

REPORT
OF
MEDICAL OFFICER OF HEALTH
ON
The Safeguarding
of Toronto's Milk Supply
WITH SPECIAL REFERENCE TO
PASTEURIZATION

(Presented to and approved by the Local Board of Health in
April, 1915, and Revised in May, 1926.)

TORONTO:
THE CARSWELL CO., LIMITED
145-149 Adelaide St. West
1926

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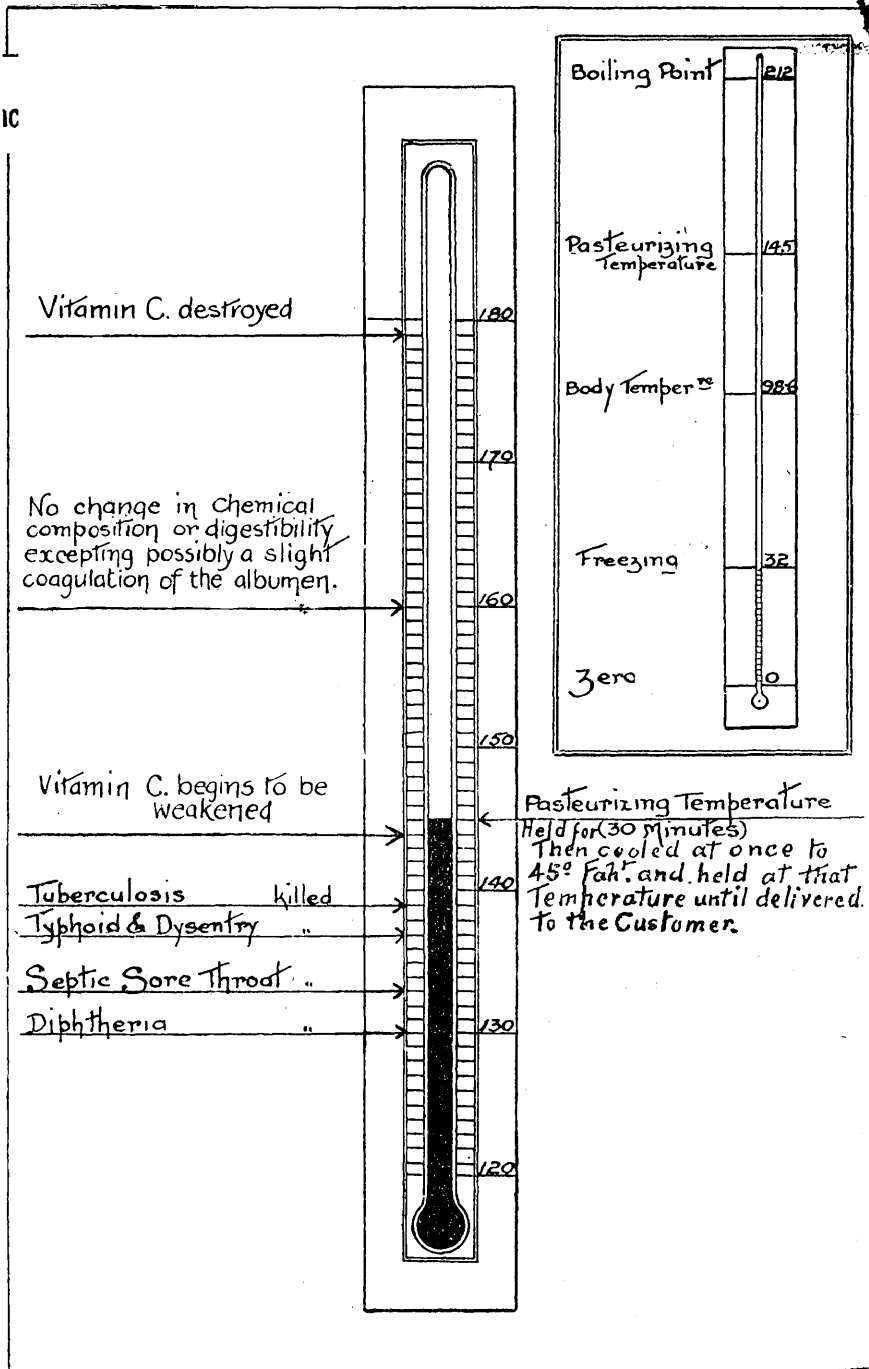


TABLE OF CONTENTS.

