed. Any man will take more interest in his job and do a better job if he knows what it is all about, and again, the results of inspection service in the plant will certainly be in direct proportion to the knowledge that each employee has of his or her individual job. In order that you may understand more clearly just what I mean by a job specification, I will read you just one that we have prepared for the operation of a hydraulic straightaway can washer.

SPECIFICATION FOR OPERATING MILK CAN WASHER
(Hydraulic Straightaway)

Object

The object in view in operating this can washer is to secure throughout the operation a clean, dry, sweet-smelling, commercially sterile can and cover. The can should be cleaned on the outside. The cover is to be placed on the can by the lid replacer as the can leaves the machine. A can may be clean and dry and not commercially sterile. By commercially sterile is meant a can containing not more than 100,000 bacteria as determined by rinsing the can with 500 c.c. (about a pint) of sterile water (water entirely free from bacteria) and plating 1 c.c. of this rinse in the usual manner.

Operation

1 See that washer is properly greased and oiled.
2 Fill wash and rinse tanks with fresh water, about 1 inch below overflow.
3 Turn on steam through thermostatic controls. See that these controls are kept in working order.
4 Open water valve on inlet pipe to rinse compartment to *barely* make rinse tank overflow.
5 Wash tank holds 140 gallons. Add the amount and kind of washing powder prescribed.
6 Keep a strong solution as prescribed of cleanser in small solution tank at all times and adjust petcock to proper point to maintain proper washing powder strength in tank.
7 Laboratory will test solution in wash tank, and keep operator advised as to operation.

8 Remove sides of washer and start pumps to be sure jets are set OK, and that washing solution is not shooting into rinse tank or rinse water out onto draining table.

9 When water in wash tank is 160 to 170 deg. F. and rinse tank 170 to 180 deg. F., you are ready to go. Maintain these temperatures at all times and don't let rinse tank overflow too much, just slightly all the time. *No water to be added to washing solution tank.*

10 Adjust prerinse and steam sterilizing and drying valves.

11 Drain cans thoroughly before washing.

12 Operate at high speed for cans that have contained milk and at low speed for cans that have contained cream or condensed milk.

13 Change water in wash tank at least after each 4th hour of operating and oftener, if necessary. Follow directions for recharging with cleanser.

14 Clean strainer to pump when solution is changed. Report at once any tear found in strainer.

15 Examine cans as they come from washer. Brush and rerun any that are not clean. Note whether cans are being dried properly. See that cover replacer is working.

16 If washer fails to work as above outlined in any particular, report it at once to your foreman.

17 Check thermometers frequently.

18 At close of each day's run thoroughly clean the washer. Remove pump strainers and clean.

Trouble Chart

TROUBLE	
1 Cover not regularly replaced	1 Cover carrier chain out of time.
	2 Cover and can not matched as they come through.
	3 No cover in position opposite can.
2 Can not clean.	1 Excessively dirty can to start with. Washer perhaps run at high speed.
	2 Washing solution not up to strength.
	3 Washing solution not up to temperature.
	4 Strainer or jets clogged so that cans do not get proper spray.
3 Can not dry or sterile.	1 Rinse water not up to temperature.
	2 Jets clogged so that cans don't get proper rinse.
	3 Insufficient steam pressure so that cans are not heated to proper temperature in steaming and drying.

4 Foul-smelling can.

1 Can not properly cleaned.
2 Rinse water contaminated with washing solution because
   (a) Steam jets in solution tank set so solution "boils" over into rinse, or
   (b) Rinse tank not overflowing properly.

I need not dwell long on the third class or clientele, namely, the dealers. What has been said above concerning inspection with education, applies here with equal force.

The Division of the Inspector's Time and Funds

I am literally swamped with work. How shall I make the best use of my time and funds? is the question with which we are confronted in this busy day and age. Well, to answer this question, let's look more closely and analytically to the work that is to be done. First, there is the milk or cream from the farm. What is our object in this phase of inspection? I think it can be said that the ultimate object is to get a milk supply delivered to the plant, said milk or cream to conform to the state chemical standards and to arrive at the plant at a low temperature, to be clean, to be of reasonable low bacteria count, and to be of good flavor. All these, of course, presuppose that this milk or cream is produced under satisfactory sanitary conditions at the farm. Now then, shall the inspection start with our laboratory tests on the milk or cream as it arrives at the plant or shall we attempt to visit all the farms, first, to inspect sanitary conditions? It is my judgment that if the latter course is followed the inspector is by no means making the best of his time and funds. I am all the more sure of this because there are any number of plants who regularly make most of the tests above outlined on each patron's milk. For example, our laboratory program at all of our milk plants now call for a temperature, methylene blue and sediment test at least once each month with two immediate follow-up tests on successive days, on all milk which arrives at temperature above 60 degrees or which is classed as dirty or very dirty on the sediment test, or which is in classes 3 or 4 in the methylene blue test. This is done in addition to the daily checking which the man receiving the milk gives it each day as he empties the milk into the weigh can. Now then, isn't it the logical thing for the inspection service to cooperate to the fullest extent with the plants doing this work, and to put their effort on the cases that need it the worst? I for one would welcome it. Along this line, one thing that needs to be done above all things is for this understanding between the dealer and inspection service to be so complete, and for the understanding between the inspection service in adjacent territories to be so complete that milk or cream which is turned down by one plant operator or inspection service cannot be accepted by any other plant operator or inspection service, until the necessary improvement is made.

Another phase of inspection is the appraisal of the finished product such as the bottle of milk or cream or a carton of butter or ice cream as it is going into the consumer's hands. Here again, there is a chance for cooperation with the plant which is regularly making tests on their finished product which can easily do away with much of the time required for sampling from wagons and stores. At any rate, this type of work referring to the sampling and testing, of these products can be done under direction by men receiving only what might be called a fair wage scale. This phase of the work should not take too much of the energy and thought of the executive in charge of the work. If the two types of work that I have spoken of are carried on about as outlined, it will readily be seen that there will be more time for the actual inspection of plants and retail outlets and co-operating and working with this group. This is where the real intelligence of the inspection service mainly needs to be used.

The "How" of Inspection

Having spent considerable time thus far in discussing the "What" of inspection work as I see it, I will now go to the second part of the subject, namely, the "How" of inspection work, and will confine my remarks principally to plant inspection. This matter of plant inspection is one that has also taken much of my time because we are making an attempt to inspect ourselves, so to speak. Before inspecting a plant, the conditions which are desired, must of course, be clearly defined, and the reasons for the requirements thoroughly understood; in other words, one must know what to look for. Now then, until one has had considerable experience, it is almost necessary that he have these requirements before him stated on some blank or other in a concise form. As we all know, there are two general forms that are used in this work. One is the score card which attempts to give a mathematical rating to each individual requirement, and the other is the Yes and No Blank which simply states whether a condition is right or wrong. I have used both. I dislike the score card because too much time is taken in deciding whether a particular item should receive a half a point or a point and a half, or three-fourths of a point, and after all it is likely to be more of a guess as to which figure is to be put down. When one is all through, it is also unsatisfactory to attempt to picture the real conditions in a particular plant or to compare it with some other plant on the basis of the total score on the card. This is because that of the number of items that necessarily must be mentioned on the card, some are of more actual importance than others. In the case of the Yes and No Blank, with the questions properly classified and arranged at the left with two columns at the right, one headed yes, and one headed no, a check mark can quickly be made in either one column or the other depending on the answer to the question. In glancing at these blanks, one can quickly see what is wrong, incidentally, there is room for remarks if necessary. On the following inspection, it is an easy matter to refer to the previous blank and see whether the unsatisfactory conditions have been remedied. It is this system that we, in National Dairy, are using or purposing to use in all types of plants. Personally, I should favor a similar proposition for farm inspection work or for the inspection of retail outlets.

One of the difficulties of using either the score card or the Yes and No Blank in checking a plant is that in checking a particular item in a certain room, that item may be at the top of the page or on page one, whereas some other items in that same room may be at the bottom of the page or on page six. This keeps one constantly glancing around the pages hunting for the items that he wants to mark for that particular room. The only other alternative is to take the items in the order in which they are mentioned on the card and in this case the inspector is likely to be constantly chasing from the basement to the attic and back. It is impossible to formulate a blank which can be used in all plants and avoid this. Therefore, after having had considerable practice, I like to leave my Yes and No Blank in the office and take a little notebook and go through the plant systematically, from room to room, and put down the things that do not seem to be right and then go back and fill out my Yes and No Blank. The chances are I have not overlooked very many of them and they will also be so fresh in my mind that I can probably answer most of the questions without even referring to my notes. If anything has been missed, it is an easy matter to go into the plant again and check up on it. To me, this is the ideal system, after one has had some experience, so that what to look for is definitely in his mind.

To go into a plant for the purpose of inspection without making any notes of any kind is certainly about as worthless a job as one can do. I have been through plants which from general appearance from just walking through the plant would lead one to think that here was a pretty fine proposition, but after digging into the corners and examining the cleanliness of equipment, especially piping, thoroughly, one may leave with quite a different view of the situation.

In closing, let me say that I am sure that the dairy industry always stands ready to welcome a sane and efficient system of inspection somewhat along the lines that I have indicated, and that we are always ready to meet the inspectors more than half way on this kind of a proposition.

THE CHAIRMAN: We will now have the discussion of this paper introduced by Mr. Ernest Kelley, of the U. S. Department of Agriculture, Washington, D. C.

DISCUSSION

ERNEST KELLEY

Chief, Division of Market Milk Investigations,

United States Department of Agriculture,

Washington, D. C.

MR. CHAIRMAN AND MEMBERS OF THE INTERNATIONAL ASSOCIATION OF ICE CREAM MANUFACTURERS: After listening to the very carefully prepared speech of Mr. Rasmussen and the very concise and clear speech of Mr. Judkins, I am rather at a loss as to what to say, and if

there is some repetition in my speech I hope you will not feel towards me as I recall a certain audience felt toward one man who was called upon at an organization meeting to make a speech. He got to his feet and he made a very rambling speech, and then he said, "I am not a speaker, I am a house painter. I feel that my place is more properly on the scaffold." One of the men in the back of the room said, "I am with you, brother."

Now, in regard to Mr. Judkins' paper on the what and how of ice cream and milk plant inspection, I want to make a few remarks before discussing this paper.

I want to refer to the wonderful suggestion of Mr. Judkins that the inspection groups in certain localities keep in close touch with the state agricultural colleges. Their interests are similar, along the lines of dairy sanitations, and one can be of great aid to the other.

Co-operation between inspection forces themselves offers a great opportunity. Doctor Leslie, in charge of the inspection in Cleveland, told me this morning that he had been relieved of a great deal of work and had a most satisfactory agreement with the Pennsylvania authorities, who inspect the cows that come into the State of Ohio from Pennsylvania, and that is one of the things that should exist in every locality, until the last link that goes into the chain between the producer and the seller is brought together.

Milk producers' organizations, milk plants, creameries, also ice cream manufacturers, are extending the inspection more and more to cover the sources of production.

Judkins said that an experienced man could be obtained, and the results obtained would be better from country inspection. That is perfectly true, but the city is traveling on limited funds. Here is a great place where the dealer or the man in the dairy industry can put his shoulders to the wheel and help out. He is in intimate contact with his producers or shippers, and has many country stations which are run by a man who is daily in contact with the patrons, and he has all the facilities to safeguard his source of supply.

The country plants, when they are run by the dealers or manufacturers, offer a fine key to the situation, and some times those in the industry think that you can organize inspection through the field men of the plants or through administrative procedure. That is all very well, but the field man may visit the country station perhaps three or four times a year. He may see the individual procedure very rarely, and I think that the matter of going into the developing of country receiving stations is a very important one, and it is very important to have a proper man. He must have three things. He must have personality. He must have a knowledge of sanitation which he has to impart to the patron that he comes into contact with, and he must have apparatus and methods by which he can make rough analyses of the milk that is coming in.

Last month I was out at a station and the patrons were coming in very early in the morning. One patron came in with a can of milk, and as I leaned over and put the dipper in to make the test I smelled immediately that the milk had turned. I said, "Something is wrong." He said, "It does not smell very good." But the manager tasted it and said, "It tastes all right; do you want to taste it?" I said, "No, I don't want to taste it, my smeller is all right." As soon as the methylene blue test was put to it, we found that the milk had actually turned, and yet that was a man whose duty it is to take milk and test it, and to know milk, and the man on whom we must depend for getting the quality of milk that we are getting now.

As a contrast to that, one of the other plants in the same vicinity had a man who had done what I considered remarkable work. His company had furnished him with a methylene blue outfit. I mention that because we are using that as a rough method. There may be other things, such as a direct microscopic count.

He took his patrons consecutively and got over to see each one of them at least once a week. He spent a good many of his evenings driving out to the patrons and talking with them about the conditions that exist on the farms.

We had made a survey of these six shipping stations just the year previous. In the meantime, work had been done by the State Agricultural Department, the State Agricultural College, the City Board of Health, to which they had been shipping, and I want to give you the results of that plant. On our resurvey this August, 96.7 of that milk was in grade one by the methylene blue test. Two years ago 59 per cent was in grade one, and they had this year no grade three or grade four or grade five, while they were milking grade three milk last year. That just illustrates what I mean.

We are apt to underestimate, I think, the abilities of the men out in the field; we are apt to underestimate their ability to help us out with this important problem. They say, "All roads lead to Rome," and I think all of these things that we have been discussing come back really to two ideas. That is, the responsibility, the duty and the privilege of the dairy industry and future dairy sanitation, and the second is the vital necessity of securing the co-operation of all interested bodies in this important sanitary problem, the improvement of the quality of milk. The dairy industry wants to improve quality. It means greater consumption; it means more palatable and more marketable products; it means less losses, less chance of disease dissemination, which is a body blow to the dairy industry when it occurs.

Industry has a definite rôle to play to uphold and extend the work of inspection agencies. The field in the community over which they preside is a tremendous one, but they cannot attain the ultimate result as quickly without the co-operation of the industry as they can with it.

The correlation of these various agencies in a workable, concerted plan will protect the consumer, lessen losses to the industry, lead to wider markets and harmonize the entire scheme of milk production and control. Do not let us allow the glorification of our agencies, as inspectors or as members of the industry, to becloud the fact that we still have a long way to go. Wonderful progress has been made, but there is still a great deal to do. When the entire industry recognizes its full responsibility and all the inspection agencies can say that the efforts in the industry are sincere and well directed, then in spite of the fact that much real work will remain to be done we will have at least entered the borders of the field of greater progress and harmony.

THE CHAIRMAN: I have pleasure in introducing Dr. Robert S. Breed, of the New York State Experiment Station at Geneva, New York, who will talk to you on "Judging the Quality of Milk and Cream by the Microscopic Count of Bacteria for the Milk Distributor and the Ice Cream Manufacturer."

JUDGING THE QUALITY OF MILK AND CREAM BY THE MICROSCOPIC COUNT OF BACTERIA FOR THE MILK DISTRIBUTOR AND ICE CREAM MANUFACTURER

ROBERT S. BREED, PH.D.

Chief in Research, Division of Bacteriology, New York Agricultural Experiment Station, Geneva, N. Y.

I count it a very real privilege to have the opportunity of speaking to this joint assembly. For twenty years I have been interested in the microscopy of milk. My name has been associated with this subject because I

have talked and written about it so much. But before Dr. Brew leaves the room I want to point out that it was his early work at the Geneva Station[1] that first showed how useful and accurate the microscopic method of counting bacteria could be made.

Lest I be regarded merely as an enthusiast for one particular method for making bacteriological examination of milk and dairy products, may I add that I have always been deeply interested in the development of any useful laboratory method for making examinations of milk or other dairy products. May I review for a moment, the development of laboratory methods for use in the control of dairy products. In the years since I finished my college course (and that is not so long ago), all or practically all of the routine bacteriological laboratory control methods for milk and dairy products have been developed. Beginning between 1900 and 1905, a few cities in America started the routine bacteriological examination of milk. Boston, under the leadership of Dr. Hill and Mr. Rickards, was one of the first of these cities, I believe, beginning this routine control about 1905. New York city under the leadership of Dr. Biggs and Dr. Park was one of the early cities to start similar work and undertook the routine bacteriological examination of its milk supply at about the same time. Dr. H. W. Conn started the work for the State of Connecticut in 1906. Dean Russell of Wisconsin also did some work in these early days for a milk dealer of Milwaukee; Doctor Peck of the Bowman Dairy Company (Chicago) began work for this company in 1905; and there were others who started work as early as this.

The first report of the Committee on Standard Methods of Milk Analysis appeared in 1910 and it was my privilege to have been present at the American Public Health Association meeting at Richmond, Va., in 1910, when this

[1] Bull. 373, N. Y. Agric. Exper. Station.

report was adopted and it has been my privilege to have been associated with this work since 1913. Five editions of this Standard Methods Report have been issued and steps are now being taken to prepare a sixth revision. In connection with this latter work it was decided to gather statistics that would show the development of routine bacteriological methods in milk control work since 1905. A preliminary report on these statistics will be presented before the Laboratory Section of the American Public Health Association at Fort Worth, Texas, next week.

Questionnaires have been sent to all of the cities of the United States and Canada where there was reason to think that routine laboratory examinations of milk were being made. Three hundred and seventy-six cities have already replied and have reported that they examined about 500,000 samples of milk by the standard agar plate method during the past year. In the same 376 cities, there were about 70,000 samples of milk examined by the direct microscopic technique, and about 130,000 samples were examined by the methylene blue reduction test.

At the same time we inquired about the work done in laboratories maintained by the market milk industry and some few laboratories maintained by the ice cream industry. In one hundred of these laboratories there were examined last year more than 2,000,000 samples by the standard plate method, about 600,000 by the direct microscopic technique and about 750,000 by the methylene blue reduction method.

These figures seem to me to be very significant as they show the progress that has been made in the 25 years since 1905. Moreover, it is clear that we are not at the limit of the development of the work by any means. In fact, the majority would agree, I am sure, that we are still in the beginning stages of the development. We realize today that the dairy inspector needs the type of accurate information that laboratory examination can furnish in order to direct his work into the most effective channels. The dairy inspector is in very much the same position as the physician who finds in these modern times that it is quite impossible for him to do his work satisfactorily without using clinical laboratories to secure definite and accurate information regarding things that cannot be determined by an ordinary examination.

So, while I am to speak this afternoon particularly of the microscopy of milk and cream, I do not want you to get the impression that I feel that this is a universally applicable method nor even that it is the only useful method of counting bacteria in milk. It has its limitations as many of you know from having made extensive use of the technique of which I am to speak. It also still has many undeveloped possibilities.

We shall use a lantern this afternoon to show a few of the typical conditions that are seen by using the microscope, and shall indicate some of the ways in which the microscope can be made useful.

These slides are arranged so as to start with the original source of the milk (the udder). The slides illustrating the process of milk secretion are followed by some showing conditions in raw milk and then conditions in pasteurized milk. It is self-evident that I cannot show all of the things that can be seen with the microscope in the few minutes that are available. There are many other interesting conditions in milk and cream that can be detected with a microscope, to say nothing of ice cream. Anyone who has become interested in the microscopy of milk and cream will realize this.

Thus far little has been done to determine whether the direct microscopic examination of ice cream can be made to serve as useful a purpose as the direct microscopic examination of milk and cream. I remember one day in the laboratory when we made an examination of strawberry ice cream. The microscope at once showed the presence of mold filaments indicating that the fruit used was not of the best quality. This simple examination indicated very clearly that the microscopic examination of ice creams could be made to serve a very useful purpose in control work. Thus far no one has published anything along this line so far as I am aware.

I. Microscopy of Milk Secretion

The man who made the photograph shown on the first slide (a longitudinal section of a cow's udder), Dr. A. R. Ward, is sitting in the audience. It is a well-known picture used in many text books. The milk is made in this region of the udder (indicating upper portion of the gland), and then it passes through the ducts in this region (incidating middle region) to the milk cistern in the teat.

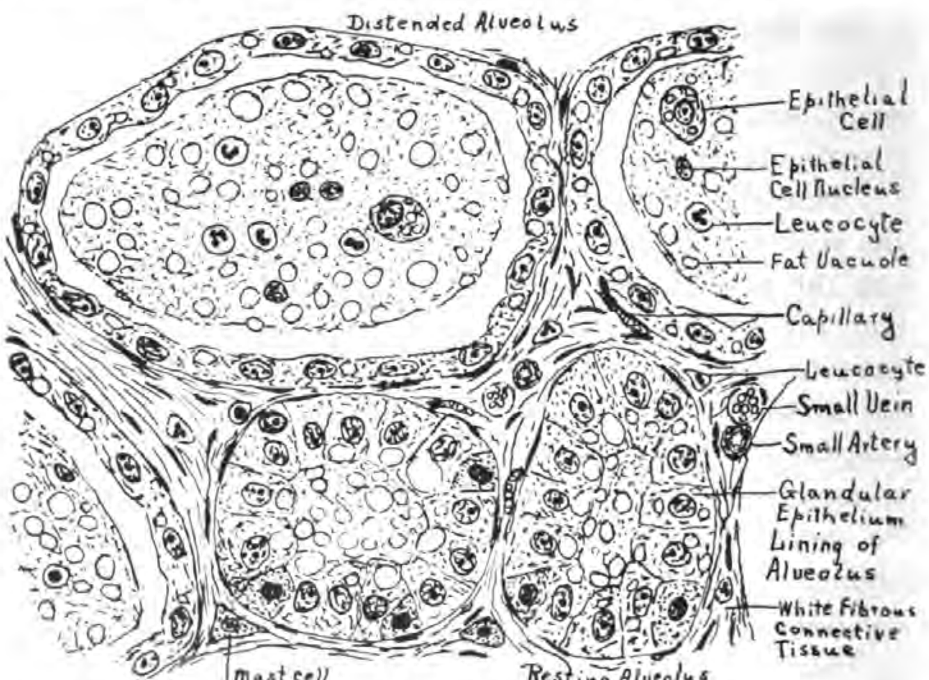

Fig. 1.

Cross section of the secretory portion of the udder, showing two resting alveoli, one distended alveolus, and portions of two others. White fibrous connective tissue with lymphatics and blood vessels shown in the spaces between the alveoli.

(The next slides showed the finer microscopic structure of the secreting portion where the milk is formed. Figure 1 has been substituted in place of these slides. This shows resting and active alveoli. Leucocytes (white blood corpuscles), detached epithelial cells and epithelial cell nuclei are seen in the milk shown in the interior of the distended alveoli. The clear areas at the distal ends of the gland cells and in the milk are fat vacuoles from

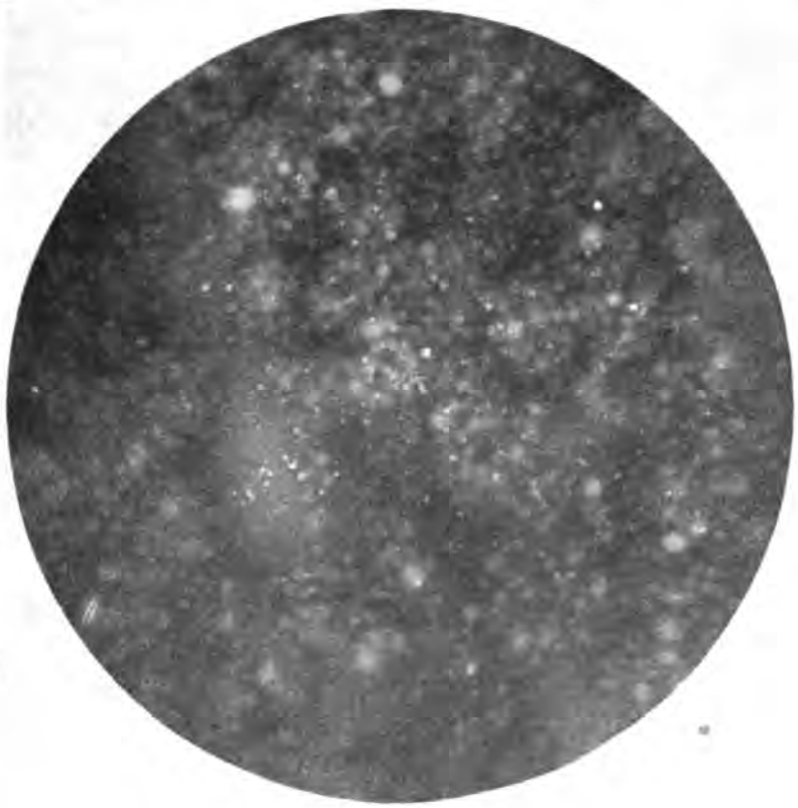

FIG. 2.

Microscopic appearance of high-grade milk. No bacteria are to be seen in the picture. The background shows a vacuolated appearance because the fat drops have been dissolved out of the dried milk-solids-not-fat. Such high-grade milk may contain leucocytes and epithelial cells in fairly large numbers. It never contains masses of bacteria. On careful search, single cocci, or less commonly rods, or single pairs of cocci or rods may be found. These are normal udder cocci and rods. Rarely, spherical masses of chromatin from degenerating cell nuclei may be present. These are indistinguishable from individual cocci. 600×.

which the fat has been dissolved in the preparation of the section for examination under the microscope.

This slide (Figure 2) shows the microscopic appearance of high-class milk that is free from leucocytes, epithelial cells and all other cellular elements derived from the secreting portion of the gland. In examining later slides please keep this picture in mind as the one that represents the typical appearance of normal milk free from excessive numbers of bacteria.

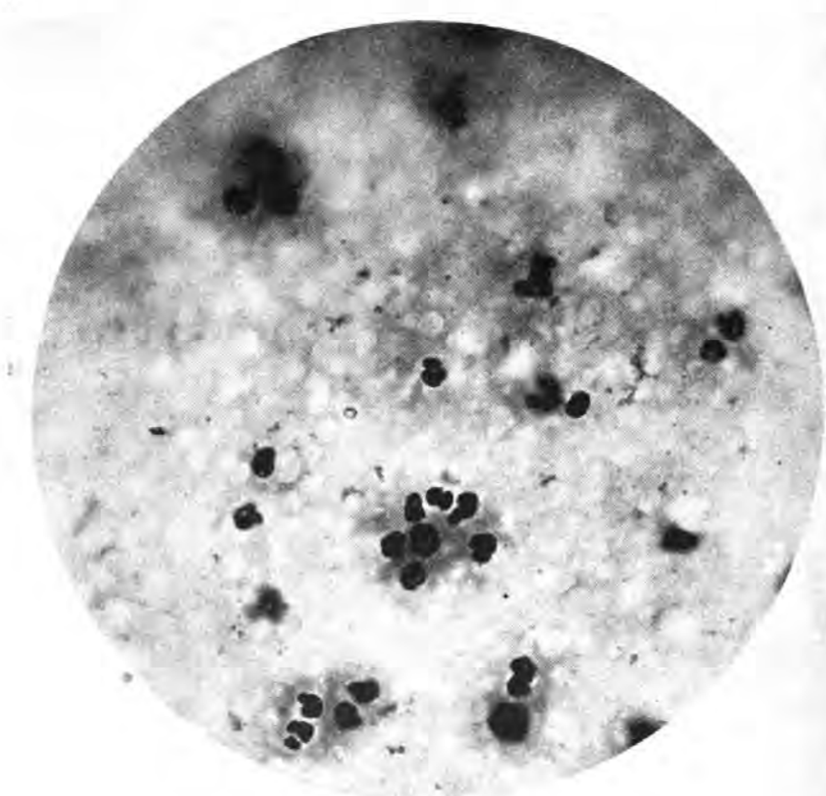

FIG. 3.

Microscopic appearance of milk in which the number of cells is greater than is common, altho there was no evidence that the milk should be classed as abnormal. The fine sediment showing in the background of the preparation is due to the treatment the preparation received. No bacteria are evident. All of the cells that show clearly are leucocytes of various types, the commoner types being polynuclear or polymorphonuclear. The cell count in this milk would be approximately 18,000,000 per cc. 600×.

Many times, even in normal milk, the white blood corpuscles will be numerous enough to show even as many as six to a dozen or more in such a preparation and I have included Slide 3 (Figure 3) because it shows the leucocytes as numerous as they may be found in normal milk.

From 1905 to 1915 there was a great deal of stress laid on the number of the leucocytes in milk and they were spoken of as pus cells because their presence in some cases is due to streptococcic infections. However, in studies that we made of the milk of a number of cows by this microscopic method it was found that the number of these leucocytes varied very greatly and that the average number in milk that so far as any examination showed was perfectly normal was nearly 1,000,000 per c.c.

I remember the history of the particular sample shown on the slide very well. It was milk from a cow whose udder was examined very carefully to determine whether there was any streptococcic infection. There was none, and there was no evidence of any other bacterial infection which would have caused this excessive number of leucocytes to be discharged in the milk. The number of leucocytes varied greatly in number from day to day and a few days before this sample was taken the number had been low. The excessive numbers of leucocytes only occurred for a very few days and then dropped back to normal. This happened about two weeks after the animal had calved and there was no evidence whatever to show that this excessive number of leucocytes had any sanitary significance.

Nevertheless, as you will see in later slides, excessive numbers of these leucocytes do have a sanitary significance when they are associated with definite bacterial infections, especially those that are streptococcic in nature.

In making microscopic examinations of milk we discovered very early that these cells did not remain equally distributed throughout the milk when this was allowed

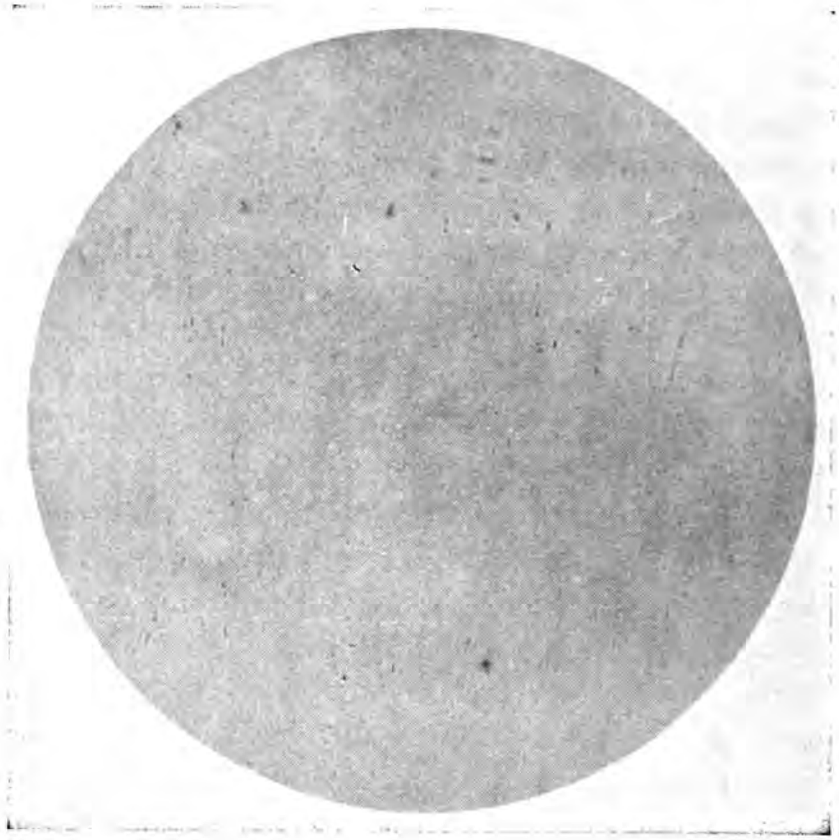

Fig. 4.

Microscopic appearance of gravity-formed skimmilk from the same source as the cream shown in Figure 5. Here no body cells are to be seen, and the background is of rather deeply stained, dried milk-solids-not-fat. A few, very small fat vacuoles are to be seen. Where these are out of focus they show with a dark center and a halo, due to refraction. No bacteria are to be seen. 600×.

to stand undisturbed. Slide 4 is a picture of skimmed milk which was made from milk where the cream had been allowed to rise by gravity. You will notice that the skimmed milk is completely free of cells.

The next slide (Figure 5) shows the cream which appeared on the same milk. As is evident from this picture, the cells rise with the fat drops and as the cream is formed they come to the surface. However, if the milk is run through a separator, the larger part of the cells are thrown out with the sediment and only a few of them remain in the cream, depending on the speed with which the centrifugal force is applied.

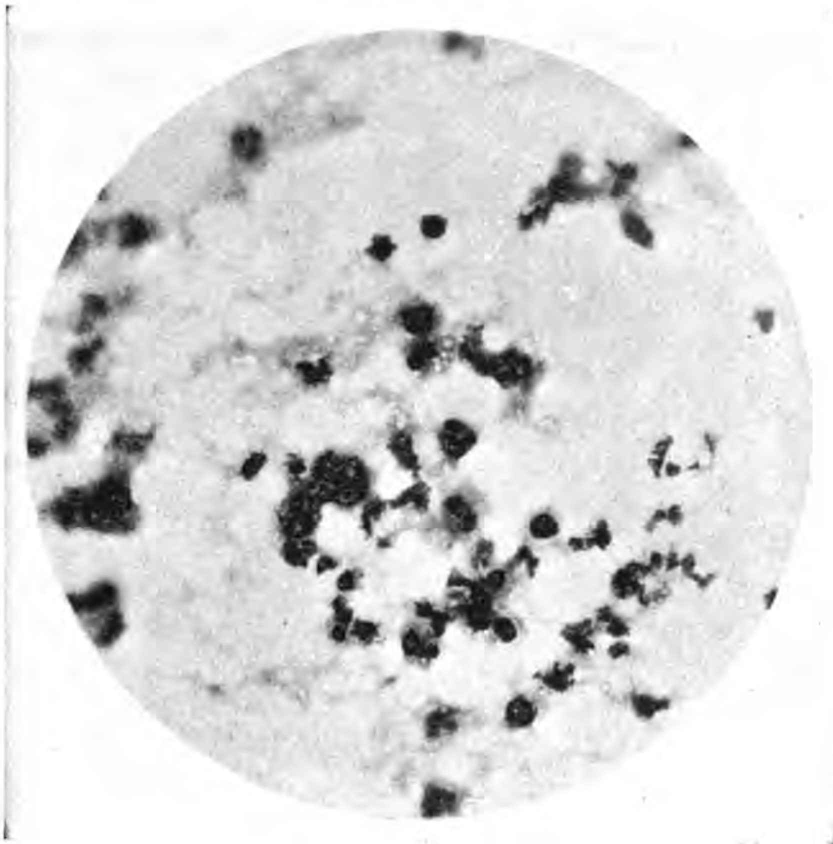

Fig. 5.

Microscopic appearance of high-grade, gravity-formed cream. The ragged appearance of the cells is due to autolysis, the milk having stood at room temperature for 30 hours before the cream preparation was made. The background of cream stains faintly as it shows many vaculoes formed by fat drops which have been dissolved in the process of preparation. No bacteria are to be seen. 600×.

2. Raw Market Milk

A few slides will now be shown to call to your mind the conditions in raw milk where bacteria are present in significant numbers.

One of the most characteristic things that can be recognized under the microscope is a streptococcic infection of the udder. If milk is drawn from an udder that is in an inflamed condition caused by the streptococci infection, the milk shows as seen in Figure 6. Here are numerous chains of the streptococci that caused the mastitis and these streptococci are accompanied by numerous leucocytes.

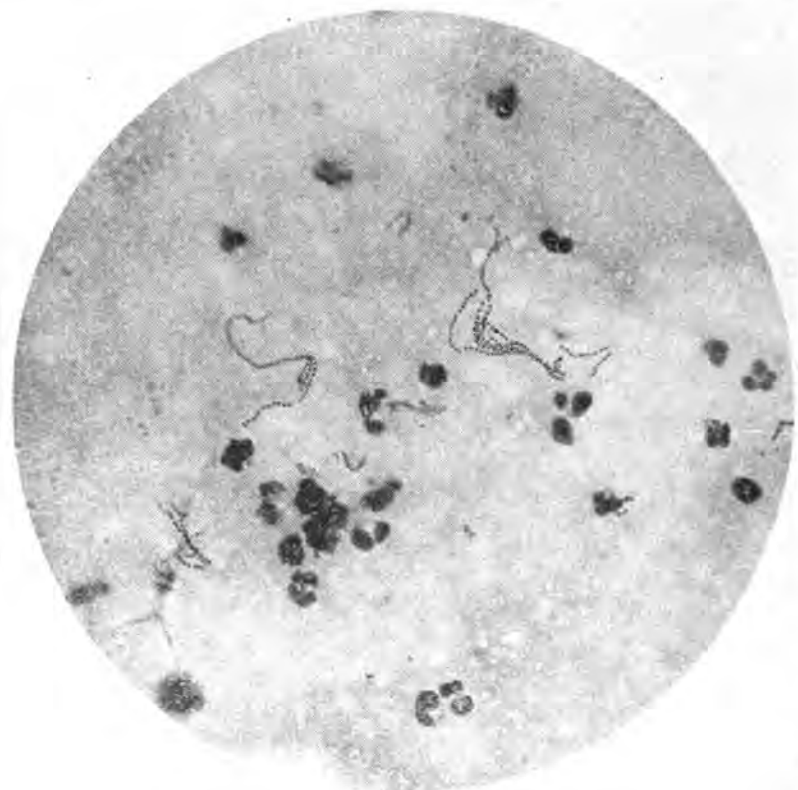

FIG. 6.

Microscopic appearance of milk from a cow suffering from streptococcic mastitis. Masses of cells composed of numerous polymorphonuclear, polynuclear, and a few mononuclear leucocytes, and a single epithelial cell (near margin) may be seen. Among these there are long-chain streptococci. As is common in such cases some of these occur in intertwined masses. Presumably this organism is *Streptococcus mastitidis* Migula. **600×**.

In this type of milk, it has been found that enough blood serum passes unchanged into the milk to affect the reaction of the milk, the blood serum having a pH of 7.0 and normal milk about 6.5 to 6.6. It is sometimes possible to recognize mastitis milk by this decrease in acidity. This is the basis of the recently much advertised Thybromol test for garget in which the indicator brom thymol blue is used to determine the reaction. Streptococci are acid formers and as soon as the milk is drawn they begin to ferment the lactose in the milk and to

Fig. 7.

Microscopic appearance of milk containing streptococci and rod-shaped bacteria. Inasmuch as the streptococci are not associated with leucocytes, some question arises as to their nature. Investigation showed that the bacteria in this picture are not pyogenic in nature and that they were derived from poorly sterilized utensils. They are probably lactic acid streptococci of the chain-forming type such as are commonly used in butter and cheese starters. They may belong to the species *Streptococci cremoris* Orla-Jensen. The rod-shaped bacteria (lower right hand clump) are of a type commonly associated with utensils. 600×.

form acid. For this reason, the Thybromol test should only be used on fresh milk as drawn from the udder.

In typical streptococcic mastitis, it is usually possible to find some chains of the streptococci engulfed in leucocytes where the bacteria are killed and digested. Such a leucocyte is known as a phagocyte. Where phagocytes are present or where masses of cells are found which contain tangled chains of streptococci it is almost certain that the milk has come from an udder infected with this type of bacteria.

Here is a slide (Figure 7) where we have streptococci of a new sort that might easily be mistaken for mastitis streptococci. You will note three groups of streptococci on the slide, the lower group being a clump of rods rather than streptococci. These streptococci are in fairly long chains but there are very few leucocytes as you will notice. When we traced the origin of this milk we found that it came from a large herd, and that nearly all of the twelve cans that came from the herd showed streptococci of this sort. It was a machine milked herd and we suspected mastitis troubles at first. However, an examination of samples from individual cows showed that this was not the case. Eventually we found that cleaning up the milking machines caused this type of streptococcus to disappear. This and other observations show that there are some fairly long chain streptococci which originate in dirty utensils so it is necessary to study slides showing streptococci carefully before asserting that the sample of milk has come from a streptococcus infected udder.

The next slide (Figure 8) shows a type of bacteria that is very common in milk that has been allowed to stand for some hours at a warm temperature, so that bacteria have grown in the milk. It is frequently possible to tell something of the history of milk from the bacteriological condition of the milk as shown by the microscope.

However, may I call your attention to the fact that in our discussion of this work, which is based on the control work that we have been doing for the City of Geneva we normally have a knowledge of the age of the milk and of the conditions under which it has been kept in addition to the information secured by the microscopic examination.

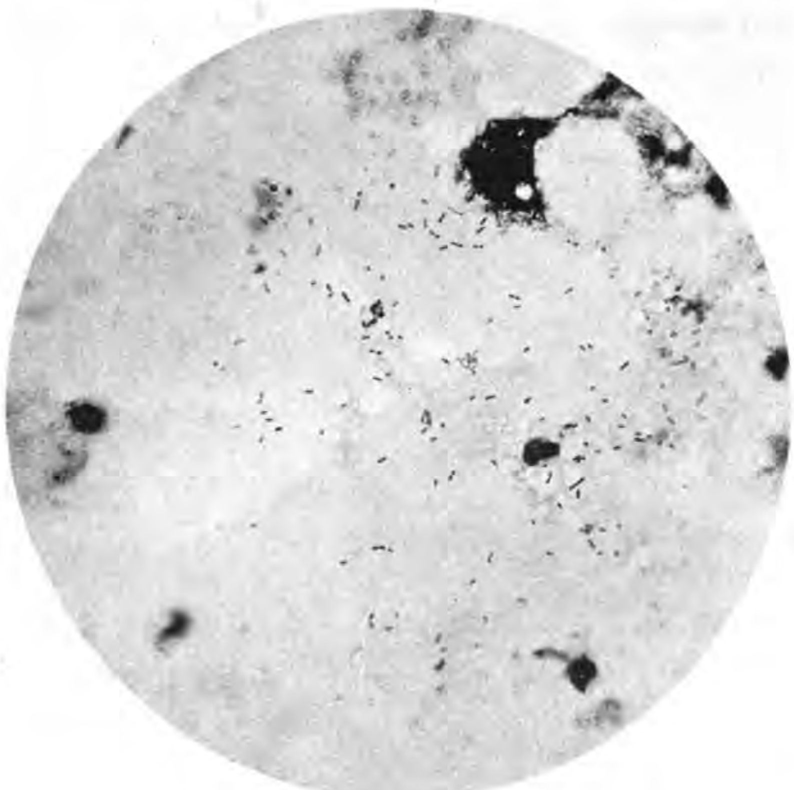

FIG. 8.

Microscopic appearance of milk containing a mixed culture which includes numerous gas-forming rods. The gas-forming rods undoubtedly belong to the colon group and are presumably *Aerobacter aerogenes* Beijerinck. Organisms of the colon group occur in milk as single rods, or as pairs of rods, or less commonly as loose groups of a half dozen or more individuals. Numerous organisms of the lactic acid type may also be seen. A few leucocytes show hazily toward the margin where they are out of focus. 600×.

Moreover, we normally take samples from each can that a producer brings to the plant, so that we have a record of several samples from each dairy. If, for example, a condition like that shown in the slide is found in the night's milk and not in the morning milk and you know also that the milk has reached the pasteurizing plant in a rather warm condition, then you are reasonably certain that you are dealing with a condition produced by growth of bacteria.

In other words, the high count is primarily due to faulty cooling. In this particular case I happen to know

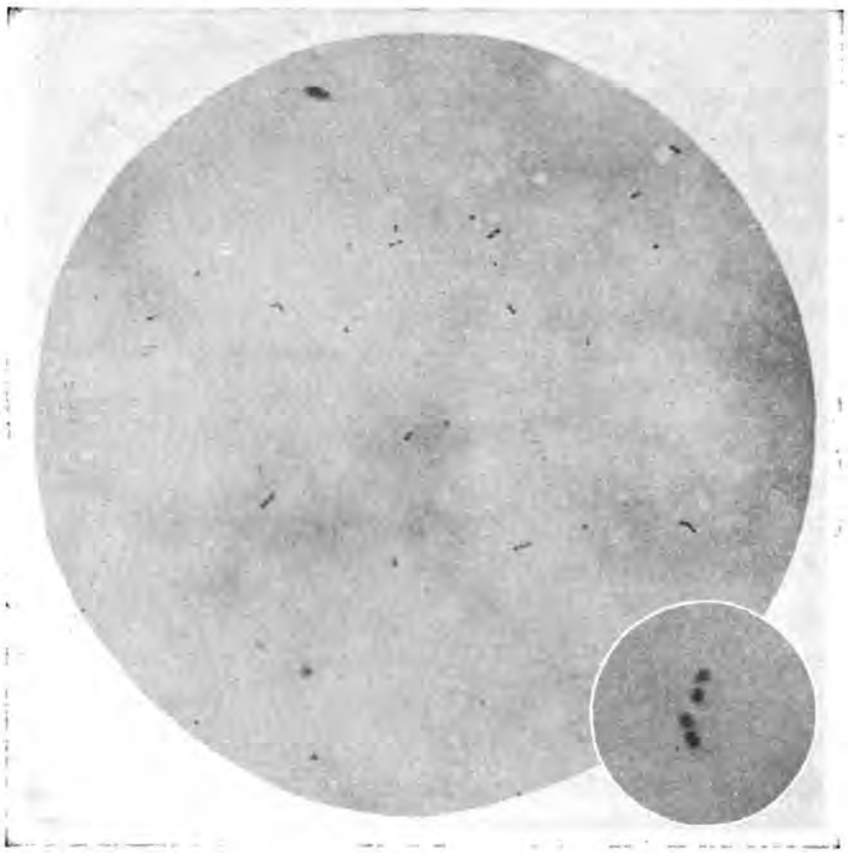

FIG. 9.