	PAGE
The Food Value of Milk	5
Percentage of Total Food Cost	8
Dangers of an Uncontrolled Milk Supply	10
Dangers from Bovine Tuberculosis	10
Percentage Incidence of Bovine Infection	11
Fatality Percentages of Bovine Infections	13
Milk as a Further Source of the Transmission of Infection	14
Typhoid Fever	14
Scarlet Fever	14
Diphtheria	14
Septic Sore Throat	15
How Can These Dangers be Eliminated?	22
Use of the Word "Certified"	23
Use of the Word "Pasteurized"	23
Objections to Certified Milk	24
Pasteurization	25
Effects of Pasteurization on Milk	27
Objections to Pasteurization	32
Almost Universal Endorsation of Pasteurization	33
How Can We Guarantee Efficient Scientific Pasteurization	37
Control Preceding Pasteurization	38

LIST OF ILLUSTRATIONS.

Temperature Chart of Pasteurization	2
Recording Thermometer	19
Chart of Recording Thermometer	20
Is There a Weak Link in the Chain?.....	40

REPORT
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SUPPLY
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Probably no other phase of preventive medicine has engaged the attention of public health administrators during the past fifteen years, to the same extent as has the efficient safeguarding of the public milk supply, and advisedly so. In a modified form cow's milk is the most efficient substitute we have for mother's milk as a food for the infant. There is no other food comparable in value for the developing boy and girl and also for invalids and it should enter largely into the diet of all.

Milk and its products, butter, cream, cheese, buttermilk, skim milk and ice cream, constitute the most important articles used for human food.

THE FOOD VALUE OF MILK.

The use of milk of domestic animals for human food dates back to pre-historic times. The ancient tribes of Asia used their flocks and herds not only as sources of meat and clothing, but also for their milk, which then constituted the most important part of their diet. As they migrated from one place to another, they took their herds with them owing to the fact that domestic animals were capable of using the various kinds of vegetation as food. The tribes were thus enabled to support life through the medium of these herds when agriculture was impossible.

It is surprising then that it has taken centuries for us to fully appreciate the wonderful value of milk as a food for the human as well as for the domestic animal. Nature has provided it as the sole

source of nutrition for all domestic animals in early life. As Saleeby has very fittingly expressed it: "You may search earth and sky and you will find that only once has nature set out to make a perfect food; something which exists in order to be a food and for no other purpose." It is quite obvious then why the ideal land for the tribes of Israel was referred to as "A land flowing with milk and honey".

However, until the discovery of the calorimeter it was impossible to compare accurately the amount of energy present in the different foods, and consequently to ascertain the relative values of the different foods from a purely nutritional standpoint. When we speak of calories as applied to the human engine, we use it in practically the same sense as in the British Thermal Unit when applied to various forms of fuel for engines, etc., the calories being the amount of heat necessary to raise one liter of water, one degree centigrade.

The most recent intensive scientific observations with regard to the food value of milk commenced about the beginning of the present century, and have consisted of a large number of experiments by expert food chemists, not only to ascertain the relative values of the different foods, but also their economic value and digestibility. The conclusion of all observers has been that no other animal food is to be compared with milk from the standpoint of nourishment, energy and cheapness. At the present time there is no other food as economical as milk for the feeding of infants and no other comparable from the standpoint of efficiency. For children between the ages of two and sixteen years milk is indispensable. Every child during this period should consume one quart of milk a day—certainly under no consideration should he have less than one pint a day.

Professor Lusk of Cornell University says: "Milk is the most important single food we possess even for adults. It is more economical to produce than meat, and if it were a question of having to limit oneself to either one or the other, it would be better to choose milk rather than meat."

We cannot expect a good community dietary if that community uses less than a pint of milk per capita per day. "No family of five," says Professor Lusk, "should buy meat until they have bought at least three quarts of milk." Even though the revenue of the home is limited, milk should be the last article of diet on which we should consider for a moment economizing.

Professor McCollum of Johns Hopkins, who has done extensive work in determining the food value of milk, states that one quart of

milk daily should be the allowance for every growing child and that adults would be greatly benefitted physically and mentally by drinking a quart of milk a day. They certainly should never consume less than a pint.