Microscopic appearance of milk, 16 hours old, souring normally. The predominant organism is *Streptococcus lactis* Löhnis. This occurs normally in milk as pairs, threes, or double pairs of lance-shaped cocci. Milk of this type is usually produced thru improper cooling, and it is usually at least 12 to 16 hours old when examined. Less commonly, the same condition is produced immediately on filling a can that has previously contained sour skimmilk or similar material. 600×.

The small insert shows two pairs of *Streptococcus lactis* taken from this preparation. One pair shows faint indication of division into four cells. 2,000×.

that almost all of the bacteria seen in the slide are of the colon group. That is, they are of gas forming types, and this particular sample of milk eventually curdled with a gassy curd.

This slide (Figure 9) shows the type of bacteria that are found in milk that is souring with a normal smooth, non-gassy curd. These bacteria are somewhat like those of the colon group in appearance but yet a close examination will show that they are an elongated pointed coccus. *Streptoccus lactis* Löhnis is an organism which looks much like very short pairs of the colon organisms. Some of the pairs shown in this slide may perhaps be colon organisms, rather than the *S. lactis* type. In this case, the sample of milk had come from a can of night's milk brought in at a temperature above 60° F so that we had no difficulty in guessing that the large numbers of bacteria were due to the growth of the bacteria in the milk.

However, it is never wise to be dogmatic in asserting the explanation of the conditions revealed by microscopic examination. I remember one occasion where the sample had been taken from milk that was only four hours old, and yet it had millions of organisms of the *Streptococcus lactis* type in it. We were at a loss to interpret this condition as no such growth could have taken place after the milk was drawn. We made inquiry of the farmer over the telephone and found that in taking his milk to his neighbor's that morning to have it taken to the milk plant, he discovered that one can had sprung a leak. He borrowed a can from his neighbor which happened to be a can which the neighbor had used for skim milk, and dumped the milk from the leaking can into this can. When we learned this, we found it very easy to understand why there were so many of the sour milk organisms in the sample that we had examined.

The next slide (Figure 10) shows a condition which, with the additional information to which I have just referred, can usually be interpreted as coming from dirty utensils. It may occur in milk only a few hours old just

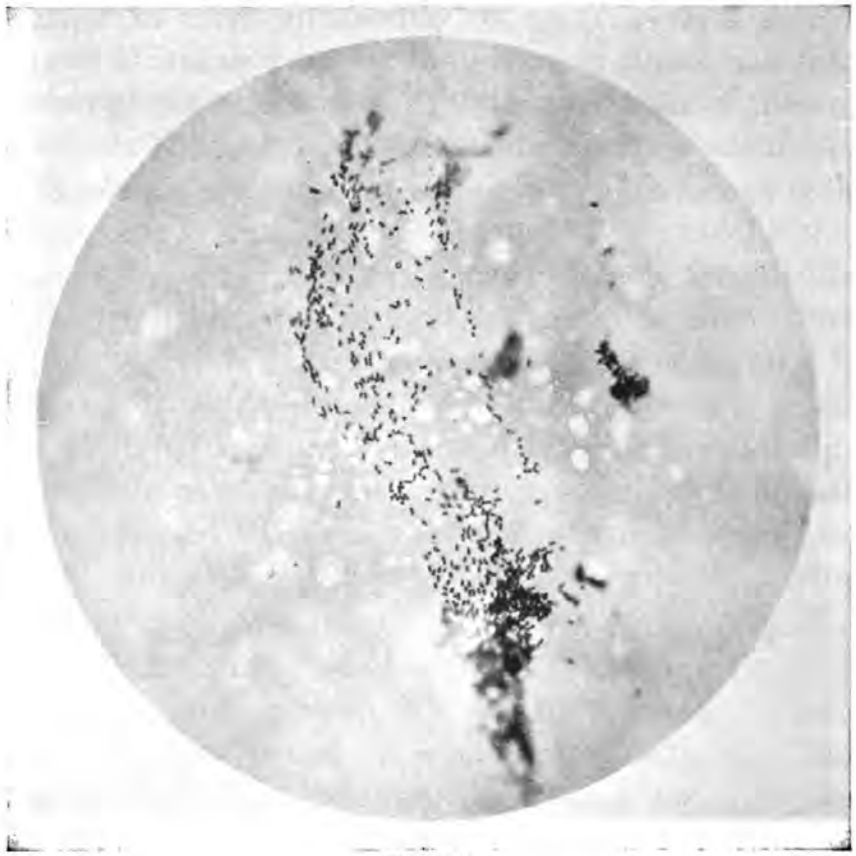

Fig. 10.

Microscopic appearance of milk that has been handled in poorly cleansed milk cans. This picture shows a film of bacteria as washed from the surface of the metal. Such masses are not broken into their component parts in preparing dilutions for agar plates. The species of this type of bacteria cannot be recognized by microscopic examination alone. 600×.

as readily as in milk that is 12 to 20 hours old. Let us suppose, for example, that we had taken eight samples of milk from a farmer's supply as brought to the plant, four of them morning cans and four of them night cans, and we found a picture like this from every one of the eight samples. I do not know of anything that would produce that sort of a result except a dirty milking machine. A milking machine in bad condition will furnish bacteria of miscellaneous types to all of the milk which passes through it even down to the tenth or twelfth cow milked with one machine. Usually, however, the first can filled will have more of those miscellaneous types of bacteria than the later cans because the milk from the first cows serves to wash the machine partially.

If you find all of the samples from a dairy showing a picture of miscellaneous clumps of bacteria you can be

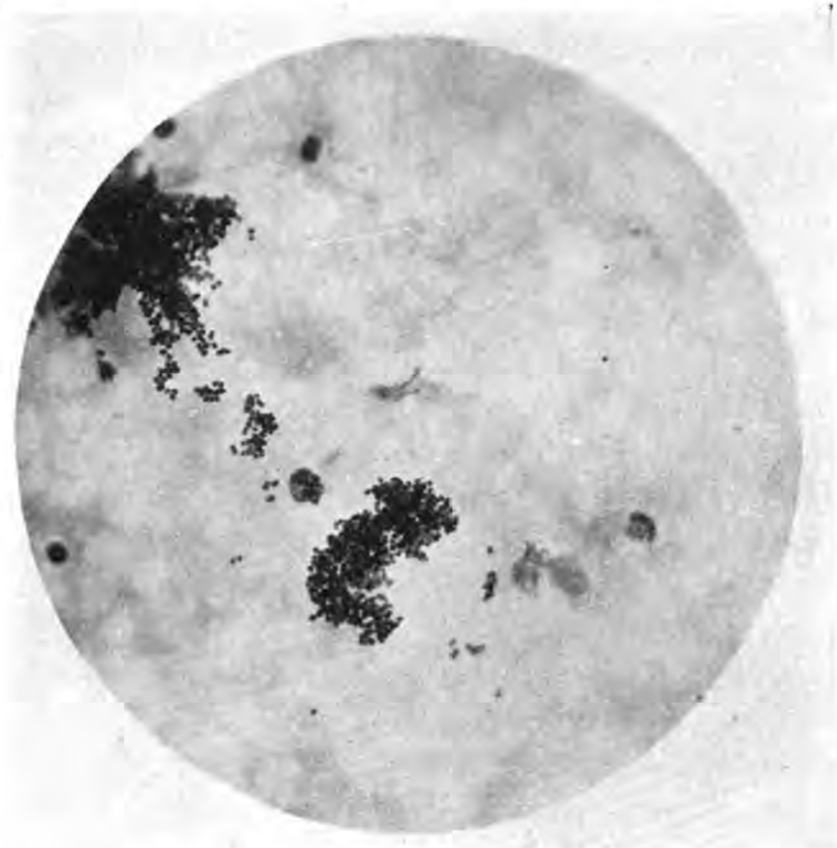

Fig. 11.

Microscopic appearance of milk handled in improperly cleansed utensils. These masses of micrococci were derived from poorly sterilized milking machine tubes. Masses of micrococci are more commonly derived from milking machines than from other utensils, tho they may also come from cans and other utensils. Similar masses of micrococci may be produced by growth so that the presence of masses of micrococci (Staphylococci) does not necessarily indicate utensil contamination. The species of micrococci cannot be identified through microscopic examination alone. 600×.

reasonably sure that the high count has been produced by using a dirty milking machine.

On the other hand, as I will show later, miscellaneous clumps and masses of bacteria are not always indicative of dirty utensils.

This slide (Figure 11) will show masses of bacteria of a different type that were likewise derived by washing dirty utensils in milk. These are micrococci and are

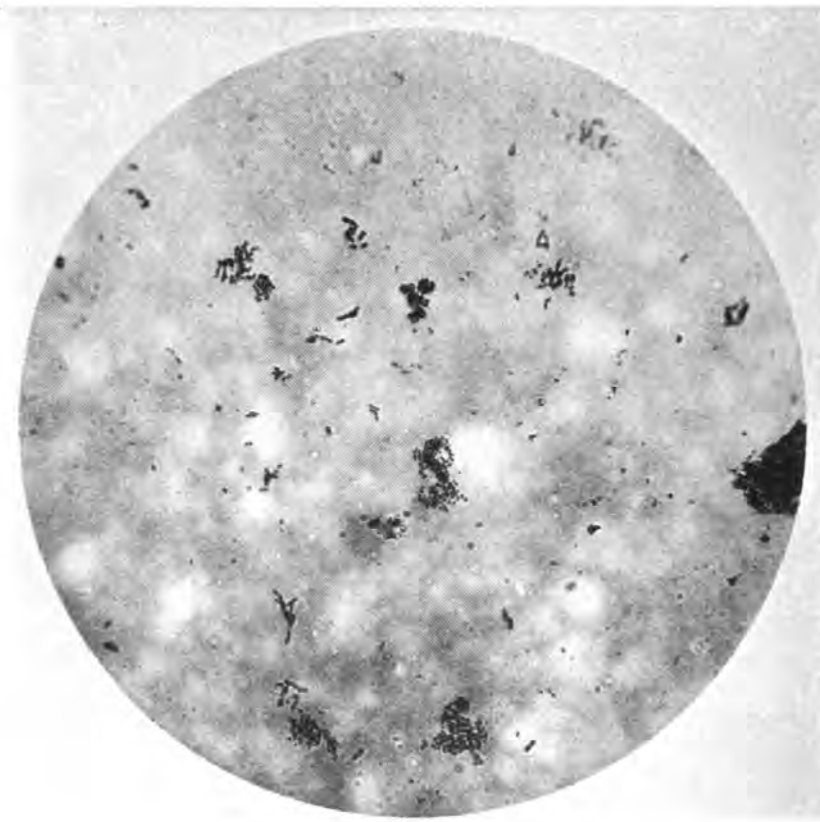

FIG. 12.

Milk drawn from one quarter of an udder which had been injured and had developed an internal abcess that was not evident to the owner of the cow until she was killed. The milk contained numerous masses of bacteria of various types which were at first, interpreted incorrectly as being of utensil origin. Streptococci, sarcinæ, miscococci, and rod-shaped bacteria were all evident in this mixed udder infection. An unusal case. 600×.

usually derived from utensils although they may grow at times in the milk in large clusters.

I have included this slide (Figure 12) for a special reason. We have spoken of the fact that samples of milk containing miscellaneous bacteria in clumps and masses have normally been associated with dirty utensils. Here is a picture that might be thought to be typical of that sort of thing. You will notice that here is a clump of rods. Up here on this edge of the slide is a clump of sarcinae and there are a few scattered micrococci throughout the slide, while here in the center is a clump of fine chains of streptococci. This picture certainly shows a miscellaneous lot of clumps of bacteria. This slide was made from a sample that was taken one day in our routine examination of can samples and as a result of our examination, we telephoned to the dairyman that we felt his milk was in bad shape because his utensils were not being cleaned properly.

The next day, his milk came in free from bacteria and we thought we had accomplished a beautiful bit of dairy inspection over the telephone. But two or three weeks later, the same condition appeared in samples of milk from the same dairy. The types of bacteria were exactly as they had been previously. We complained more vigorously than before that there was careless cleaning of the utensils. The next day the dairyman appeared with four samples of milk drawn from four quarters of a cow in his herd and asked us to examine them. The milk from one of the four quarters showed the miscellaneous clumps that we had thought to be derived from the utensils. As soon as we discovered this fact, we asked the dairyman for the privilege of examining the cow more thoroughly, but received the reply that the cow was "hanging on the barn floor." He had slaughtered her, and found a deep seated abscess in the udder caused by a mixed infection. The abscess had developed from an injury caused by hooking. We had completely deceived ourselves in regard to the source of the organisms present in this particular sample of milk.

So again we should like to emphasize the fact that it is not wise to be dogmatic in interpretations of the conditions seen under the microscope.

Fig. 13.

Microscopic appearance of a sample of pasteurized milk taken at the end of a five-hour run. Two fields of the microscope are combined so as to show the variety of types of bacteria present. Numerous pin point colonies were developing from the pasteurized milk from this plant on routine plates at this time. 600×.

3. Pasteurized Milk

In taking up the microscopy of pasteurized milk, which is still an undeveloped field, may I say that there are many false ideas about what may be seen on the microscopic examination of pasteurized milk. I well remember a statement sent to me by a prominent bacteriologist, a dairy control official, who stated that you *could not* make a microscopic examination of pasteurized milk.

It is, however, quite possible to make such examinations and many objects of interest may be found; but it is not easy to interpret the conditions found correctly. Many people believe that nearly all of the bacteria seen in pasteurized milk are dead. Others that the dead bacteria do not stain with methylene blue. Neither idea is 100% correct. Some dead bacteria stain with methylene blue and cannot be distinguished from living bacteria. However, the larger part of the dead bacteria do not stain, so that a large proportion of the stained bacteria are alive.

FIG. 14.
A mass of thermophilic rods in pasteurized milk. 600×.

The recent work on bacteria that grow during pasteurization, shows that there may be great numbers of bacteria in a living condition in pasteurized milk and that many of these were not in the milk when it entered the pasteurizing plant.

The first slide of pasteurized milk (Figure 13) shows a condition frequently found in such milk. Undoubtedly these bacteria were living when the slide was stained. If you will look closely you will see that these rods are of spore forming types which are not found normally in raw milk. When bacteria of this type are found in pasteurized milk they are ordinarily of thermophilic types that have grown at pasteurizing temperatures. No way has yet been discovered to distinguish microscopically between thermophiles and more common types of spore formers that are sometimes facultative thermophiles. These scattered rod-shaped bacteria of the spore forming type are typical of the conditions shown in milk taken at the end of the run where thermophiles are abundant; but it is necessary to plate the milk and incubate at high temperature (56-63° C) in order to determine whether the rods present are thermophilic in nature.

This slide (Figure 14) shows a very common condition even more clearly. In this figure masses of thermophilic rods are shown as found in the pasteurized milk. This particular sample of milk came from a milk plant that filtered the milk twice, once before pasteurization to take out the dirt, and once after pasteurization because they feared that fragments of enamel might chip off of old equipment that was soon to be replaced. Because the dirt was taken out by the first filtration, the operators did not feel that it was necessary to change the filter cloth in the second filter during the run. It was a seven hour run and there were several times during the run when there were shut downs because the milk bottles did not come in fast enough. They also shut down each day for the noon lunch hour and shut downs also occurred because of temporary shortages in the raw milk supply. During these shut downs, hot milk stood in the second filter. The result was that the sediment on the filter cloth in the second filter was a solid mass of these thermophilic rods, and the milk that pased through the filter showed numerous masses of thermophiles.

The next slide (Figure 15) again emphasizes the fact that it is necessary to be cautious in regard to interpretations, as applied to long-chain streptococci. In reality this is not a preparation made from pasteurized milk, as

Fig. 15.
A long chain streptococcus from milk heated to 110° to 120° F. probably of a heat resistant type (S. glycerinaceous). 600×.

this particular sample of milk was taken immediately after the milk had passed through a forewarmer and it was filtered just before pasteurization. The milk passed through the filters at a temperature of 110 to 120° F. and this is a temperature that favors the growth of certain heat resistant bacteria. In this case many of the bacteria present were of the long chain streptococcus type, one chain being shown in the figure together with other bacteria. This milk still showed large numbers of these long chain streptococci after it had passed through the pasteurizers. These streptococci were not associated with leucocytes and were not of the mastitis type. They were rather of the heat resistant types of streptococci, which had grown during the process of filtration, at a temperature below that of ordinary holding pasteurization.

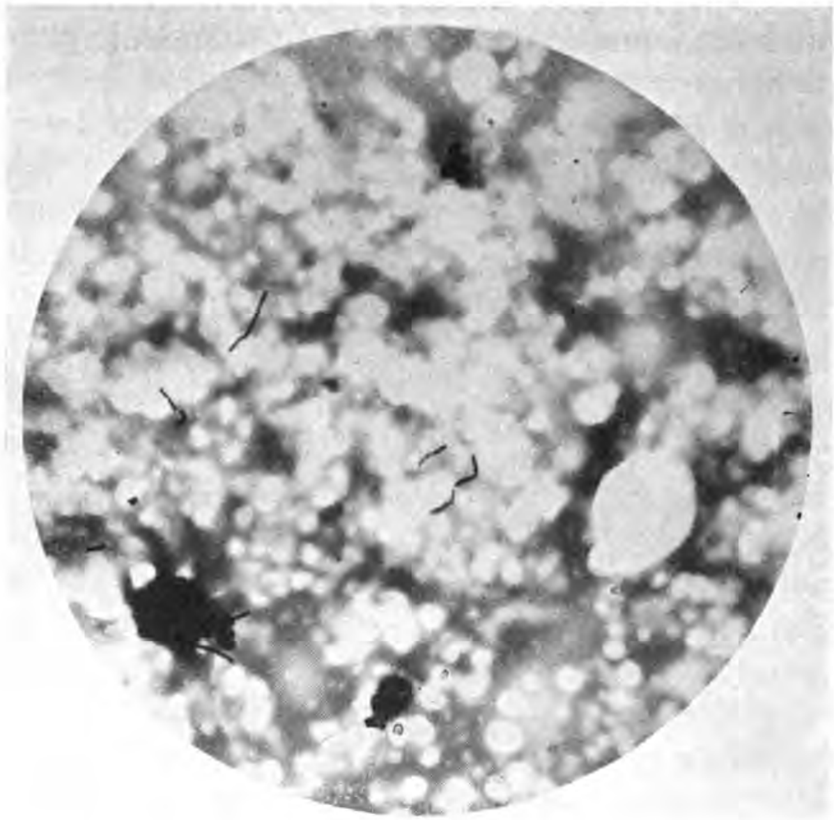

FIG. 16.
Microscopic appearance of foam from pasteurizing vat, showing thermophilic bacilli. 600×.

The next slide (Figure 16) shows a picture of foam. Foam is commonly found to be associated with the development of thermophilic bacteria in pasteurized milk and in this picture we see the rod-shaped bacteria that are typical spore forming thermophiles.

The next slide (Figure 17) shows another condition, which is associated at times with the presence of these large rod-shaped spore-forming bacteria in pasteurized milk. This microphotograph represents some of the milk stone scraped off of a pasteurizer and stained for examination under the microscope. It is practically a solid mass of thermophilic organisms. Even in such cases caution must be observed in jumping to the con-

FIG. 17.
Microscopic appearance of milk stone scraped from pasteurizing Vats. 600×.
Numerous bacilli and spores are evident.

clusion that milk stone is a source of thermophiles because milk stone scraped from dairy equipment frequently shows no bacteria whatever on microscopic examination.

As stated at the beginning all that has been shown is merely suggestive of the things that can be done with the microscope in the examination of milk and cream. As a matter of fact, it requires accurate bacteriological knowledge to interpret many of the conditions that are found. Even our ablest bacteriologists are unable to interpret the conditions revealed by the microscope without supplementary information. It is desirable to have as much additional information as can be obtained; such as age of sample, temperature at which it has been kept and the like before interpretations can be made of many of the things seen under the microscope.

This technique is finding its greatest practical value as shown in these pictures in connection with the control of the quality of raw milk as it is delivered at pasteurizing plants.

Nevertheless, the last few slides shown suggest certain possibilities that may be developed in connection with the examination of pasteurized milk, and many laboratories are finding it useful to make routine microscopic preparations of samples of pasteurized milk at the same time that they make routine agar plates.

If rod shaped bacteria of thermophilic types are present, then additional plates should be prepared for incubation at higher temperatures in order to determine whether the bacteria are true thermophiles. In this and in other ways the microscope is likely to find additional uses in connection with the routine control of the quality of milk, cream and ice cream.

THE CHAIRMAN: The discussion of this particularly instructive paper by Dr. Breed will be introduced by Dr. J. L. Hileman of the Dairymen's League Co-operative Association, New York.

DISCUSSION

J. L. HILEMAN

Chief, Laboratory Division, Dairymen's League Co-operative Association, Inc., New York City

Dr. Regan was called back to New York yesterday and he asked me to take his place. I want to outline briefly for you the organization we have into which we fit the microscopic examination of milk samples that you have heard discussed by Dr. Breed.

We are controlling the quality of our milk received from some twenty-six thousand farmers. In order to do this we have a staff of some seventy dairy service men or dairy inspectors. These dairy service men have assigned to them some three hundred fifty farmers. They are responsible for the quality of the milk received from the farmers under their supervision. These dairy inspectors are supervised in their work by six overseers.

Now, in order to aid these inspectors in controlling the quality of the milk received from these farmers, we make microscopic examinations of this raw milk at least once each month in all cases. Some twenty thousand of these farmers have samples taken twice each month, as the milk is brought to the milk plant.

These farmers deliver their milk to two hundred and fifty milk plants, and the examinations are made in those plants. This work involves the examination of over three hundred twenty-five thousand samples each year.

Now, we consider milk containing more than six hundred thousand individual bacteria per cubic centimeter to be poor milk. Our laboratories, of which we have sixteen, grade these samples and send these dairy inspectors a report of their findings. All samples that are graded as poor are checked up by the dairy inspectors by means of a personal visit to the farmer. These inspectors make an effort to help the farmer correct or see what is the cause of the large number of bacteria present in his milk.

We feel that the method developed by Dr. Breed has been of immense assistance to us in improving the quality of our raw milk supply.

We are using the method also very effectively in checking the quality of raw milk transferred from one plant to another plant. We have manufacturing plants to which we transfer milk from some of our smaller receiving plants, and we are making a practice of examining this transferred milk daily. This enables us to know just what kind of milk is coming out of each one of these receiving plants. If we find large numbers of bacteria in this milk, an investigation is made to determine where the trouble is. Sometimes we find it is the farmer; sometimes we find it in the plant. It is a very useful method to keep you out of trouble and you will almost invariably find that you can correct any trouble before it has had an effect on your product and has gotten you into difficulties with your customers.

The Chairman: Has anyone anything else to add to the discussion of this paper?

Well, ladies and gentlemen, this brings a very enjoyable and instructive session to a close, and, just before adjourning, I would like to thank you again for the privilege of having acted as your chairman, and express the hope that we may meet again next year under the same arrangement.

We will now stand adjourned.

Friday, October 24
9.00 A.M.

REPORT OF COMMITTEE ON SANITARY CONTROL OF ICE CREAM

R. E. Irwin, *Chairman*

The Committee desires to submit a progress report. Last year our report contained regulations recommended for municipal and state regulatory officials interested in the preparation of municipal and state laws governing the manufacture and sale of ice cream. During the past year these regulations have been widely distributed and criticisms are being received. It is now the intent of the Committee to consider the criticisms submitted and revise the regulations presented before our Association in 1929.

REPORT OF COMMITTEE ON PUBLIC RELATIONS

George W. Grim, *Chairman*

The Committee on Public Relations was appointed following the 1929 meeting of this Association at Memphis, Tenn. It is our understanding that the purpose of the Committee was to consider co-operation among similar associations and also the formation of State or Sectional Milk Inspectors Associations with the hope of arousing and increasing the public interest in Dairy Control work as well as developing a greater feeling of security in those sections where milk supplies are protected in the approved way. The Chairman has been in touch with the seven members of this Committee. Definite suggestions have been made by four.

The suggestion has been made that the International Association of Dairy and Milk Inspectors proceed to form affiliated regional sections, the details of organization and affiliation to be decided upon after this suggestion has been acted upon by the Association. All of the members of the Committee who have communicated with the Chairman favor the formation of such affiliated State or Sectional Associations.

It is observed that the small town inspectors and the subordinate members of the Milk Inspection Staff of our larger cities frequently do not have the opportunity of attending the annual meetings of the International Association of Dairy and Milk Inspectors. Regardless of the meeting place most of the men actually engaged in daily dairy inspection do not find it possible to attend the meetings. It is obvious that a group of affiliated organizations would reach a far larger proportion of the rank and file of our profession with greater regularity than is now the case.

The Committee suggests that the various means of establishing closer relations between the National Association and existing State Associations be studied and if possible the maintaining of contact between the National Association and the Local State or Sectional Associations during the course of annual meetings. All members of the Committee considering this suggestion felt that the benefits both to the National Association and the Local Associations would be considerable through the maintaining of such contact.

It is obvious that one of the primary problems which must be treated by the Committee on Public Relations must deal with the consideration of means of bringing the activities of the International Association of Dairy and Milk Inspectors to the attention of the general public. As a means of accomplishing this end it is suggested that the Association formulate and carry into effect definite plans whereby more extensive publicity will be given to the activities of the International Association of Dairy and Milk Inspectors at the time of its annual meetings.

It is considered highly advisable that there be prepared during the course of the annual meetings a mimeographed report which will set forth briefly the high points of the meeting and indicate the trend of progress in milk sanitation, copies of the report of annual meetings to be available for distribution not later than noon of the last day of the Convention. Delegates in attendance at the Convention should be urged to present copies of such reports to their constituents upon return to their homes. Further, they should be urged to secure publication of such reports in their local and state newspapers.

Still another means of increasing the public's interest in dairy control work is suggested through the preparation by a subsequent Committee of occasional news releases and magazine articles between meetings; topics such as the Market Milk situation in various parts of the country; the importance of dairy control work; the importance of milk as a food; the improvement which is being made in milk handling and distribution; have been suggested for general publicity.

It has been suggested that copies of publicity material of this character be supplied the Secretaries of each of the Dairy Inspectors Associations in the United States and Canada and that they be urged to send out the material to the general press. There is an Associated Press representative in most of our large cities, and the Secretary of the State organization should be able to interest him in the use of some of the material. Such articles should be identified as coming from the International Association of Dairy and Milk Inspectors.

An effort has been made to tabulate the existing State or Regional Associations of the United States and Canada. The following list of such Associations has been made available to the Committee:

Massachusetts Milk Inspectors Association.
Michigan Dairy Inspectors Association.
Northwest Association of Dairy and Milk Inspectors.
California Association of Dairy and Milk Inspectors.
New York State Association of Dairy and Milk Inspectors.
Northern Ohio Milk Inspectors Association.
Pennsylvania Association of Dairy and Milk Inspecors.
Connecticut State Milk Inspectors Association.

The Committee would be glad to have the names of any additional Milk Inspectors Associations of which any of the Association members may be aware.

REPORT OF COMMITTEE ON DAIRY FARM METHODS

T. J. Strauch, *Chairman*

Last year your committee submitted a report upon what it considered one of the most important factors in the production of a sanitary quality of milk, namely the proper cleaning of all utensils used in the handling, storing and transportation of milk. This year's report deals with the quick cooling and storing at a low temperature of milk on the farm.

The greatest trouble encountered in the handling of milk is the growth of bacteria. The cows, utensils and equipment may be kept immaculate, but unless the animal heat is removed and the milk kept at a safe temperature, a rapid growth of bacteria will result. In order to prevent this bacteria development, the milk should be cooled and held between the temperature of 40° and 50° F. By exercising proper care on the farm, the number of bacteria which gets into the milk during the process of milking is small, but these will increase rapidly if the milk is not quickly cooled and kept cool until used.

One of the greatest handicaps the dairy industry has today is the lack of proper cooling facilities on the farm. With dairy laws in many sections of the country, requiring that market milk must be cooled immediately to 50° Fahrenheit or lower, and so maintained until it reaches the consumer, it is necessary to have some means on the farm other than spring or well water to cool milk at the source of production. Ice for the average producer is the most efficient and practical way of cooling milk when cost is considered. It is not possible to obtain natural ice in all sections of the country due to climatic conditions, but where the season is long enough or cold enough to obtain ice eight inches or over in thickness, and the cost is not too great in obtaining the ice, natural ice can be used to advantage. In using artificial ice, the factors to be given consideration are cost, melting while enroute, accessibility and regularity of supply. Where either natural or artificial ice is used at the farm, an insulated tank is recommended. With such a tank, quick cooling is readily obtainable. The insulation of the tank reduces the cost of operation by saving ice. Another advantage is that water will not freeze in winter in a tank of this type. In determining the size tank to be constructed, consideration must be given to the amount of milk to be cooled. To obtain rapid cooling, the tank should contain about three gallons of water for every gallon of milk in the cans. The tank should be made of such a depth that the water will come well up on the necks of the cans. It has been determined from experiments that owing to heat losses through a non-insulated tank, that it takes over three times as much ice to get the same results as it would if a properly insulated tank had been used.

There seems to be some difference of opinion as to whether better results can be obtained from a bacteriological standpoint if the milk is pre-cooled by running it over a tubular cooler through which well or spring water is circulated before placing the cans in the tank of water, or if the can is placed in the water without this initial cooling. Those advocating the latter method claim that as there is very little if any increase in the bacterial growth in milk during the first two hours, and as milk placed in a tank of ice and water should be well below 50° Fahrenheit before that time, they see no good reason for this pre-cooling.

Insofar as your committee has been able to learn, the best results have been obtained where the initial cooling over a tubular cooler has taken place before the milk was placed in the vat.

It has only been during the past few years that any great improvement in the equipment for cooling milk on the farm has been made, the outstanding contribution being the small electrical refrigeration unit. There are three methods of cooling used in connection with the refrigeration unit. Where milk is delivered to the distributing depot once a day, the dry or wet storage is used. The dry storage consists of a walk-in box with a brine tank installed near the top of the box. The wet method consists of an insulated tank, the water in which has been cooled by brine circulating through pipes in the box, the box being of sufficient size to hold the required number of cans of milk.

Where milk is delivered twice a day and within a few hours after milking, the aerator method only is used. The aerator is used in both the wet and dry methods before the cans are placed in storage. The aerating coils of the cooler should be divided into two sections, so that the upper section is cooled by circulating well or spring water through it. This gives the warm milk its initial cooling at a much less cost than by doing it with brine which has to be cooled by the refrigeration machine.

While there is not complete accord as to the best means of cooling milk under all conditions, those who have done considerable experimenting all agree that where ice is used, the cork insulated tank insures the most efficient use of the ice. There are a number of bulletins available at the present time showing the construction of an insulated milk cooling tank.

While the electrically operated cooler seems to be better adapted and more economical for cooling milk at the farm in some parts of the country, especially in the south, your committee at the present time has not sufficient information covering the cost of operation of this type of cooling system to be able to recommend its use exclusively.

HIGHER MILK STANDARDS

Roy F. Leslie, D. V. M.

Chief Meat and Dairy Inspector, Department of Public Health and Welfare, Cleveland, Ohio

It certainly is fine to have meetings of this kind and make resolves and talk about the wonderful business we are in and the importance of our work and the milk supply and what a wonderful food milk is and what a responsibility we have. They help a great deal. It is only human to need a little pepping up occasionally. I feel this is especially true of the dealer and dairyman and that it is up to us to help him along this line, for as a noted author has stated, "The condition of the mind is everything, and first it has to be in the mind."

Now then, first let's help get higher standards in the mind of the dealer and dairyman, let us think out good constructive programs and then carefully carry them through, and in these programs let us not forget the consumer, he pays the bill. We could mention and perhaps write a paper on such items as the following:

De Laval Aids in Producing Cleaner Dairy Products

De Laval
No-Foam
Milk Clarifier

De Laval
Milker

De Laval
Cream Separator

FROM the time cows are milked until the butter, cheese, ice cream or whole milk is delivered to the consumer, there is a De Laval machine which guards its purity and makes its production more economical.

At milking time there is the De Laval Milker which keeps the milk from contact with germ-laden stable air. It is designed so that thorough cleaning is easily accomplished by ordinary farm methods, while special cleaning and sterilizing equipment is available to further simplify the process. The special grade of rubber tubing used may be sterilized without injury. Because of its many sanitary features, the De Laval Milker is widely used by producers of Grade A and Certified Milk.

De Laval Cream Separators produce cream of the highest quality, free from taints and odors. Their superiority in this respect is proved by the fact that the prize winning butter at each annual convention of the National Buttermakers Association, with but one exception, has been made from De Laval-separated cream.

De Laval Centrifugal Milk Clarifiers are widely used to remove sediment and other objectionable matter from whole milk. They are designed to handle cold milk before pasteurization and thus make it easier to comply with present regulations regarding sediment removal. They operate without affecting the cream line and the No-Foam type eliminates foaming of the milk.

Write for De Laval Catalog describing the product in which you are interested.

THE DE LAVAL SEPARATOR COMPANY

New York	Chicago	San Francisco
165 Broadway	600 Jackson Blvd.	61 Beale Street

De Laval

Check and Double Check
Direct Delivery (from filler to consumer)
Paper Containers
State Ordinances
Inter-City Agreements
Medical Inspection

However, we have had many fine papers along this line and in writing this paper I thought it might be well to go over some of the other phases of milk inspection.

We need police power but should be very careful so as to not discredit it. Be sure you are right before going too far, especially into court, for if a few court cases are lost your case is weakened. By gradually checking closer though in a fair way you help to create public opinion and say what you may, public opinion is a wonderful aid in not only winning a court case but any case.

While we must have police power, yet a premium is the only permanent and sure way to obtain real and lasting results. In many communities only a short time ago milk was sold below the minimum state standard of 3.0 per cent butter fat. Why was this? Why, you know! no premium for butter fat, just pure police power, milk sold by the gallon. Now milk almost everywhere is sold on a butter fat basis, including a label on the cap of the per cent of butter fat and the result is that now little trouble is had on butter fat content. Why not establish the premium idea in other lines, such as sanitary conditions, barn score, bacteria count, cleanliness, plant score, etc.

A new phase of inspection to help higher standards is as old as the hills, "Service." In mentioning Henry Ford's name I am sure no criticism will be raised, for it seems that he above all men somehow has retained public confidence and why? Because I think it is universally agreed that the basic idea back of the original

Ford car was "Service"—transportation service to be sure, but service. In what ways may we be of service? In a recent story in the *Saturday Evening Post* it is told how some men were out in an open boat. The ship they were on was shipwrecked and after several days no land being in sight the water supply became low and the general situation desperate. A quarrel started up between the officer in charge and one of the crew and during the trouble the sailor fell overboard into the supposed sea, but to the great surprise of all, when the sailor came up he cried, "Fresh Water." Later a check up showed that they were in the mouth of the Amazon.

In the dairy industry, especially dairying many are in the mouth of the Amazon and don't know it. It is up to us through service to let them find it out. It is said the average butter fat production per cow is around 150 pounds per year and that in testing associations it is around 300 pounds and we all know of many records of over 1,000 pounds. Helping along breeding lines may be far fetched for a dairy inspector, but I list it under "Service" and there are many items of this kind that could be listed if time would permit.

Now last but not least, toward "Higher Milk Standards" is another old standby—"Co-operation." A simple illustration of this is to help a dealer or dairyman when you can in a legitimate way. You may not and he may not at the time think much of it, but sooner or later you may need a little co-operation, and if you have consistently done your part you will find very few refusals on the part of the other party.

In conclusion, as a brief review for Higher Milk Standards I offer the suggestions of a Premium, Service and Co-operation.

GRADE A MILK FROM FARM TO TABLE

A. D. Burke, B. S., M. S.

Head of Dairy Department, Alabama Polytechnic Institute, Auburn, Ala.

and

Irven M. Cox

Assistant, Bureau of Dairy Inspection, Jefferson County Board of Health, Birmingham, Ala.

For the moment we speak as producers of milk, practical producers, for any code of laws which inhibits the practical defeats its own purpose. The only excuse for having regulations is because the majority must direct the actions of the ignorant, the indiscreet and the unscrupulous. After all, the simplest code is usually the best, and one often wonders why the dairy industry must be burdened with so many cumbersome details. As a matter of fact, details are essential, not particularly to assure compliance with the law but rather as a guide to enable one to meet certain requirements.

Thus it is in the production of Grade A milk, both raw and pasteurized. There is nothing mysterious or mythical about the procedure. On the whole the regulations are simple and the extra cost of producing this high quality milk is small. To be sure details are involved but many of them may be touched upon lightly, provided the major operations are carefully watched.

While we are speaking chiefly as present day producers, our interest in the production of Grade A milk has been that of both producer and inspector. As in every industry, we find it demands an intimate acquaintance with two important essentials:

1 The goal to be reached
2 Systematic methods

Having a goal is essential in that it establishes certain definite standards of quality and safety. In our case, just as in every phase of the dairy industry, it was determined by state and municipal regulations, which stipulated a maximum limit of 50,000 bacteria, a minimum requirement of 3.25% fat, 8.5% solids not fat, a temperature of not greater than 50° F., and other requisites, all as set forth in the Standard Milk Ordinance.

We experienced no difficulty in maintaining our chemical and physical standards. How well we succeeded in controlling bacteria is shown in part by the following table for each of the past 12 months.

BACTERIA COUNT OF GRADE A RAW MILK DAIRY FOR 12 MONTHS

Date	Count
October	
3-29	3,000
10	2,000
17	1,000
23	3,000
November	
8	28,000
15	18,000
29	3,000
December	
10	7,000
January	
7-30	7,000
February	
6	3,000
12	4,000
21	4,000
March	
7	8,000
20	6,000
April	
2	8,000
10	5,000
17	4,000
22	1,000

May	
1	4,000
8	5,000
15	760,000
22	14,000
29	3,000
June	
4	1,000
11	5,000
18	6,000
July	
2	2,000
15	22,000
23	8,000
August	
7	6,000
14	4,000
September	
11	4,000
18	3,000

Under 50,000	32—97.0%
50,000 - 200,000	0
200,000-1,000,000	1
	33 Total

Attention is called to the count of May 15, 1930, which ran 760,000. No one can attribute the cause. It is but one of those inexplainable accidents that occur in any industry. The milkers blamed poor equipment and the fact that the inspector took an old sample of milk, but more than likely a temporary break-down in the sterilizer was responsible. Aside from this single instance, the significance of these counts is apparent when one realizes they were attained—up until June, 1930—under what anyone would call very commonplace farm conditions. Since that time the dairy has moved into superior new quarters where a future upset can be attributed only to faulty methods. And after all the question of Grade A milk production is not so much a matter of equipment as a practice of methods. In its simplest interpretation, it involves essentially but one thing, namely:

Controlling of Bacteria

Aside from maintaining the chemical and physical standards, every step in the procedure centers about this single objective. Regulations on bovine and human health, a pure water supply, sanitation in and about the barn, use of small-top pail—everything points to that ultimate goal. These and many other well-known items need not be developed in this discussion. We are concerned only with major practices which we believe to be the controlling factors in our war on bacteria. These we have listed as follows:

1 Keeping down dust and dirt
2 Eliminating flies
3 Efficient cleaning and sterilization of utensils
4 Proper cooling and low storage temperatures
5 Protection during delivery

Controlling dust and dirt is comparatively easy. It necessitates but a few inexpensive operations. In what we consider our practical system, it consists in grooming the dirty cow, wiping the udder and flanks of all cows, with a cloth dampened in a chlorine solution immediately prior to milking. The problem of eliminating dust and dirt from feed operations can be accomplished by placing the grain mixture in the manger at least fifteen minutes prior to milking and feeding the hay in a hay rack under a shed or out in the open. Perhaps in the south we are fortunate in that our systems vary from those in the north. Ordinarily we have a milking barn in which the cows are turned during the milking period and a night barn which acts as a place of feed storage as well as a protection to cows during inclement weather.

The fly menace is one of ever pressing importance in all dairy sections, but its control is often attempted through ineffective methods. We are not of that family of producers or inspectors who rely mainly on the use of sprays and fly traps. Our practice has proven that a number of tested sprays heat up the cow. On the other hand, there is no gainsaying that fly sprays in light and proper applications do add to cow comfort and the mental attitude of the milker, even though little if any increased milk flow is attained through their use in the well operated dairy.

We have found one very effective method of controlling the fly—with its subsequent bacterial menace—to consist in fencing around the barn and milk house at a distance of about 150 feet. Cows enter this enclosed lot only at the time of milking and pass directly into the barn. Twice daily all manure is removed to a corner of the lot, from which it is hauled to the fields twice weekly. Thus there have been few fly breeding places and our spray utilization has been cut to a minimum with very light applications about the legs and udder at the time of milking.

The question of screening the barn is one that has enlisted attention both pro and con. In our opinion it is considered a fallacious procedure to screen the milk house and permit the source of supply to go unprotected.

Sterilization of utensils is another momentous problem. Perhaps no other dairy procedure—except possibly cooling—is subject to so many variations and yet no problem is more important. There is no time for discussion. We can but give you a résumé of one effective method.

Our dairy producing Grade A milk is equipped with a three compartment wash vat. Bottles are washed in hot alkali water and followed by two rinsings; one in hot and the other in chlorinated water. From here they pass to a sterilizer which is connected to a steam jet from a boiler. The sterilizer may be a novel idea to some in that it consists of two galvanized iron cylinders one fitted inside the other with a layer of asbestos sheeting between. We have found it simple to construct, low in price, easy to clean and very effective in holding heat. All utensils are left in the sterilizer from one milking to another.

Now take the question of cooling. You men in the north, where springs abound, are more fortunate than we in the south in those localities where cold springs are at a premium. Cooling is our most serious problem. On the larger Grade A farms in close proximity to the cities, electrical power is effectively employed to operate mechanically refrigerated cabinets of the dry or immersion type. Our particular dairy is equipped with an immersion type. An insulated box holding 100 gallons of water is cooled to a temperature of about 38-40° F. This water is circulated through a tubular cooler and back into the box. As closely as we were able to figure, the cost of cooling milk by this system, including all items of expense, except depreciation, amounted to about 10 cents per 100 pounds of milk. This figure is for one average week of July. This system apparently lends itself to speed, cheapness and high efficiency in cooling but it may be severely criticized from the standpoint of sanitation unless carefully operated. There is no question but that cooling is the great factor in maintaining low bacteria counts and good flavor in Grade A milk, and the method and dispatch with which it is carried out are equally important. After the bottles are mechanically capped, and covered with cracked ice, prompt delivery to the consumer's ice-box or protected spot completes the final step in the production of Grade A milk.

Time will not permit a discussion of Grade A pasteurized milk. Aside from the application of heat, the details of handling are essentially the same. Each demands its share of careful attention and supervision because after all one can have no greater responsibility than the production of Grade A milk from Farm to Table.

FARM STERILIZATION OF DAIRY UTENSILS BY HYPOCHLORITE

C. K. Johns, M.Sc.

Central Experimental Farm, Ottawa, Ontario

In 1918, the workers at the Illinois Agricultural Experiment Station (8) made a notable contribution to our knowledge of dairy bacteriology by pointing out the extreme importance of the utensils as a source of bacterial contamination of milk. Since that time their conclusions have been verified by a large number of workers. Of the ordinary utensils employed in hand milking, the shipping can was shown to be the main source of bacteria. While considerable improvement in can washing equipment for milk plants has taken place during recent years, it is still true that comparatively few distributors are returning dry cans to their shippers. Some organisms invariably resist the heat treatment during the washing process, and warm weather encourages a rapid growth in the traces of moisture remaining in the can. Consequently, if these cans are given no treatment by the farmer before being filled with milk, large numbers of bacteria may be added to the milk, particularly when 24 hours or more elapse between the washing of the can and its being filled with milk at the farm.

While it is well known that thorough steaming, or scalding with liberal amounts of boiling water, is effective in the destruction of this bacterial growth, few farms have facilities for satisfactory heat sterilization of utensils. Even where such facilities do exist, the results are not always what one might expect. On the other hand, cold water solutions of sodium hypochlorite of the quick-acting type have proven themselves, under laboratory studies and semi-practical tests in our own laboratory (3, 5) and elsewhere (1, 2, 6, 7, 10), to be very effective germicides when used as a rinse for cans and other utensils. The question arose, however, as to what results might be looked for when the average milk producer was given a supply of hypochlorite and directions for its use, and left to use it without any supervision.

Before any work with the farmer was attempted, studies were conducted to make certain that there would be no possibility of hypochlorite being used—or rather, misused—by the farmer to preserve his milk. In these studies (4) the maximum amount of hypochlorite which could be added to milk and escape detection after 18 hours storage at $<60°$ F. was first determined, and it was found that such concentrations were ineffective in preventing bacterial development in the milk.