The United States Department of Agriculture, in dealing with the milk problem states that two facts stand out prominently as regards the increased production and use of milk: First: That milk as purchased on the market supplies food material together with growth promoting elements, more economically than either meat or eggs. Second: That the dairy cow is our most economical producer of human food. One great law of food conservation is to turn inedible food into edible food. The dairy cow can utilize and does utilize coarse material, inedible by the human, such as grass, cornstalks, hay, etc., and turns them into milk, which is a most valuable food for human consumption. In fact, the most recent developments in food research have revealed the fact that milk is the only perfect food we possess, inasmuch as it contains all the elements essential for the developing of the human body and the maintaining of life and growth. These are proteins, carbo-hydrates, fats, mineral salts and vitamins.

The proteins are the albuminous compounds as found in the casein or curd. They correspond to lean meat and the white of the egg. They are the muscle making and muscle repairing elements.

The fats, which rise to the top as cream, correspond to the fat of meat and oil, and supply heat and power, and it is well to note in this connection, that butter fat is superior to all other fats for man.

Carbo-hydrates are present in the form of milk sugar, and correspond to the starch in cereals, and like fat, yield heat and power.

The mineral matter is for the most part composed of combinations of lime, potash, sodium, phosphorus and other chemical elements essential for the development of bone.

It is worthy of note, however, that while milk alone constitutes a perfect and efficient food for the infant, yet it would not be an economical food for adults, as it does not contain a sufficient proportion of carbo-hydrates. Milk with the addition of cereals or bread or potatoes, however, constitutes a perfect mixed diet.

The statement that milk is our most valuable single article of diet, and the most economical can be better understood when a comparison is made with other articles of food. It is then that the economical aspect of milk as a food for the human can be best appreci-

ated. For instance, one quart of milk (40 ounces) is equal in food value to:

1 lb. of steak, of which the average cost is.....	\$.33
11 eggs, of which the average cost is.....	.41
3½ lbs. of fresh codfish, of which the average cost is.....	.53
2½ lbs. chicken, of which the average cost is.....	.85
1 quart of oysters, of which the average cost is.....	1.20
1 lb. of loin of pork, of which the average cost is.....	.36

In comparing the cost of these different articles, we readily see the economic advantage of milk and when we add to this the fact that in most instances the cost of cooking and serving food is equal to, or greater than the cost of the food itself, the economy of milk as a food in institutions is still more important.

Probably a more practicable comparison of the relative value of milk and other foods can be made by considering them on the basis of a single serving at our meals. Professor Rosenau of Harvard, who has made extensive and careful studies of this phase of the problem, states that one tumblerful of milk is equal in food value to:

- 2 eggs, or 1 large serving of lean meat.
- 2 large potatoes, or 5 tablespoonsful of cooked cereal, or
- 3 tablespoonsful of boiled rice, or
- 2 large slices of bread.

It is, therefore, generally conceded that where an economy has to be made in the home diet, the meat part should be cut to one-third and the amount of the milk be multiplied by three. This, Professor Sherman of Columbia University, has graphically represented, in the following table, which is recommended as the various proportions of an ideal diet on a percentage cost basis:

PERCENTAGE OF TOTAL FOOD COST.

Meat and fish	12%
Eggs	6%
Milk	30%
Cheese	3%
Butter and other fats	11%
Bread and cereals	13%
Sugar	3%
Vegetables and fruits	17%

The necessity for a more serious and careful consideration of milk as a food has been forced upon the people of this continent as the

result of surveys that have been made in the various schools. These have revealed the fact that a large percentage, ranging all the way from 35 to 70 per cent. of children in certain instances, are undernourished, and that where home investigations were made, this undernutrition was found to be largely due to the lack of milk entering into the diet.

There is little doubt in my mind that if every developing child could be guaranteed a quart of milk a day, without any other change in this routine diet, that 90 per cent. at least of this undernutrition would be overcome.

Until recently, our biological chemists and food experts were under the impression that all food products could be divided into four classes or substances, namely: proteins, carbo-hydrates, fats and salts or mineral substances. In 1906 Professor Hopkins of Cambridge University, England, made the first original experiments on vitamins or accessory food factors, by feeding the first of two sets of rats of the same age and weight, the proteins, fats, sugar and salts, and the second lot on the same substance, plus a small quantity of fresh milk. The first set lost weight and became sick, while the second set remained well and steadily gained in weight. In eighteen days, Professor Hopkins reversed the diet, with the result that the first set then gained in weight and recovered from their disease, while the second set lost in weight. The only difference in the diet of these two groups of rats was the addition of milk.