Having settled this point, the writer approached Dr. J. B. Hollingsworth, Chief Food Inspector for the City of Ottawa, with a plan for testing out the value of hypochlorite sterilization on a number of farms producing fluid milk for the city market. Dr. Hollingsworth, who is a past president of this association, has accomplished a great deal in the way of milk improvement during the 25 years he has been in Ottawa and he enjoys to a marked degree the confidence of the milk producers of that district. Believing that the hypochlorite rinse method was worthy of study he readily agreed to co-operate with the Division of Bacteriology in carrying out the plan proposed.

The plan adopted was as follows: During each of the four weeks in June, Dr. Hollingsworth selected a group of 10 shippers, including good, bad and indifferent types of producer. Dr. Hollingsworth and the writer then called on each of these farmers, explained briefly the purpose of the test, and obtained their promise to give the hypochlorite rinse a trial. Daily composite samples were then obtained from the milk of each of these farmers as it arrived at the plant on 4 days, in order to obtain some indication of the quality of milk being produced where the utensils received the usual attention. Samples were analysed by the methylene blue reduction test and by plating on purple lactose agar and incubating at room temperature for 5 days.

After having obtained the four samples for the control week, a supply of H. T. H. (calcium hypochlorite powder) and a package of washing soda were delivered to each farmer. Instructions for making up a stock solution of approximately 3 per cent available chlorine, and for the preparation and employment of a sterilizing rinse of approximately 60 p.p.m. available chlorine, were also furnished. The farmer was instructed to wash his utensils as usual but to omit the customary rinsing with hot water. Instead, he was asked to rinse his pails, strainers, shipping cans, etc., with hypochlorite immediately before each milking, taking care to drain the utensils thoroughly before using them. Samples of milk were again obtained on 4 days of the following week, and analysed in a like manner. In this way, four groups of 10 farmers[1] each were studied between June 9 and July 10. The groups were overlapped by running the control week of the second group concurrently with the hypochlorite week of the first group, as you will see from the table distributed. Daily maximum and minimum air temperatures were obtained from the records of the Division of Field Husbandry at the Central Experimental Farm, Ottawa.

To facilitate comparison between the results of the control and hypochlorite weeks, the bacterial counts were grouped into 4 classes $<30,000$, 30,000–100,000, 100,000–1,000,000, and $>1,000,000$, while the reduction times were grouped in accordance with the Scandinavian Classification as given in Standard Methods of Milk Analysis.

[1] In one case it was found that the hypochlorite had been delivered to the wrong man, consequently the results from one farmer in the 3rd group had to be discarded.

TABLE I

SUMMARY OF ANALYSES OF 311 SHIPMENTS OF MILK FROM 39 FARMERS

	Group 1		Group 2		Group 3		Group 4	
BACTERIA COUNTS	1st Week	2nd Week	1st Week	2nd Week	1st Week	2nd Week	1st Week	2nd Week
% below 30,000	0.0	0.0	0.0	5.0	0.0	33.3	2.5	12.5
% 30,000-100,000	23.8	7.9	5.1	15.0	36.1	36.1	17.5	22.5
% 100,000-1,000,000	57.2	55.3	56.4	75.0	50.0	22.2	50.0	55.0
% above 1,000,000	19.0	36.8	38.5	5.0	13.9	8.4	30.0	10.0
Median Count	180,000	530,000	560,000	270,000	170,000	38,000	270,000	220,000
Average Count	826,500	936,050	2,203,400	379,775	722,333	483,277	853,400	1,983,750
METHYLENE BLUE REDUCTION TIMES								
% over 5½ hours	40.5	50.0	30.8	70.0	63.9	91.7	65.0	77.5
% 2 to 5½ hours	59.5	50.0	64.1	30.0	36.1	8.3	35.0	20.0
% 20 min. to 2 hrs.	0.0	0.0	5.1	0.0	0.0	0.0	0.0	0.0
% under 20 min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5
Median Reduction Time (hours)	5.25	5.38	4.50	6.25	6.00	8.88	7.50	8.25
Average Reduction Time (hours)	5.63	5.28	4.58	6.43	6.39	8.53	7.15	7.36
Average Maximum Air Temp. (° F.)	68	78	78	80	80	73	73	77
Average Minimum Air Temp. (° F.)	51	62	62	58	58	53	53	57

N. B. 1st Week—Control. 2nd Week—Hypochlorite Rinse Employed.

The summarized data obtained on 311 samples of milk from 39 farmers appear in Table I. Within each group the first week is the control week, while the second week is the hypochlorite week.

As will be observed in the table, considerable variation in temperature between the first and second weeks occurred in several groups. A lower temperature during one or the other week meant (1) slower growth of bacteria in the empty cans, and (2) slower growth in the milk after the can was filled, making comparison of results more difficult. For this reason, it is preferable that each group should be discussed separately.

In the first group studied, the temperature made a sudden jump after the control samples had been taken. As this was the first warm spell, many farmers were caught napping, and the effect of insufficient cooling was plainly seen in the results of the routine methylene blue test conducted on the entire body of 262 shippers by the plant laboratory. Only 17.5 per cent of the shippers were in Class 3 during the first week, as compared with 44.1 per cent during the second week. Compared with this marked decline in quality during the warmer week, the showing of the 10 farmers using hypochlorite is not unfavorable.

For the second group we were fortunate in enjoying very similar temperature condition during both weeks, and it is possible to draw more definite conclusions regarding the value of the hypochlorite rinse. Judged by the results of either test, by average, median or distribution into classes, there is a quite definite improvement during the second week which may reasonably be credited to the influence of the hypochlorite rinse in reducing contamination of the milk from the utensils.

The third group contained a higher percentage of first-class producers as will be observed when the results from the control week are compared with those of the other

3 groups, bearing in mind that this was a warm week. While there is a definite improvement with this group during the second week, the fact that the weather was cooler makes it difficult to decide just how much of this improvement is due to the use of hypochlorite rinse.

With the fourth group, the temperature conditions favoured the control week, although to a lesser degree than with Group 1. Here again a small improvement was noted during the second week. The misleading impression which may be obtained where the average of a series of counts is taken is well illustrated in this group. A few extremely high counts during the second week resulted in an average count over twice as high as that for the first week. Where the median count is employed, these extreme counts carry much less weight, and a more satisfactory comparison may be made.

The few outstandingly high counts probably arose as a result of the holding over of morning's milk until the following morning in cases where the truck called very early. Where the cooling was not effectively carried out, the opportunities for growth in such milk were far greater than in fresher milk, and under the influence of high temperatures during the second week some very high counts were obtained. One can was sour on arrival but was included in the sample just the same. This sample gave a count of 39 million and reduced in 12 minutes. The temperature on arrival at the plant was 60° F. indicating that faulty cooling and long holding were doubtless responsible for the high bacteria population.

Factors Tending to Minimize Value of Hypochlorite Rinse

1 The author learnt indirectly that certain farmers had stated that they had no intention of using the rinse. They reasoned that this was so much extra work for

which they received no increased remuneration and that if the results were promising the use of hypochlorite would be made compulsory.

2 In all but the third group, there were two or more milking machine users. In most cases these machines were not being adequately cared for and the freshly drawn milk received a heavy contamination from the rubber parts before entering the pail. Under these circumstances, the effect of rinsing the metal utensils with hypochlorite was minimized.

3 Although in the past the farmers had always been instructed by the Health Department not to give the cans any treatment, since they had been properly washed and sterilized at the plant, a number made a practice of rinsing all cans with cold water immediately before milking. Since this practice, as Prucha and Harding (9) have shown, is valuable in effecting the mechanical removal of bacteria, the difference between the hypochlorite and control weeks would naturally be much less marked where this practice was followed during the control week.

4 The fact that no really warm spell was encountered during the five weeks of the test resulted in considerably less bacterial development in the cans. Had hotter weather been encountered, the difference in favour of the hypochlorite would doubtless have been much more marked.

Conclusions

Despite the influence of the unfavorable factors mentioned, there is a definite indication that the employment of hypochlorite rinse resulted in a worthwhile improvement in the quality of the milk supplied by the 39 farmers included in these studies.

This improvement was secured without offering the farmer any incentive for using the hypochlorite, and

without exercising any supervision whatsoever to see whether he was using the hypochlorite properly—or at all.

The cost of the materials supplied, which included four times the quantity of washing soda required, was 19 cents per farmer. Since the one-half (Imperial) gallon of stock solution was sufficient to provide rinses twice daily for 80 days, the cost is less than 1/4 cent per day per farmer.

Since many distributors do not appear to be able, with their present can-washing equipment, to deliver cans to the farmer which are at all times fit to receive milk, there would appear to be a place for the use of a hypochlorite rinse by the farmer for the purpose of destroying the bacterial growth which has taken place since the can left the can washer. Furthermore, since this involves additional work without remuneration on the part of the farmer, it would seem only fair that the hypochlorite should be provided by the distributor free of charge, since he benefits from the improved quality of the milk shipped to him.

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THE STATUS OF FLAVORS IN MILK

C. L. Roadhouse

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The public is inclined to consider milk as being good or bad in taste or flavor without trying to analyze the nature of the flavor present. Even those who are drinking milk regularly are inclined to describe the flavor by comparing it with something with which they are familiar. That was the case with the newcomer from Ireland, who, when tasting soda water for the first time, said that it tasted like when his foot was asleep.

As we practice the tasting of milk we become more skillful in identifying the different tastes. Although the average person describes milk as "pleasing" or "not pleasing" to the taste, the milk judge in most instances will definitely recognize in milk such things as feed flavor, sweetness, saltiness, bitter, oxidized and some other less common "off" tastes and flavors.

We have defined taste in milk as the sensation perceived when milk is taken into the mouth. It is the sensation produced by the normal soluble constituents in milk such as milk sugar or lactose and the salts of milk. Flavor is the sensation perceived after the milk is swallowed, and originates more commonly from feed which the cow consumes, from chemical changes in the milk fat occurring after the milk is drawn from the cow, and from absorbed odors.

Taste and Flavor of Milk from Different Cows

In order to determine the variation in taste of milk from different cows we have collected samples of milk from 536 cows supplying the University Farm Creamery at Davis, California. These cows were given no feed during the five hour period before milking in order to eliminate the influence of feed on the taste of the milk. Of these cows, 467 or 87.1 per cent were normal, and 68, or 12.9 per cent of the cows produced milk with abnormal taste. Of the animals producing milk with abnormal taste, 34 or 6.34 per cent produced milk with salty taste; 17, or 3.17 per cent with rancid flavor, and 18 or 3.36 per cent with other abnormal tastes. The salty tastes and rancid flavors varied from very slight to distinct salty and bitter rancid.

Salty Taste in Milk

At the beginning of lactation the milk of an individual cow has a certain milk sugar and salt content which normally shows the maximum percentage of milk sugar and the minimum percentage of chloride for the lactation period. As the lactation period advances, the sugar content gradually lowers and at the same time the salt content increases. After the ninth or tenth month of lactation the sugar content may be lowered to a point where the taste is less sweet than at the beginning of lactation, and since, normally, the chloride increases during the same period the milk is likely to develop a rather sharp taste, which is usually due to the increase in the percentage of chloride. This may be considered to be a normal development in the milk produced by all cows, and it accounts for the fact that cows advanced in lactation may give milk with a less pleasing taste than that produced early in the period of lactation.

Salty milk may develop following inflammation of the udder. An inflamed quarter usually gives a smaller quantity of milk even following recovery, and in all instances of this kind which the writer has observed, the milk produced was different in flavor from the milk of the other quarters. Frequently it was found to be salty in taste, and analysis showed a low sugar and high chloride content.

Rancid Flavor in Milk

It is quite common to find rancid flavor in milk samples taken from individual cows. The data reported above shows that 3.17 per cent of the samples taken from more than five hundred animals showed rancid flavor. A small dairyman delivering market milk in Amador County, California, after losing most of his customers, brought samples of milk from each cow to our laboratory. The samples from two of these cows were distinctly rancid, and it was the opinion of the owner after observing these samples, that his flavor trouble had been caused by the rancid milk produced by these cows. At least a dozen letters have been received during the past year reporting rancid flavor in the milk from cows in different parts of the state. Rancid flavor in milk, when caused by lipase ferment, develops 6 to 12 hours after the milk is drawn from the cow.

Other "Off" Flavors in Milk

There are some other "off" flavors which develop in milk which are believed to be due to digestive disturbances, to pathological conditions of the organs of reproduction, and to other causes which have not been definitely determined. From our survey, however, these flavors were responsible for only 3.3 per cent of the samples which showed "off" tastes and flavors.

Effect of Feed on Flavor of Milk

It has been reported and recognized for a long time that certain strong flavored feeds when given to cows previous to milking produce a taste in the milk which causes it to be less pleasing.

Our experience has been that when a given quantity of strong flavored feed such as alfalfa, clover, or silage is given to several cows in sufficient quantity to produce a definite feed flavor in the milk of any of the cows, it is also present in the milk of all other cows if they consumed all of the feed which they had been given. From this we would emphasize that feed taste is a definite thing. If animals consume twenty pounds of green alfalfa or clover for instance, within the five hour period before milking, there will be a definite taste in the milk of all the cows, which will not be observed in the milk from cows which have not consumed such feed.

Experiments conducted at the California Experiment Station in 1926 showed that the giving of other non-flavor producing feeds with 20 pounds of green alfalfa does not modify the alfalfa taste in the milk if all the alfalfa given is consumed.

Absorption of Feed Flavors into the Milk

It has not been clear to some investigators how feed flavors could be absorbed into the milk within half an hour after the feed was consumed by ruminants. In such animals the feed is stored for a considerable time in the rumen before it is returned to the mouth for final chewing. It then passes into the third and finally to the fourth stomach in the course of digestion. The facts in this case, it seems to me, have been made clear by Schalk and Amadon in Bulletin No. 216, published by the North

Dakota Agricultural Experiment Station, which describes the physiology of the ruminant stomach.

Schalk and Amadon made a most interesting study of this subject through a gastric fistula made into the rumen through the left flank of the cow. Through this opening electric connections were made and the rumen illuminated in a way that made it possible to study their subject.

From their study it is pointed out that as soon as roughage was swallowed into the rumen it was flooded with waves of liquid forced into the rumen from the second stomach, this taking place with each peristaltic contraction of the rumen.

It seems clear that this liquid normally would take up a large amount of juice expressed from the feed during partial mastication in the mouth and during the masceration process in the rumen. Portions of this liquid pass along through the digestive tract to the abomasum or fourth stomach where it is partially absorbed, and further absorption would take place in the intestinal tract. The rapid absorption of these juices, rather than the feed, would seem to be concerned with the early absorption of feed flavors by the animal.

Influence of Sunlight on Flavor and Odor of Milk

In Research Bulletin No. 64, Hammer and Cordes referred to the abnormal flavors developing in milk from sunshine in their study of brown glass milk bottles. During the past year we have made a study of the influence of sunlight on the flavor and temperature of milk and cream kept in glass and paper containers.

It was shown in support of similar studies carried out by other workers that sunlight caused a definite "cappy" or "cardboard-like" taste in milk when it was exposed in clear glass bottles to the rays of the sun for forty-five minutes. From the work conducted by us it was indicated that a slight "off" taste was present when the milk was exposed to sunshine for as short a time as ten minutes. Milk placed in amber colored glass bottles and paraffine paper containers was not influenced in taste by the action of the sun. The milk kept in amber glass bottles absorbed heat faster than that kept in clear glass bottles, while milk in the paper container absorbed heat slower than that in either the amber or clear glass bottles. Pint samples of milk exposed to sunshine in paper, clear glass and amber glass bottles, for four hours showed a temperature of 91° F. for the paper container, 99° F. for the clear glass bottle, and 109° F. for the amber glass bottle. As would be expected, the dark amber color absorbed the heat rays more rapidly than did the clear glass or paper containers.

Strong sun rays shining against milk in clear glass bottles will undoubtedly cause oxidized flavor in milk. Route salesmen should be informed of this possibility and instructed to place the bottle of milk upon delivery where the direct sunlight will not come in contact with it. Even strong indirect sunlight will influence the flavor of milk if the bottle is left exposed for several hours.

The Relation of Metals to the Flavor of Milk

This subject has been given careful study at our Station by E. S. Guthrie of Cornell University, working under a fellowship furnished by the California Milk Distributors' Association, in co-operation with G. A. Richardson and the writer.

Particular emphasis was placed upon the influence of different metals upon the flavor and odor of sweet milk. In addition to this, the effect of the milk on the metals was also studied.

The conclusions drawn from the work emphasize that sweet milk held at pasteurizing temperature for one-half hour in contact with copper or any of its alloys, such as Monel metal, nickel silver, bronze or brass, will, after two or three days in storage, give a distinct oxidized or cardboard-like odor and flavor. In addition to the change in the odor and flavor of the milk there is also loss in weight of the metal. Chemical analyses of the milk thus exposed showed an increase in copper content as compared with the control samples. Even when small surfaces of copper were exposed to hot milk in which the loss in weight of the copper was so slight that it could not be detected by a sensitive balance, there was, nevertheless, the development of a slight oxidized odor and flavor in the milk. That the milk had induced corrosion in these metals was evident from the appearance of the metals, as well as by their loss in weight.

Certain other metals, however, were found to neither tarnish nor lose weight upon exposure to sweet milk, nor to catalyze the chemical reactions which are largely responsible for the oxidized odors and flavors of milk.

The results of this study indicate that the metals commonly used in the dairy industry may be grouped as follows:

Those metals showing little or no loss in weight and not affecting the flavor of fresh milk: Chromium-nickel steel alloys, such as Allegheny metal (Super-Ascoloy) and Enduro Nirosta KA2, pure aluminum, glass enamel, and tinplated metals.

Those metals showing a slight effect on flavor: Chromium steel alloys, such as Ascology and Enduro A, nickel, and poorly chromium-plated or tin-plated metals, or metals on which these platings have worn thin.

Those metals producing a definite astringent, cardboard-like, oxidized or metallic flavor: Ambrac, brass, bronze, copper, Monel metal, nickel bronze, nickel silver, Waukesha metal, and poorly plated copper or copper alloys.

The dairy industry as a whole has not been giving as much consideration as should be given to the subject of milk flavors. This is the most neglected problem at present before the producer and distributor of market milk. The industry should be better informed on this subject and more alert in doing those things which are now known to be beneficial. Dairy and milk inspectors have an opportunity to carry information on this subject to those with whom they come in contact.

CO-OPERATION IN QUALITY IMPROVEMENT OF MILK SUPPLIES

C. I. Cohee
Secretary, Philadelphia Interstate Dairy Council,
Philadelphia, Pa.

During the period since the World War we have seen great changes in the development of the milk industry in the United States. It is during this recent period that the dairy industry has largely capitalized on the information given to it through scientific and research work. Research in nutrition has given us information concerning the value of milk in the human diet that has placed it on a high plane among the foods contributing to human welfare.

Almost every doctor, nurse, dentist and school teacher in the United States is now working indirectly to aid the milk industry—not because of any personal interest in the industry itself but because of a realization, based upon scientific findings, of the importance of milk in the diet. The knowledge of the great findings of the scientists accompanied with disseminating the information on the part of those who are laboring for the welfare of the human race, has brought the milk industry itself to the realization of the important position that it occupies. The full responsibility that rests upon the shoulders of those producing and handling this necessary food is a very vital thing, so that we are in an entirely different position today from the standpoint of milk improvement work, from that in the period prior to 1914. The feeling of responsibility has been greatly increased not only because of this newer knowledge of nutrition but because of the type of men in the dairy industry itself. Great corporations have existed for many years in the distribution of milk. The leadership that established those corporations is now being felt throughout

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countless smaller organizations, which in some instances heretofore have not had the broad vision now present among these great distribution leaders. This has resulted in wide-spread high ideals on the part of milk distributors with respect to the quality of the product.

The farm press, the agricultural colleges and extension services have been of great assistance in taking to the dairy farmer the findings of the scientific world. All these organizations, together with producer organizations, Granges and other types of farm organizations have had their part in bringing farmers to a realization of the importance of milk in the human diet and, therefore, the necessity of improving the quality. The entire dairy industry looks upon the matter of quality improvement today in a broader light from that of fifteen or twenty years ago.

Milk regulations and other requirements affecting the quality of milk are no longer considered a necessary evil, serving only as a means of contention between producers and distributors of milk and of health officials. Rather on the other hand, all these various groups now fully realize that the advancement of each group results in the common good for all. Such differences of opinion as may still exist between those in the industry and those responsible for public health, are confined to methods to be applied in bringing about the desirable conditions rather than in the fundamental matter of whether or not the improvement in the milk supply shall or shall not be made. Thus, we find today public health officials, farmers and milk distributors meeting together to consider ways and means of improving the milk supply.

The dairy industry itself has taken active steps in recent years to improve the quality of its supply. Leaders from both the producers and distributors standpoint are strongly behind a program of milk improvement and the quality of this supply may safely be left in such hands.

The greatest need on the part of the public health officials, therefore, is to check up on those who lag behind and keep them up to the mark with respect to quality, knowing that the leaders of the industry will do more for themselves in the way of improvement of the supply than can be accomplished economically through public health procedure. There is scarcely a large city in the United States which does not have a concrete illustration of what the dairy industry can do and is willing to do in the way of improving quality.

Millions of dollars have been spent in bringing into milk plants and to the dairy farm more up-to-date equipment for the production and handling of milk. Milk plant machinery that has scarcely lost its gloss of newness, is often junked because something that is better has been developed. Plants that were equippd with what was considered the latest and best in the way of equipment ten years or even five years ago, are now being re-equipped, because of improvements that have occurred in that short space of time.

Almost every section of the country is finding closer co-operation between the industry and our public health officials, than has ever before been the case. Outstanding examples of the results of such co-operation can be found on very hand. In Philadelphia, for the past nine years there has been organized and in operation a co-operative movement, instigated by the producers and supported by both producers and distributors—the Philadelphia Inter-State Dairy Council.

The results that have been obtained by the Dairy Council, through such co-operation in quality improvement, have been and are being daily demonstrated. Here, a complete program of milk improvement is carried forward on a co-operative basis. Farm inspection on each farm shipping milk to the market is made twice a year and more frequently if necessary.

Milk plants are inspected at regular intervals and equipment is constantly checked to see that proper results are being obtained. This inspection also extends to the milk itself, which is frequently subjected to inspection for flavor, odor, sediment and bacteria content.

There are many advantages to both producer and distributor as well as to the public through such co-operative efforts. Obviously such a program on the part of the industry, while it should in no way take the place of public health inspection, does permit more effective work on the part of the public health officials by conserving public funds, inasmuch as a large percentage of the milk improvement work can safely be entrusted to the industry.

From the standpoint of the producer, it appears that more effective work can be accomplished through co-operation than through any other means. Farmers are in many cases prone to believe that they are being unduly burdened through inspections made on their farms by representatives of the Board of Health. They more readily fall in with a program in which they themselves have a part, even to the extent of helping to pay the bill, than is the case where the milk improvement program has come to them from a source in which they have no voice or control. Experience in the Philadelphia territory indicates that the best results in milk improvement work can only be obtained where there is full co-operation on the part of the producer. Such co-operation can seldom be received unless he himself is part of the improvement program.

From the standpoint of the distributor of milk, co-operative milk improvement work is exceedingly important. It frequently serves as a basis for closer co-operation between producer and distributor. It makes unnecessary to a large extent the personal work in milk improvement on the part of the distributor himself. It keeps intact each dealer's supply by avoiding situations making a producer desirous of changing from one dealer to another as is frequently the case where improvement work is attempted by the individual dealer.

Another important reason for co-operative milk improvement work is that more can be accomplished for each dollar expended through this method than is the case through any other form of procedure. Regardless of what policy is pursued in milk improvement work someone must necessarily pay the bill. It may be the producer through the price which he receives for his product, or it may be the consumer through the price which he pays. Milk improvement work is necessarily expensive and the bill must be paid. However, the bill is not nearly as large where the program can be established on a co-operative basis. Progress that is fully as rapid is being made in those cities where the milk improvement work is on a co-operative basis as is the case in other comparable cities.

Thus, this new phase of co-operation has demonstrated its worth. The milk inspector of today who wishes to serve the public best can accomplish the most by securing the united efforts of the producer and distributor of milk—in other words, get together.

Friday, October 24
2.00 P.M.

REPORT OF COMMITTEE ON MILK ORDINANCES

WILLIAM B. PALMER, *Chairman*

The Committee desires to render the following report for consideration by the Association:

Revised edition of the United States Public Health Service Standard Milk Ordinance has not come to the attention of the Committee since last report on this subject was submitted to the Association. It was, however, understood at previous convention that a revision would be issued and submitted to official departments and other organizations and agencies for consideration.

A PROPOSED STATE MILK CODE

The Committee is of the opinion that it would be of interest and value to the Association to know of recent action in the State of New Jersey to adopt a State-wide milk grading code. The matter was originally undertaken by the State Department of Agriculture, the State Dairy Advisory Committee having been organized for the purpose of drafting and recommending a code.

The proposed code provided for the following milk grades:

1 Certified
2 New Jersey Grade A Raw
3 New Jersey Grade AA Pasteurized
4 Grade A Pasteurized
5 Grade B Pasteurized
6 Ungraded Raw Milk

Standards were specified for each grade.

The intent was to adopt and enforce the regulations under the agricultural laws. Under this arrangement the regulations would become optional rather than compulsory as the laws authorize the Department of Agriculture to grade products, including dairy products, only upon producers' applications. Inasmuch as boards of health exercise jurisdiction over milk supplies, duplication and confusion would result and there would be confliction with municipal ordinances which were adopted and in force in accordance with State statutes.

The health departments through the New Jersey Health Officers' Association took up the subject. It was then proposed to request the State Department of Health to enact the regulations into the State Sanitary Code. It was demonstrated that supervision of milk supplies is a public health activity, complete authority being contained in the State public health statutes.

It was the concensus of those concerned in or affected by the proposed regulations that a uniform milk code is desirable for milk sheds of large marketing centers. However, the practicability of a State-wide code was questionable because of several factors, chief among which were—

1 Regional conditions and practices
2 Northern New Jersey supplies had been and were being produced and handled under official health department standards while in southern New Jersey dealer standards prevailed, and which in many respects were in variance with the usual public health milk grading specifications.

During the present month a hearing was held by the State Department of Health on the question of adopting the regulations in the State Sanitary Code. The Department of Agriculture urged enactment of the code but the health officials opposed it. The larger milk companies adequately equipped to efficiently supervise production and distribution of milk supplies and experienced in the maintaining of the public health requirements supported health officials. Opposition was based on the facts:

1 That the State statutes vest boards of health with authority to adopt ordinances, rules and regulations governing the production, processing or distribution of milk supplies within their several jurisdictions, license milk dealers, and specify penalties for violations;

2 The statute creating the State Sanitary Code states that the code shall be enforced by all local boards of health; it shall

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> supersede in those matters to which it pertains all local ordinances, although local boards of health may adopt further ordinances but same must not conflict in any way with the State law or State Sanitary Code. Thus, if the proposed code was adopted local boards of health would be divested of their powers as any additional ordinances would be in conflict with the State Sanitary Code.

Attention is called to the fact that when codes, particularly standard codes for application over state or larger territories are contemplated consideration must be given to existing state statutes defining powers of boards of health in matters of public health and milk control to insure communities against the possibility of being obliged to permit the introduction of questionable milk supplies or supplies inferior in sanitary quality to those already dispensed under efficient official and dealer control and in accordance with local ordinances and standards.

It has been demonstrated in the above case that the phraseology of a state code does not eliminate the above mentioned possibilities.

Final action has been deferred by the State Department of Health until corrective legislative action can be secured.

Federal Legislation

It is understood by the Committee that a bill known as the "McNary Bill" is pending in the United States Senate and possibly action will be taken at the next session. The bill reads as follows:

> S. 4133—A BILL For promoting the economic welfare of the dairy industry, and for other purposes.
>
> BE IT ENACTED BY THE SENATE AND HOUSE OF REPRESENTATIVES OF THE UNITED STATES OF AMERICA IN CONGRESS ASSEMBLED, That for purpose of promoting the economic welfare of the dairy industry and the welfare of consumers of milk by encouraging the production and distribution of milk of the highest quality the Secretary of Agriculture shall, in conducting research, investigational, educational and demonstrational work in producing, processing, and distributing milk, render such assistance and advice as will enable milk producers and distributors more advantageously to dispose of their products, and to make available to consumers milk of highest quality.

SEC. 2. That the said Secretary also shall from time to time render assistance to the dairy industry by defining methods for producing, processing, transporting and delivering milk; such definitions shall be advisory in their nature and shall include the methods for grading and the requirements for grades of milk which in his opinion are desirable. His definitions and advice shall be based upon the results of scientific research and investigations and his definitions shall be reasonable in their terms as is consistent with effectiveness in promoting the welfare of producers, distributors and consumers of milk, and the said Secretary shall upon request render such assistance as he may deem appropriate in connection with the adoption of the definitions issued in pursuance of this Act as State, City or Local measures, either in whole or in part, or in such modified form as may be applicable.

SEC. 3. That this Act shall become effective upon its approval, and from and after that date all work of an advisory, research, investigational, or educational nature regarding methods for producing, processing, distributing and delivering milk shall be deemed to be a function of the Department of Agriculture; and any other department or agency of the Federal Government now engaged in similar work shall, with the taking effect of this Act, discontinue the prosecution of such work.

SEC. 4. That there is hereby authorized to be appropriated annually, out of any money in the Treasury not otherwise appropriated, for the purpose of carrying this Act into effect, such sums as may be required.

It will be observed that it is the apparent intent to transfer the present investigational, educational and demonstrational work of a public health character from the United States Public Health Service to the Secretary of Agriculture. It is difficult to comprehend what the advantages from a public health standpoint would be if this action materialized.

Unquestionably supervision of public milk supplies is a public health activity. It necessarily follows that if this bill should become a law that precedent would be set and similar action likely urged in the various States. Some attempt has already been made, particularly in New York and New Jersey, but without avail.

The Committee recommends that this Association give consideration at this meeting to this proposed legislation and decide upon suitable action to be taken.

This report has been signed and approved by all members of the Committee present at this meeting with the exception of one member who objected to some of the items contained in the report.

SOME PRESENT OPPORTUNITIES FOR THE DAIRY INDUSTRY

ROBERT W. BALDERSTON

Manager, National Dairy Council, Chicago, Ill.

When we stop to contemplate the remarkable strides which have been made in the field represented by your association one is astonished at the progress which has been made. The imagination jumps ahead with thoughts of the future awaiting us as a result of the research work now being done in your field and the rapidity with which you are applying the lessons to your problems. The problems of the International Association of Milk Inspectors have a special significance in that they bring together those responsible for milk control and milk improvement:

1 From our national, state and local Boards of Health
2 The research groups from the United States Department of Agriculture, state experiment stations and other institutions of higher learning
3 Representatives of the United States Department of Agriculture and of our state agricultural extension services
4 The instruction staffs of our colleges and vocational schools, and finally
5 Representatives of that increasingly important group within the dairy industry which is co-operating with all the other groups and with the individual companies and the farmers to improve the quality and extend the scope of our work for a finer market supply.

Friends, it has taken the combined efforts of all these groups to make possible the phenomenal progress which has been accomplished during the last two decades not only to insure a safe milk supply but to raise the standards toward the ideal. We realize there are many places in the country producing milk below the established standards. We realize further that we are just beginning to make a little progress in milk grading and classification on the basis of the sanitary care under which it is produced and handled so there is not time for us to stop and pat ourselves on the back.

There are too many opportunities in the future for us to be satisfied with what we are doing. In modern parlance we have developed a good field from which to take off in a flight whose height and length we can today hardly conceive.

Let us illustrate some of the factors which have made possible the success now attained. Some ten years ago at a public conference of health officials and dairy leaders, at Harrisburg, Pa., to consider milk regulations for that State, President Irwin, on behalf of the State Department of Health, proposed a code which some of us vigorously opposed. We objected not because the regulations were unfair or that they were impractical or lacked scientific backing. We objected because there had not been sufficient education among our milk producers. Without such preliminary publicity we felt it would be impossible to secure the proper type of co-operation to make effective the proposed enforcement. We insisted that if an effort were made to enforce such a code throughout the State immediately it would either become a "dead letter" or the enforcement would provoke active opposition and set back the course of milk improvement many years. We asked the State Department, through Mr. Irwin, to give us five years to do educational work among the producers. With, I think, some reluctance this request was granted.

The industry in all parts of the State, through its co-operative associations and its distributors under the direction and through the co-operation of our agricultural extension forces, developed a campaign of education among the producers educating them to the benefits of an improved milk supply both from the health and improved market standpoint. Within the five year period producers' associations—the Dairymen's League, the Interstate Milk Producers' Association and the Dairymen's Co-operative Association had through co-operation with the distributors an approved code of sanitary requirements.

Exactly ten years later, in 1929, a new milk code was passed by the Legislature which was prepared by the State Department of Health in collaboration with representatives of the City Departments of Health, of the State College of Agriculture and representatives of the dairy industry. Futhermore this code provides that its administration shall be by the State Department of Health and City Department of Health and that the industry shall be held responsible in a large measure for co-operation in its enforcement through inspectors approved and licensed by the State but employed by the industry.

Perhaps you will pardon personal satisfaction which your presiding officer and your speaker have in this ten years of progress for it represents rather significantly the way in which future progress can be made. It is a beacon light for our future airplane flight.

I am tremendously impressed with the New York State Department of Health in placing on its staff for research work one whose investigational work has been most helpful in our trail blazing work in the past. I refer to Dr. Brew whom I see in the back of the room.

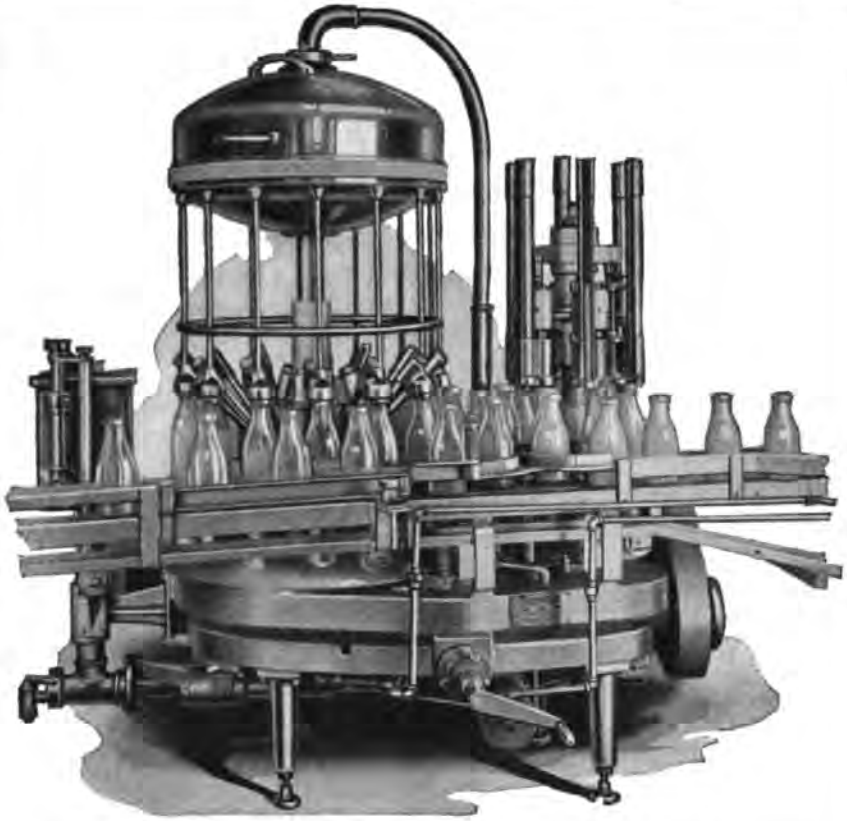
Equally significant is the statement of the American Public Health Association to the effect that the milk supply of California is to be commended as one of the finest in the United States and we all know that it has been secured and is being improved through the combined efforts of all the agencies which I have been referring to this afternoon and under a plan which gives each one its proper place in such a programme.

Now what of the future? We have our scientists who through lifelong research can tell us what are the factors which make for a safe and ever-improving milk supply. We have our federal, state, municipal and local health officials to interpret this research work in definite regulatory terms telling us what kind of a milk supply and what kind of dairy products they want for the people of their respective jurisdictions. Then we have through the United States Department of Agriculture our state colleges and state extension services and vocational school systems, a nationwide and effective instrument to educate the farmer how to produce the kind of milk which is demanded by the public through its health officials. Finally, the industry itself has organized as never before to help in this work.

Our co-operative associations have as a guiding principle the importance of a quality product and through education and through inspection are raising the standards for their members. Milk distributors have their field forces engaged in a similar work. No longer does the producer and distributor look on the inspector as simply a policeman and consider the regulations as being the arbitrary exactions of an imperious and arbitrary power. He has taken more and more pride in his premises and quality of his milk. Some markets carry a bonus payment for low bacteria count and their farmers vie with each other for place in the race for low counts. All this, friends, is but indicative of what are the possibilities for the future if we all pull together.

On behalf of the National Dairy Council and in the interest of the dairy industry of the United States, may I again express my appreciation of your efforts to improve the milk supply and to secure increased consumption now that its quality and safety is such as you can recommend.

May I in return pledge our heartiest support in your efforts to further improve the high standard of American milk supply, a standard not equalled anywhere in the world.



A MODIFIED METHYLENE BLUE REDUCTION TEST

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Largely because of its economy of skilled labour and equipment, the methylene blue reduction test has achieved considerable popularity in the examination of incoming raw milk supplies. Unfortunately, this test, as commonly carried out, has a definite shortcoming in the length of time required for reduction in the case of high grade samples. Because of the resulting inconvenience to the analyst, and since the accuracy decreases with increasing reduction period, the method is not well suited to the examination of samples of Certified or Grade A standard. To help overcome this shortcoming by shortening the reduction time, the idea of a preliminary incubation at a lower temperature suggested itself.

In deciding upon the most suitable temperature and period for the preliminary incubation, three points were considered. The first was to obtain just the right amount of development that the reduction time on the high grade milks would be considerably shortened without losing the ability to distinguish between fair and poor samples. The second was the encouragement of the growth of those bacteria most actively concerned in the spoilage of milk at domestic storage temperatures. The final consideration was the convenience of the analyst. If the modified reduction test is to be applied to high grade milks, the period of preliminary incubation must be of such length as to enable the analyst to commence the subsequent incubation with methylene blue at an early hour next morning. Thus he would be spared the necessity of remaining late at night waiting for the best samples to reduce, as is frequently the case with the ordinary method, especially where incubation is not commenced until late in the day.

Early experiments indicated that a temperature of 55 degrees F. for 18 hours was the most generally suitable for the preliminary incubation period. Subsequent experience in the analysis of over 500 samples has confirmed this impression. While there might be some temporary advantage in varying the time and temperature in accordance with seasonal variations in the quality of the milk supply, it is felt that this would not compensate for the inability to compare data from different periods or between different laboratories. Consequently a temperature of 55 degrees F. for 18 hours is definitely recommended for the preliminary incubation.

While the preliminary incubation shortens the reduction time considerably, the highest grade samples may still require so long to reduce that the error introduced by the creaming effect, as demonstrated by Thornton and Hastings (2), may be sufficient to impair the accuracy of the test. To overcome this difficulty, advantage was taken of the discovery of these workers that any measure preventing the uneven sweeping of the bacteria to the surface of the milk by the rising butterfat not only shortens the reduction time but also virtually eliminates variations between replicate tubes. Since shaking at 15 or 30 minute intervals, as carried out by these workers, makes the test unduly complicated, some studies were made on the influence of frequency of shaking upon reduction time in replicate tubes. The results of these studies showed that even a single shaking after 6 hours was of marked value in improving the accuracy and shortening the reduction time. Since the percentage of samples not reduced in 6 hours in the modified test is unlikely to be large, mixing at this stage involves little extra work, and does not mar the simplicity of the test to the same extent as where more frequent shaking is demanded. Consequently, the shaking of any tubes not reduced in 6 hours is recommended as the second modification of the ordinary methylene blue reduction test.

Having decided upon the necessary modifications, a comparison was made of the results from the ordinary and modified reduction tests. Samples of shippers' milk were taken from the weigh-tank into duplicate tubes. On arrival at the laboratory one set was incubated immediately in the usual manner. The other was given the preliminary incubation at 55 degrees F. for 18 hours, and incubation with methylene blue at blood heat commenced early next morning. Three sets of approximately 100 samples each were studied in this manner. The degree of correspondence between reduction times by the two tests is shown in Figure 1, where the results obtained

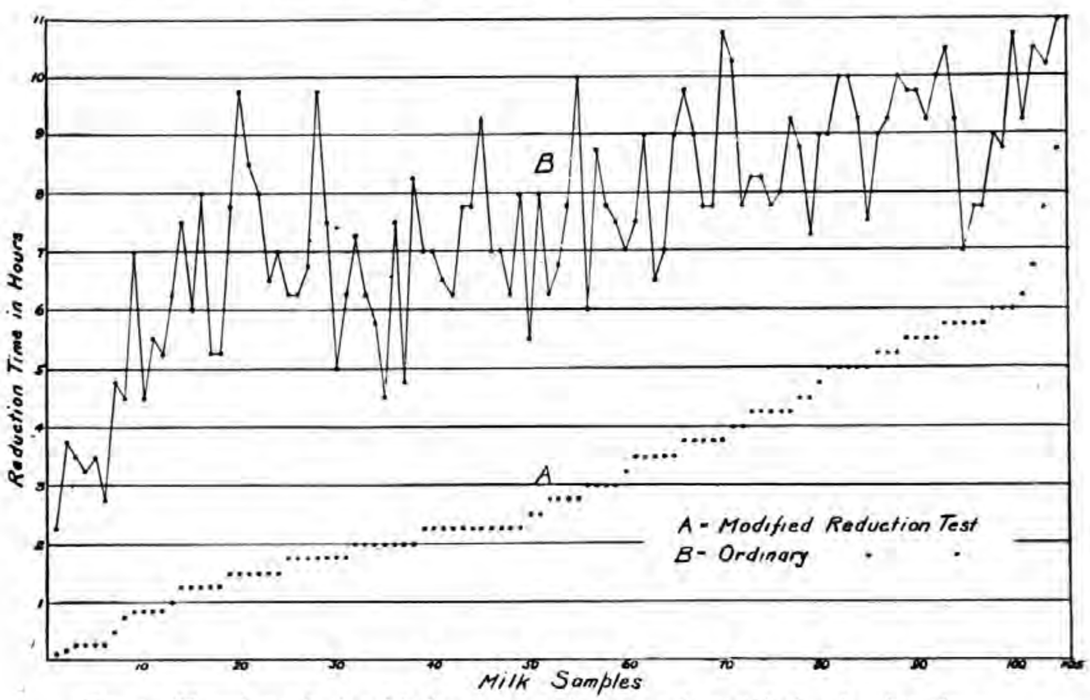

FIG. 1—Showing relationship between ordinary and modified reduction times in a series of 104 samples.

with a set of 104 samples are depicted graphically. As will be observed, while the general trend is the same, individual samples show considerable variation in corresponding reduction times. In view of the fact that the modified test encourages the development of bacteria capable of growth at 55 degrees F. as well as those growing at blood heat, while the ordinary test encourages the latter types only, no thoughtful person would expect precisely parallel results from all samples. The important question is as to which of the two tests gives the more accurate indication of keeping quality.

Since the methylene blue reduction test is recognized as an official method (1), it was necessary to demonstrate that the modified test is at least as accurate as the ordinary test in the determination of keeping quality. While doing this, the opportunity was taken to make parallel studies of the plate count and Breed microscopic count in the same connection, so that the relative accuracy of each of these tests might be compared. The plan adopted was to analyse by each method a group of 22 to 25 samples each week for six weeks. As a standard whereby the accuracy of each test could be compared, the length of time required for the sample to turn sour or develop an off-flavor at 60° F. was determined by tasting at frequent intervals. Since certain workers have employed the increase in acidity as a measure of keeping quality, the amount of acid developing during 48 hours at 60 degrees F. was also determined by titration.

In order to measure the relative accuracy of each method, the following device was adopted. The entire series of 145 samples were arranged in descending order of keeping quality as determined by taste. The same was done with these samples by each of the 5 different methods of analysis employed. Then, taking each sample individually, the difference between the placing by any one method and the placing according to keeping quality was debited against that method as the "error score." For example, if a certain sample was placed 19th by the plate count and 12th by taste, the plate count would be debited with a 7 point error score for that sample. This error score was calculated for each sample with each different method of analysis. Then with the samples arranged in order of keeping quality, the error scores were totalled for each group of 15 samples (10 only in the last group). These scores are summarized in

TABLE 1

SUMMARY OF ERROR SCORES

(145 Samples)

Ranking of samples by keeping-quality	Total error score for group of 15 samples by Acidity Increase	Modified Meth. Blue	Ordinary Meth. Blue	Plate Count	Breed* Count
1- 15	167	151	230	104	162
16- 30	182	116	131	178	143
31- 45	254	143	196	230	245
46- 60	287	206	286	355	290
61- 75	321	309	306	382	350
76- 90	284	349	374	427	292
91-105	373	321	333	329	380
106-120	378	235	308	297	380
121-135	294	284	347	285	320
136-145	175	116	166	168	211
Grand Total	2,715	2,230	2,679	2,755	2,793

* Counts on 4 samples of pasteurized milk omitted.

table 1. In addition, the distribution of error scores is shown in table 2, while the dot diagrams, Figures 2 and

TABLE 2

DISTRIBUTION OF ERROR SCORES BY DIFFERENT METHODS OF ANALYSIS

(145 Samples)

Method	Number of samples having error scores between 0–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91–100	101–110
Acidity Increase	54	38	27	13	5	5	2	0	0	0	1
Modified Meth. Blue	66	42	15	13	5	3	1	0	0	0	0
Ordinary Meth. Blue	59	35	20	17	9	1	4	0	0	0	0
Plate Count	63	29	18	17	7	6	4	1	0	0	0
Breed Count *	53	34	21	17	9	4	1	2	0	0	0

* Counts on 4 samples of pasteurized milk omitted.

3, illustrate the correlation between keeping time and reduction time.

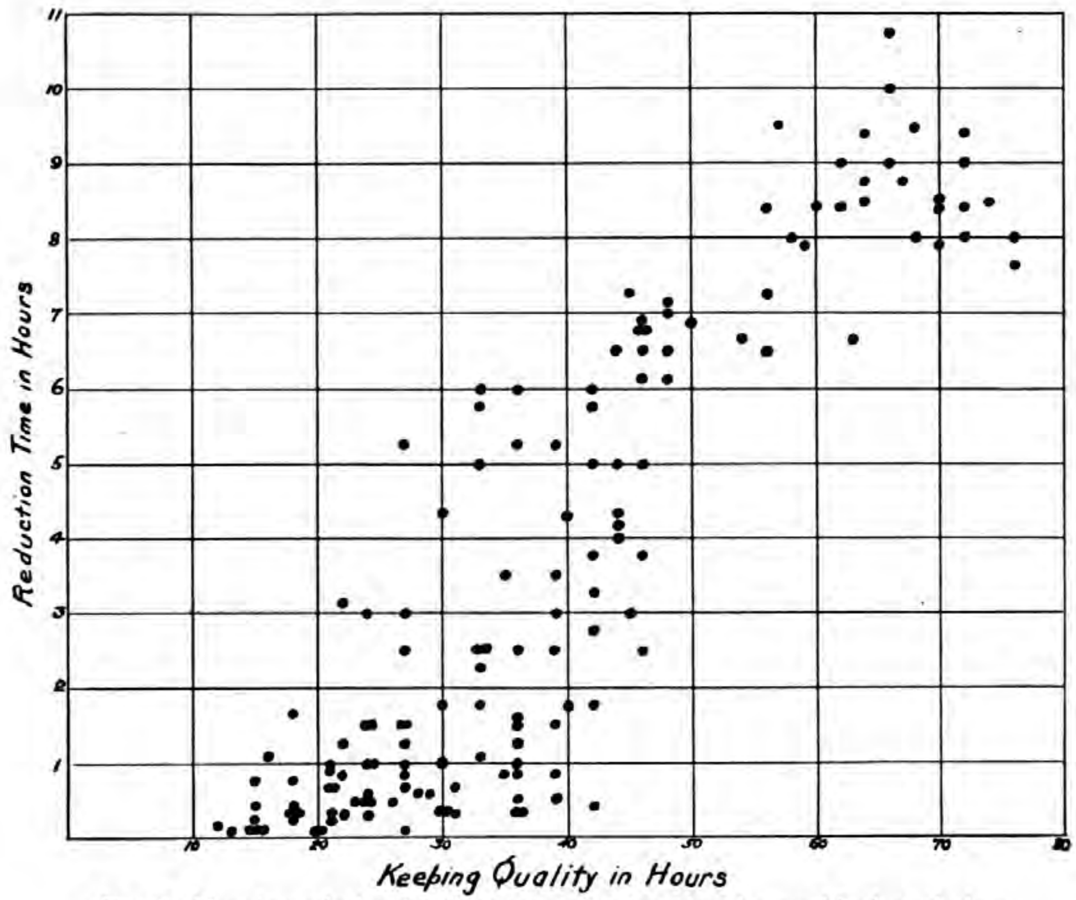

FIG. 2—Showing relationship between reduction time by modified methylene blue test and keeping quality on 145 samples.

The outstanding point in connection with these studies is that no one method is overwhelmingly superior in indicating keeping quality, as anyone familiar with the complex factors concerned would expect. The second is that the increase in acidity is scarcely an accurate enough measure to justify its employment as the standard by which the accuracy of other methods may be compared.

Comparing the bacteriological tests themselves, it will

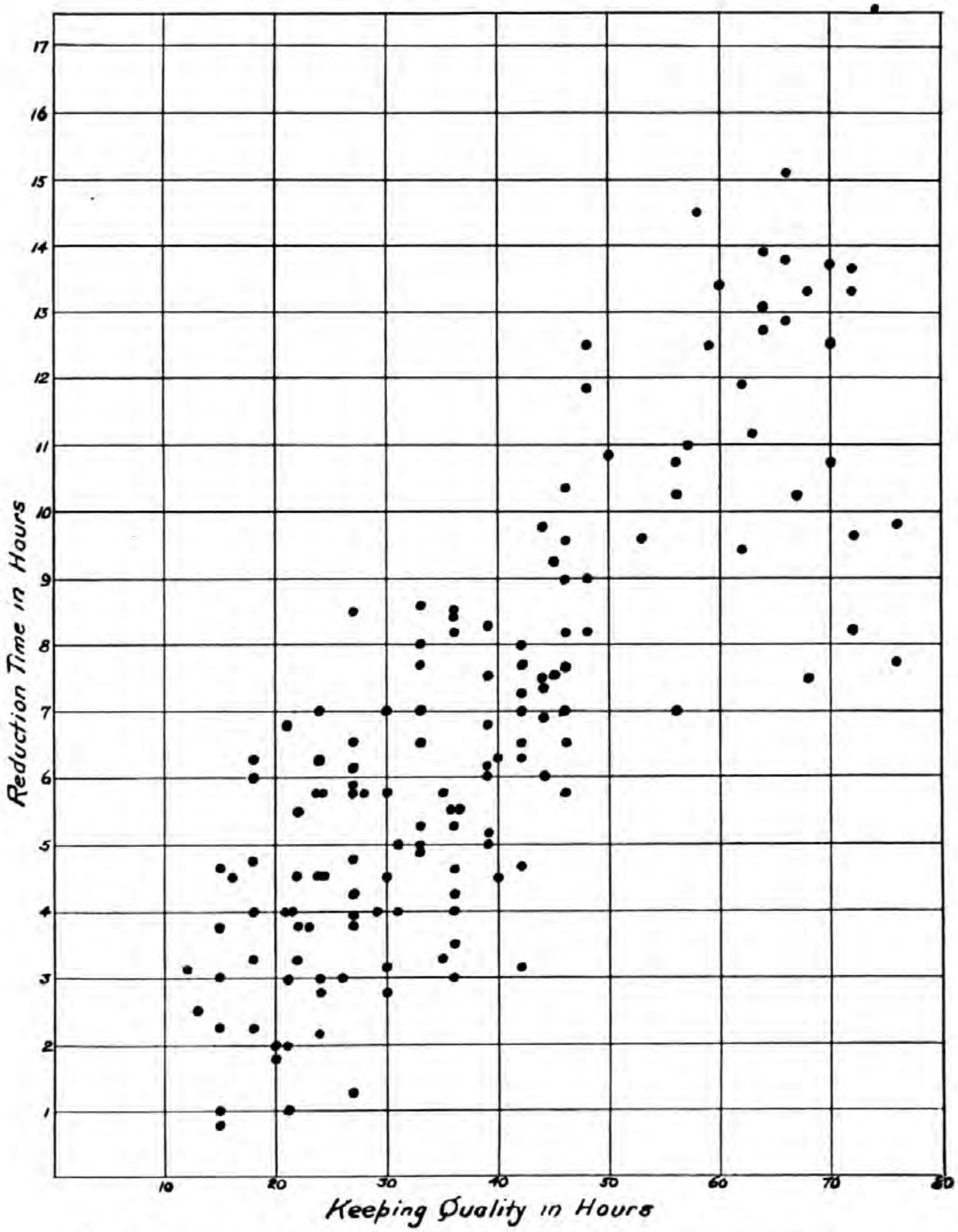

FIG. 3—Showing relationship between reduction time by ordinary methylene blue test and keeping quality on 145 samples.

be observed that the modified test, through the encouragement of the growth of the common spoilage bacteria, actually does show a slight but definite advantage over the other three methods studied in ability to rank a series of samples in approximate order of keeping quality. When compared with the results from the ordinary test, it will be observed that the modified test shows a significantly lower error score in practically every group (Table 1), while in distribution of error scores it again shows an advantage, 108 samples having an error score of 20 or less as compared with only 94 by the ordinary test (Table 2). While the plate count shows an advantage on the first group of 15 samples, this is more apparent than real, since if the first 20 samples are compared, the advantage goes to the modified reduction test. Comparing the plate and microscopic counts, the former has a slight advantage both in total error score and in distribution of error scores.

Thornton and Hastings (2) consider the ordinary methylene blue reduction test as accurate a measure of the keeping quality of milk as any other method yet available. If any conclusion may be drawn from a study of 145 samples, it would appear that the modified test affords a somewhat more accurate indication of keeping quality than any of the other methods studied.

The underlying reason for the development of the modified reduction test was the need which developed for a simple test, well adapted to plant conditions, by which samples of milk from several hundred shippers might be ranked in order of quality and this ranking utilized in connection with a tentative plan for adjusting price in accordance with quality. The plan in mind is a modification of that employed since 1922 by the Midland Counties Dairy, Birmingham, England (3). The special feature of their scheme is that instead of setting up a definite standard and offering a premium for all milk meeting this standard, they adopted the principle of paying a premium to a definite percentage of shippers at the top of the list, where the entire body of shippers was ranked monthly in order of merit. The results obtained during the first 7 years of operation of this scheme show it to have been amazingly effective in bringing about a sustained improvement in the quality of the milk supply.

Since the payment of a premium increases the cost of the total supply, and since dealers are rarely able to recover the extra cost from the average consumer, this plan has not been generally adopted. It would seem that the valuable features of this scheme might be preserved, and the above objection avoided, by the establishment of a penalty group consisting of a corresponding percentage of shippers at the bottom of the list. By cutting the price to the poorer shippers to the amount of the premium to the best shippers, the price may be made to correspond to the quality of the milk without noticeably increasing the total cost of the supply.

The modified methylene blue reduction test has been in use at a certain plant for the past 8 weeks. The plant bacteriologist is favorably impressed with its advantages over the ordinary test, and intends to continue its use. Since this plant had previously been grading the shippers by the ordinary methylene blue test, and penalizing the lower grades by a price cut, they wished to know what reduction times by the modified test would correspond to certain reduction times by the ordinary test. To meet this need, data on 348 samples analysed by both methods were assembled; for each reduction period by the modified test the median value of all the corresponding ordinary reduction times was calculated. Then by plotting these values, the tentative conversion curve shown in Figure 4 was obtained. From this the reduction time by one test may be converted into the average reduction time by the other.

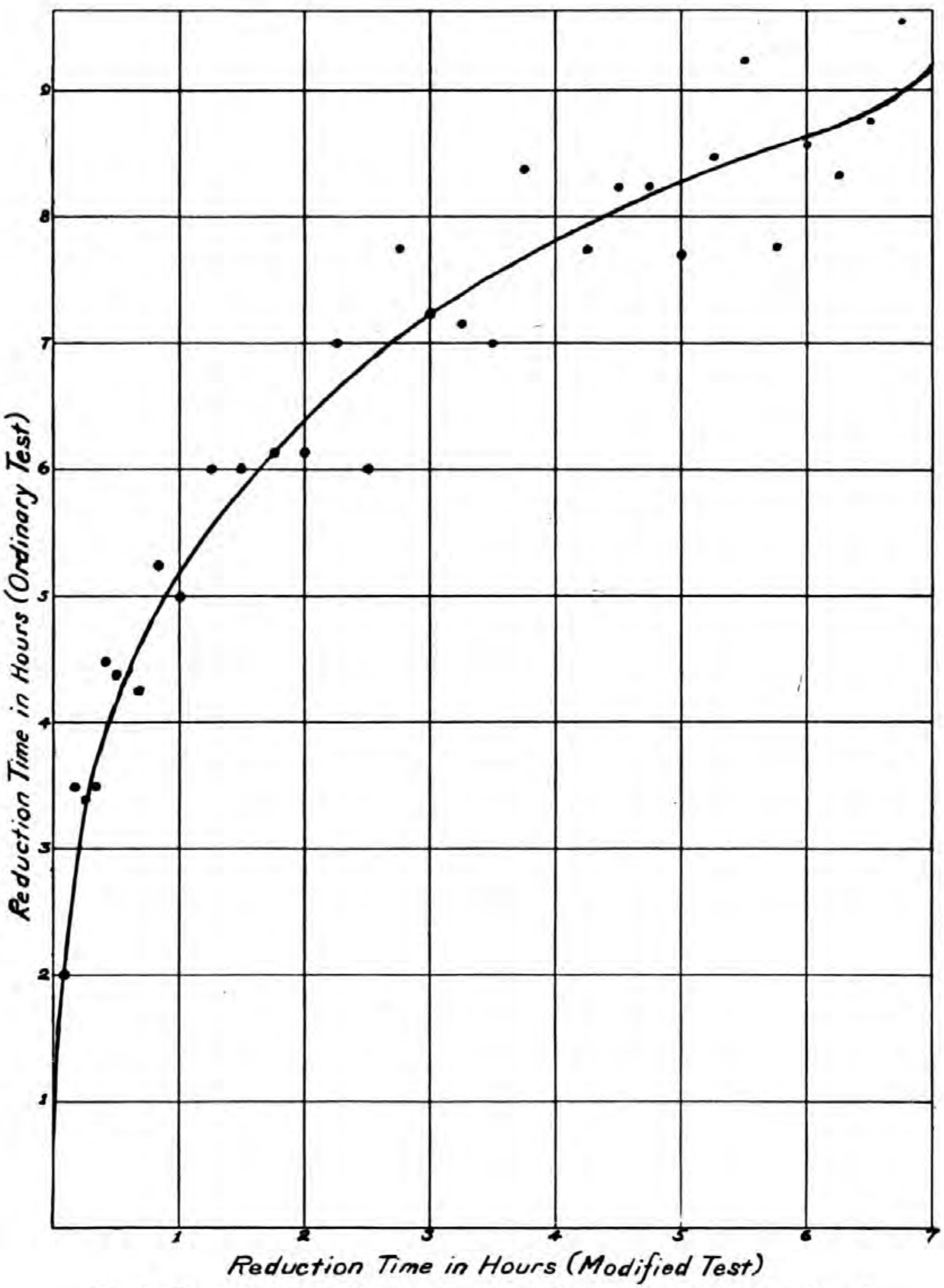

FIG. 4—Tentative curve showing corresponding average reduction times by ordinary and modified methylene blue tests.

Summary

A modification of the methylene blue reduction test has been developed. The modifications introduced are:

(a) preliminary incubation at 55 ° F. (12.8 ° C) for 18 hours and

(b) mixing contents of tubes not decolorized in 6 hours when subsequently incubated at blood heat. Both modifications shorten the reduction time, while the mixing also reduces variations between duplicate tubes.

The chief advantages of the modified test are (1) greater convenience to the analyst, (2) improved accuracy on high grade milks, and (3) closer correlation with keeping quality.

In a study of 145 samples by the ordinary and modified reduction tests, acidity increase, plate and Breed counts, the modified reduction test proved to be the method best suited to the task of ranking a series of samples in order of keeping quality.

Literature Cited

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2 Thornton, H. R. and Hastings, E. G. Jour. Dairy Sci., 13, 221-246, 1930.

3 White, E. Proc. World's Dairy Congress, pp. 323-328, 1928.

TIME AND TEMPERATURE TEST OF KEEPING QUALITY OF MILK

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When held at ordinary temperatures, milk changes flavor, odor and other attributes necessary for its use as a food. The chemical changes which occur in a milk upon prolonged holding may be due to the development of microbial life during the holding period, to the action of enzymes already present in the milk, and to the catalytic action of metallic salts and light. Changes of the butter fat by oxidation due to light alone are probably of rare occurrence under ordinary conditions. However the oxidation of butter fat presumably due to the catalytic action of minute amounts of contaminating copper and iron salts occurs much more frequently. While undoubtedly in all ordinary market milk, raw or pasteurized, the action of enzymes formed prior to the beginning of the holding period does continue, this action is believed to be insignificant except in rare instances.

The changes produced in milk during a holding period at ordinary temperatures are generally conceded to be due to the growth of microorganisms. Although there are many bacteria which are able to act upon the milk proteins causing putrefactive changes or rennet coagulation, in the mixed flora of ordinary market milk, be it certified, Grade A, ordinary raw, or ordinary pasteurized milk, the acid-producing organisms rapidly outgrow the other types so that the first appreciable change is practically always souring.

Breed, Harding, Stocking, and Hastings, 1917, in the N. Y. Agricultural Experiment Station Bulletin 438, "What is meant by 'quality' in milk," state that "The true measure of the keeping quality of milk is the time which elapses before it actually sours. This is the measure employed by the customer . . ."

Many tests have been proposed for the estimation of keeping quality in milk. At the present time there are three tests in general use: the standard plate count applicable to all grades of milk but used mostly for pasteurized and low count raw milks; the direct miscroscopic count and the methylene blue reduction test used primarily for ordinary raw milk.

The standard plate count measures inadequately the living bacteria in the milk especially those of the lactic acid group. The direct microscopic count enumerates both living and dead bacteria and like the standard plate count gives little indication of the types of organisms present. The methylene blue reduction test shows a certain kind of bacterial activity without regard to the types of organisms.

For the estimation of keeping quality of milk the following test is proposed: The sample of milk is placed in air at a temperature of 68° F. and the time determined for an increase in titratable acidity of 0.06 of one per cent acid, calculated as lactic acid. The temperature of 68° F. has been selected as standard as it is approximately the average temperature to which milk is exposed under customer conditions. By experiment it is found that with an increased acidity of 0.06 per cent milk begins to have a slight "acid" taste. However many people do not detect by taste an increase in acidity until it is much greater. Changes other than souring may be observed by noting the odor of the samples.

This test has the advantage that it measures approximately the length of time that the milk will remain usable under customer conditions. Very little apparatus is required for the test: merely a supply of standard alkali (preferably tenth normal sodium hydroxide), a burette, a titration dish and stirring rod, a supply of phenolphthalein indicator solution, a pipette for measuring the milk for titration, and an incubator at 68° F. However, an initial sample of 100 cc. is required, and a half pint sample is better. The holding time required varies with the grade of milk examined but will usually be 48 hours or less. Under laboratory conditions the samples may be tested for acidity at the start of the holding period and at the beginning and end of the day's work until soured. From these data the approximate time of souring may be calculated.

During 1927 and 1928 the standard plate count and the increase in acidity upon holding at 68° F. were determined for 522 samples of raw milk and for 619 samples of pasteurized milk. The comparison of these two tests is shown in the accompanying two tables. It should be noted that both pasteurized and raw milks were tested on the same days.

In the case of raw milk the keeping quality time and the plate count show a general agreement. Usually milk with a plate count under 5,000 remained sweet at 68° F. for 24 hours or longer while milk with a count of over 25,000 practically always soured within 24 hours. As a rule the greater the plate count the poorer the keeping quality by actual test. However some raw milk with a plate count of over 25,000 had better keeping quality than other raw milk with a plate count of less than 2,000.

In the case of pasteurized milk there was no apparent relation between the plate count and the keeping quality. This was due probably to the presence of thermophilic bacteria in the pasteurized milk. These milks were collected at the time of delivery to the consumer and so probably represented milk pasteurized the preceding day. Some milks with a plate count of more than 1,000,000 had better keeping quality than other pasteurized milks with a plate count less than 5,000. Such instances might even occur in samples handled on the same day but from different pasteurizers. Apparently the plate count of pasteurized milk has at times little connection with the actual keeping quality of the milk as measured by the time of souring at 68° F.

Conclusions

The time required for a milk to sour when held at 68° F. offers a simple and fairly accurate test of the keeping quality. This test shows a general relation to the standard plate count when applied to raw milk. However in the case of pasteurized milk there is in general no relation between the test and the plate count.

TABLE I

COMPARISON OF THE STANDARD PLATE COUNT WITH KEEPING QUALITY TEST ON RAW MILK SAMPLES 1927-1928

Standard Plate Count	Keeping Quality Test at 68 ° F. Sour in more than / but less than	0 hrs. 10 hrs.	10 hrs. 24 hrs.	24 hrs. 34 hrs.	34 hrs. 48 hrs.	Total
0 to 1,000		0	0	10	1	11
1,000 to 2,000		0	9	55	4	68
2,000 to 5,000		0	43	121	2	166
5,000 to 10,000		0	28	32	2	62
10,000 to 25,000		0	21	11	0	32
25,000 to 50,000		0	9	3	0	12
50,000 to 100,000		3	9	1	0	13
100,000 to 200,000		3	16	1	0	20
200,000 to 300,000		9	23	0	0	32
300,000 to 500,000		22	20	0	0	42
500,000 to 1,000,000		43	12	0	0	55
more than 1,000,000		9	0	0	0	9
	Totals	89	190	234	9	522

TABLE II

COMPARISON OF THE STANDARD PLATE COUNT WITH KEEPING QUALITY TEST ON PASTEURIZED MILK SAMPLES 1927-1928

Standard Plate Count	Keeping Quality Test at 68 ° F. Sour in more than / but less than	0 hrs. 10 hrs.	10 hrs. 24 hrs.	24 hrs. 34 hrs.	34 hrs. 48 hrs.	Total
0 to 1,000		0	0	0	0	0
1,000 to 2,000		0	0	1	0	1
2,000 to 5,000		0	24	5	0	29
5,000 to 10,000		0	24	20	7	51
10,000 to 25,000		0	42	69	40	151
25,000 to 50,000		0	38	84	27	149
50,000 to 100,000		0	51	87	13	151
100,000 to 200,000		0	19	29	4	52
200,000 to 300,000		0	0	9	0	9
300,000 to 500,000		0	0	7	1	8
500,000 to 1,000,000		0	0	6	0	6
more than 1,000,000		0	2	8	2	12
	Totals	0	200	325	94	619

BRIEF NOTES ON LABORATORY INCUBATOR TEMPERATURES

FRIEND LEE MICKLE, A.B., M.S.
Director, Bureau of Laboratories
Connecticut State Department of Health
Hartford, Connecticut

An opportunity is taken to present some temperature records and charts and to place certain facts before this assemblage of dairy experts in order to ask for comment and suggestions as much as to attempt to completely interpret them. These records, obtained when we were able to place a portable recording thermometer into use on some of our laboratory incubators, were not altogether unexpected or materially different from similar data that have been observed from time to time by others, including persons here present, but which usually have been discussed informally. It seems perhaps well to give these observations formal presentation here to place them on record and secure discussion.

The writer is of the opinion that the use of bacterial colony counts for the exact separating of milk into grades may become a lost art in the not distant future but firmly believes that such counts possess a very real usefulness if properly carried out and wisely interpreted and used. One of the prime reasons that bacterial colony counts have fallen upon evil days is that generally they are not carried on with the same care that chemical and other quantitative tests are made. There are many variable factors involved that certainly at times vitiate the results and work real economic hardship to producers and dealers as well as causing misunderstandings between laboratories. If we are to continue to use plate counts it behooves us to investigate the causes of errors and discrepancies and then remove them. Perhaps varying incubator temperatures are a bigger source of error than is universally realized.

The incubators upon which these temperature records were made were all Thelco electric incubators described in the catalogue of a laboratory supply house as having inner and outer walls of asbestos transite, the space between inner and outer walls being filled with air-celled insulation to give walls more than one inch in thickness, being provided with inner glass doors to allow inspection of contents without disturbing temperature of chamber, and being fitted with adjustable aluminum ventilators, one placed near the top on either side. The catalogue stresses as distinctive advantages of these incubators, even distribution of heat, constancy of temperature and dependability. In inside dimensions, each of these incubators are 36″ wide, 18″ deep and 28″ high. The heating elements, removable and covering the bottom of the chamber, are two 300-watt units made of asbestos transite and wound with special resistance wire. The bimetallic regulator and the control element, located on the ceiling of the incubator near the center at the front, are said to be designed to maintain the temperature indefinitely over a range from room temperature to 60° C. An advertised feature is that when the thermostat has been adjusted to the desired temperature it can be locked, preventing "creeping" either up or down. Each incubator was equipped with three perforated metal shelves adjustable as to height. A maximum-and-minimum type incubator thermometer was in use on each of the three incubators in addition to the recording thermometer.

The recording thermometer was a Bristol Model 211, with 8-inch 7-day gauge, ranging from 0–55° C., with 6-foot bronze armored tubing and plain bronze bulb 202, bulb head being slightly less than one-half inch in diameter to allow of insertion through the incubator ventilators.

The recording thermometer was first installed on a newly purchased incubator, described as No. 1. This incubator had been connected to the electric current and was regulating but it was not in use for bacteriological purposes. The bulb of the recording thermometer was placed just below the bottom shelf at a point near the middle of the rear wall, remaining there from April 14th to April 20. Except for once when the door was purposely left open for a brief period the record was uniform throughout the week, tending to just slightly exceed the desired temperature of 37.5° C.

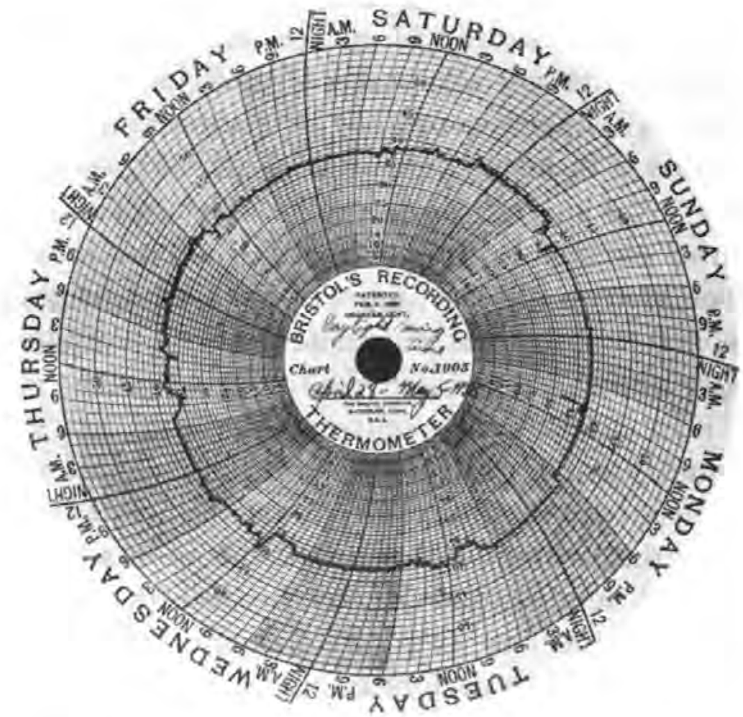

CHART I

At the end of the week the bulb of the recording thermometer was moved from where it had been when that chart was obtained to a point at the rear of the top shelf only a few inches from the bulb of the maximum-and-minimum thermometer. The temperature curve apparently did not vary more than a degree throughout the week.

Assuming that this incubator was working entirely satisfactorily, the recording thermometer was transferred on April 28 to an incubator of identical type and size that was in use in the laboratory for diagnostic bacteriological purposes and which is designated as No. 2. In Chart I is reproduced the temperature record for the following week, the bulb of the recording thermometer being maintained in the same position at the rear of the top shelf as in Incubator No. 1 the week before. From a study of Chart I the assumption was reached that this incubator was not regulating nearly as satisfactorily as the new incubator, probably because it had been in use for several years. Variations in temperature took place at times when the doors of the incubator had not been opened, especially during the night, that had not been apparent on the preceding charts. In view of conclusions reached later, attention is called here to the fact that the temperature chart recorded the expected temperature during Monday but was noted to rise suddenly about two degrees on Monday evening, show irregularities during the week, remain slightly high much of the time throughout the week, drop rather definitely again to the desired temperature about Sunday noon when the diagnostic specimens were removed and record correctly while the incubator remained approximately empty until Monday morning. The irregularities are partially explained by the opening of doors during working hours, although not altogether so, when it is known that the work was carried on by experienced bacteriologists who were specially careful about not leaving the doors open unnecessarily while studies were being made. Irregularities outside of working hours were at that time unexplainable.

The following week, May 5-11, it seemed desirable to transfer the recording thermometer to Incubator No. 3, an incubator that had been in use routinely for milk plates, the bulb being placed in a similar position to where it had been when the thermometer had been installed on Incubator 1 from April 14 to April 20. The curve fluctuated considerably during the week but ran fairly smooth from Friday morning until Sunday night, although just slightly below the required temperature. After comparing this record with the first chart obtained with the newly purchased incubator it was decided to use the new incubator in the future for milk platings because that incubator seemed to hold more accurately to the desired temperature. This change was made on Monday, May 12, the bulb of the recording thermometer being placed just below the bottom shelf at a point near the middle of the rear wall the same as when the first chart and the one just discussed had been obtained.

A most disturbing thermometer record was obtained during the period May 12-18, the chart showing a satisfactory temperature record only at times when the incubator was nearly empty. Comparing this chart with the first two charts obtained, it now seemed evident that the unsatisfactory curve was due rather to the loading of the incubator with large numbers of samples than to any regulating defect of the incubator itself, since it had previously functioned satisfactorily with the thermometer bulb in a similar position. All of the irregularities that occurred during the daytime are not explainable by the fact that the doors were opened as necessary. Irregularities and high temperatures during the night most certainly were not attributable to that cause. A temperature close to 37.5° C. was recorded until Tuesday morning when the recording line became irregular, usually recording high, until Friday noon when it definitely and rather suddenly dropped to 36° C. and recorded a practically straight line gradually rising to 37° C. until the chart was removed on Monday morning. The change mentioned on Friday was co-incident with the removal of practically all of the plates and tubes from the incubator just as the rise in temperature had occurred on Tuesday when the platings for the week began. On Tuesday night the upper and middle shelves on both sides had been filled with plates and the bottom shelf was fairly well filled with racks of fermentation tubes. On Friday night the lower shelf at the left side was filled with tubes. Only a few plates then remained on the other shelves. These were removed Saturday.

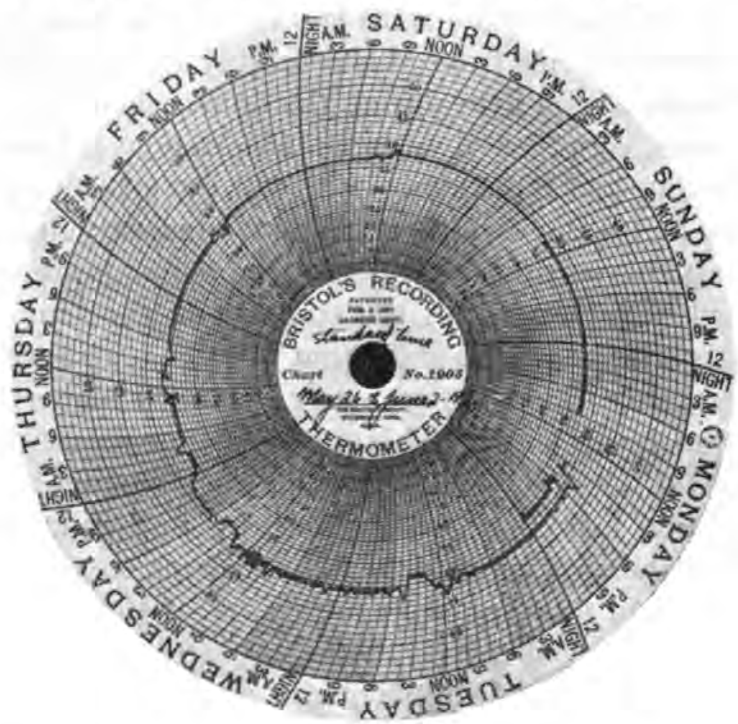

CHART II

On May 19 it was decided to install a tiny "Polar Cub" electric fan in the incubator to attempt to procure a better circulation of air. The fan was placed on the lower shelf at the right and facing the rear and side walls. The thermometer bulb was moved to the right side of the incubator above the top shelf. The curve obtained was much more satisfactory than the one that preceded it. At that time it was impossible to tell with certainty whether the noticed improvement was due to the installing of the fan or to the changed location of the bulb, or to both causes. It later seemed likely to have been due chiefly to the fact that the bulb was relatively near to the regulating device.

On May 26 it was decided to return the bulb of the recording thermometer to the bottom shelf, slightly on the left side. The same "Polar Cub" electric fan was continued in operation in the same place in the incubator. Chart II shows the curve obtained. Although the fluctuations in temperature were less in general than in the two charts obtained from May 5 to May 18, the temperature remained too high during the hours when the incubator was very heavily loaded on Monday, Tuesday, Wednesday and Thursday. The fan stopped operating because it became over-heated on Wednesday about 10 P.M. It was surprising to us that the temperature curve dropped co-incident with the stopping of the fan. Apparently the explanation is that in some manner the temperature around the regulator remained higher than the temperature near the bottom of the incubator in the vicinity of the bulb of the recording thermometer. Such a condition may have been caused by the rising of air from the heating units past the regulator to the vents up a channel established in the center of the incubator because of spaces between the halves of each shelf while the other portions of the incubator remained cooler, due to the interference by the contents of the incubator to an even distribution of heat. The point to which especial attention is called is that on Thursday afternoon when the load was removed from the incubator the curve became much more nearly a straight line and throughout Friday, Saturday and Sunday was nearly all of the time within a degree of the correct temperature. On Thursday night, Friday, Saturday and Sunday only a few plates and tubes were in the incubator. (The double record showing on the chart for Monday is the result of an incorrect setting of the chart. The stylus pen was placed on the chart on Monday morning at the 6 P.M. instead of the 9 A.M. line so that the temperature recorded on the lower line is really the temperature during Monday forenoon instead of Monday afternoon and evening.)

On June 2 the "Polar Cub" fan was replaced by a larger fan of an ordinary household variety with four 4-inch blades. It was installed on the bottom of the incubator as before except that the face of the fan was tipped back until it faced directly up. The bulb of the recording thermometer was allowed to remain at the same point on the bottom shelf at the left side and near the rear of the chamber, as during the preceding week when Chart II was obtained. In this chart and, in fact, from this time on in all future curves,—with the exception of one week in August and one in September for which as yet no explanations have been found,—we get away from sharp points and the curves show relatively long sweeping temperature changes with the thermometer recording the desired temperature only during the times when the incubator remained empty or less than one-third filled.

The chart obtained from June 16 to June 23 is similar to the one just discussed. The bulb was maintained in the same position on the lower left shelf in the rear as when Chart II and the one the week after that were obtained, and with the fan at the right side of the incubator but now moved to the top shelf and facing upward. It had been found desirable to move the fan from the bottom of the chamber because of the drying up of the agar in the petri dishes. Even with the fan on the top shelf and pointing upward it is very desirable to keep a beaker of water on the top shelf at all times to give sufficient humidity in the incubator.

Chart III was obtained during the week beginning June 23. The bulb and fan were in the same positions as during the preceding week. On Monday night only a few plates were in the incubator and the temperature went up slightly. On Tuesday afternoon the incubator

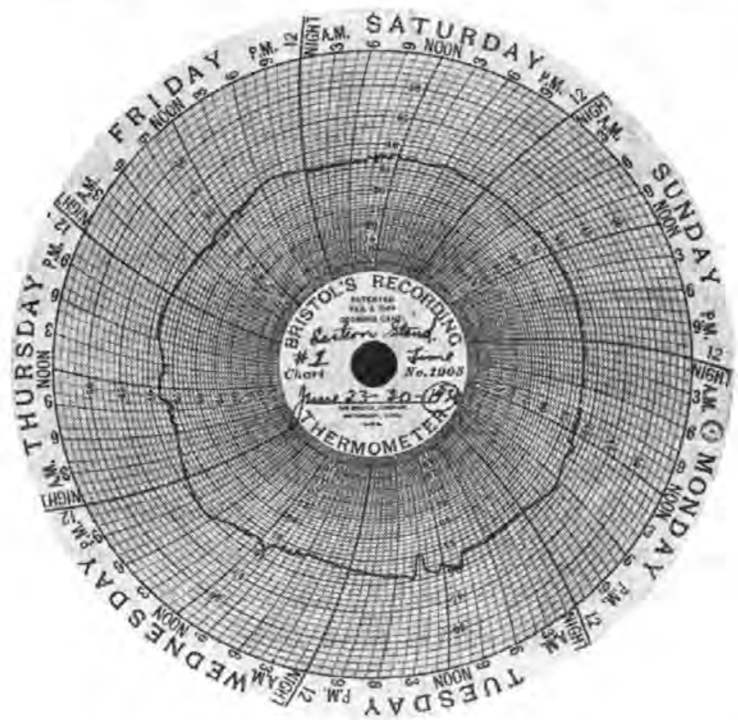

CHART III

was practically packed with plates and from that time on the work grew gradually less until Saturday noon, when the incubator remained empty until Monday. The chart shows very strikingly the tendency for the temperature to rise and then gradually drop each time the incubator became over-loaded.

In the chart obtained from June 30 to July 7, the thermometer bulb and the fan again remained in the same positions as for the two preceding weeks. This was a week of considerably lighter work and the temperature varied less from the desired temperature during the hours the incubator was in use.

During July and August there were three weeks, not consecutive, when the temperature curves failed to return to a correct reading over the week ends. The incubators contained some plates and tubes during these times but were not heavily loaded. That was during hot weather and the incubators are located in a room on the west side of the building where the room temperature in summer sometimes goes above 37.5° C. That seems to us a possible or even probable explanation of these three charts. Otherwise, temperature records, continued up through September, have been in line with those already discussed.

Chart IV was obtained by a series of experimental

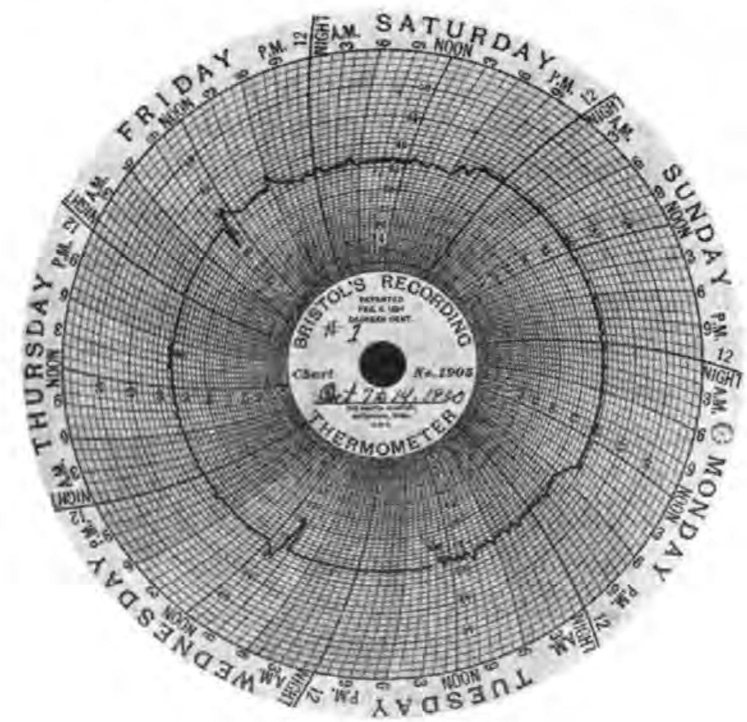

CHART IV

test loads. On October 7, with the fan still running on the top shelf, with the thermometer bulb still slightly above the bottom shelf, and the incubator empty until 9:30 A.M. on Wednesday, October 8, the curve indicated satisfactory regulation at 37.5° C. Then 275 petri dishes that had been chilled in the refrigerator were introduced. The result is shown in the curve, indicating a drop due to the introduction of the plates with a subsequent rise in temperature probably due to the temporary interference by the contents with the free movement of heated air from the heater to the thermostat even though the incubator was not packed with plates and channels were left between the stacks of dishes on the shelves below the fan.

At 9 A.M. on Thursday, October 9, the fan was turned off. At 4 P.M. the entire load was removed from the incubator and the fan was started. The incubator soon adjusted itself and regulated satisfactorily until Friday, October 10, at 9:30 A.M., when the incubator was again loaded with 275 petri dishes which this time had been heated to approximately 37° C. Similar, although slightly less noticeable, temperature changes occurred to those caused when the colder plates had been introduced. At 4:50 P.M. 100 more petri dishes were added to observe the effect of distinct crowding of the incubator and the blocking of vertical channels in the chamber with the exception of a vertical space in the center of the incubator between the halves of each shelf. The result, as recorded on the chart, indicates a definite effect of overloading on the regulation of the incubator under these conditions. On Saturday, October 11, at 7 P.M. the fan was again stopped. The effect, as shown in Chart IV, was a distinct rise in temperature as recorded by the bulb, which continued until the fan was again placed in operation on Monday, October 13, at 3 P.M. The result of stopping the fan was the opposite of the result noted earlier on Chart II. This has not been satisfactorily explained but is perhaps concerned with the disposition and size of the respective loads. It was apparently not due to outside room temperatures.

Conclusions

From these observations we have formed the following conclusions which are subject to modification as the result of comment by others or further study:

1 The incubators of the sort used regulated reasonably satisfactorily around 37.5° C. when empty.

2 The temperatures in different parts of the incubators were affected by the load placed on the shelves of the incubator.

3 With the incubator moderately loaded mechanical circulation of air tended to hold the temperature near the lower shelf,—the point at which these studies were made,—rather closely at 37.5°C., the regulating temperature.

4 With the incubators as heavily loaded as has been frequently noticed in many control and research laboratories, and not allowing sufficiently definite air channels between the plates, tubes or other contents to permit free opportunity for air circulation, and with the fan operating, the temperature 7½ inches above the heating elements at the bottom of the chamber varied over a range of from five to seven degrees Centigrade, while the registering thermometer near the regulator showed the desired temperatures nearly all of this time.

5 The opening of doors to introduce or remove contents caused sufficient recognizable temperature changes to indicate need for keeping these intervals to a minimum. The noticed effect of open laboratory doors or windows during times of loading incubators indicated a definite need that the incubator be so placed as to be unaffected by drafts or air currents, and preferably placed in a small inside room.

6 Following the addition of a large batch of plates and the consequent dropping of recorded temperature from opening of doors, there was repeatedly noticed a subsequent rise of recorded temperature above 37.5° C., apparently due to the interference of the added contents in allowing the heated air to freely rise and actuate the thermostat, even with the fan operating.

7 The recorded variation in temperatures within these incubators were greater than have been frequently stated to be necessary to produce a wide variation in the bacterial colony count of a given sample,—particularly where thermophilic bacteria are present,—sufficient to greatly affect the bacteriological grading of the sample. No attempt was made to study the actual temperatures of the media itself and hence the real effect of these temperature changes upon growth of bacterial colonies remains undetermined. Regardless of the value of bacterial plate counts (a moot question) or the use to which they are to be put, if made they should be carried out with accurate technique and satisfactory equipment. Unreliable or fluctuating temperatures introduce an added variable that may be sufficient at times to vitiate results.

8 Finally, in the author's opinion, there is definite need for action on the part of this Association, looking toward a cooperative study of incubator temperatures in which this Associa-

tion will be officially represented, together with other interested groups. Provisions should be made so that from such a study will come definite recommendations and specifications for the proper construction of laboratory incubators including any necessary provision for heating, insulating, water-jacketing, ventilating and also for some mechanical device, so that no incubator can at any time be loaded with petri dishes or other contents beyond a capacity at which it will regulate efficiently.

Acknowledgement

The writer wishes to acknowledge that most of these observations were taken by Mr. Caryl C. Carson, Chief Chemist of our Laboratories. Mr. Carson also assisted materially in the preparation of the manuscript.

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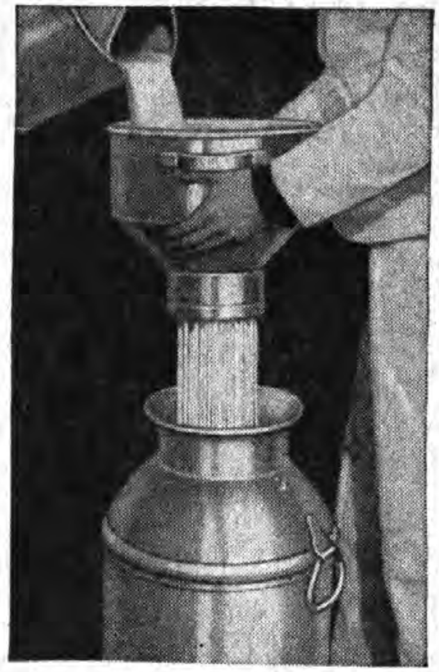

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