In 1912 Professor Hopkins published the results of his experiments, extending over several years, confirming the foregoing observations. These experiments constitute the pioneer work in revealing the value of these accessory food factors or vitamins, in our diet.

In 1914, Funk, of London (to whom is credited the coining of the word "vitamin") together with outstanding authorities on this continent, found this growth promoting substance which Hopkins had found in milk, to be present in many animal fats such as butter, cod-liver oil and beef fat, but that this substance was absent from oils of vegetable origin. Since that time several other of these vitamins have been discovered and food experts are agreed that they are essential for the properly balanced diet.

Here again it is interesting to observe that all three of these vitamins are found present in milk, and consequently the addition of milk in sufficient quantities to our daily diet will insure for us a properly balanced diet. It is important to note, however, that the presence of one of these vitamins "water soluble C" or the "anti-

scorbutic" vitamin, in either the human milk or the cow's milk is determined for the most part by the food that enters into the nutrition of the mother or the cow.

It must be apparent, therefore, from the foregoing, which is but a fraction of the evidence that could be produced, but which represents the consensus of opinion of all recognized authorities, that milk is a food that we cannot afford to do without. It is a food that we must have, and yet this most valuable article of diet, with the various contaminations that ordinary market milk is exposed to without proper safeguarding has been and is responsible for more sickness and death than all other foods combined.

Obviously then, any municipality that fails to efficiently safeguard its milk supply is guilty of criminal negligence.

DANGERS OF AN UNCONTROLLED MILK SUPPLY.

In addition to the terrible role played by impure milk in our infant mortality—raw market milk being in a large measure responsible for the prevalence of diarrhoeal diseases in the hot summer months—we have the well-recognized dangers of the transmission of bovine tuberculosis to children. In addition to that, there have been numerous outbreaks of typhoid fever, scarlet fever, diphtheria, septic sore throat, and in fact epidemics of all communicable diseases, traced directly or indirectly to a contaminated milk supply. Milk is capable of not only acting as a frequent source of the transmission of disease germs from one person to another, and from the animal to the human, but also as a medium in which a few germs introduced may increase to millions within twenty-four hours, at the temperature of a living room.

With the possibilities of milk to spread disease, and with the potential foci of infection in man associated with milk handling, it is surprising that there have been so few reported milk-borne outbreaks. This failure must be placed at the door of the epidemiologist.

DANGERS FROM BOVINE TUBERCULOSIS.

To what extent then does bovine tuberculosis affect man, and how can we best control it?

To the late Professor Robert Koch are we indebted for having discovered that the great White Plague in man and beast is due to the germ known as the "tubercle bacillus" and for years he maintained that the germ in man and beast were identical. However, in 1901, at the International Congress on Tuberculosis, in London, he took the stand that bovine tuberculosis was harmless to man. This statement

has been regretted by many, but in my judgment it was, indirectly, probably one of the most valuable statements that he had made up to that time in connection with this problem, as I question very much if we would today be in possession of more than a fraction of the indisputable evidence we now have of the dangers of this bovine tuberculosis to mankind had that statement not been made. Immediately following this conference, at which Professor Koch promulgated his opinions, Royal Commissions were appointed in England, Germany and other European nations, and also in the United States and it is to these Commissions and many private investigators that we are indebted for our present knowledge of the real dangers of bovine tuberculosis in the human. The findings of these Commissions were practically the same, that from 25 to 26 per cent. of all cases of tuberculosis in children under sixteen years of age were of the bovine type.

Of the various investigations made on this Continent, in this connection, there are none more valuable and better known than those made by Dr. Theobald Smith of Harvard and Dr. W. H. Park, Director of the Public Health Laboratories of New York, and his colleagues.

The cases of human tuberculosis examined by Dr. Park and his associates are specially valuable, inasmuch as they are not selected cases. The following is a summary of the experimental work by Dr. Park, as well as the work of many others who were endeavoring to solve the same problem. These figures show clearly how dangerous the bovine type of organism is as a source of infection in man.

PERCENTAGE INCIDENCE OF BOVINE INFECTION.

Diagnosis.	Adults 16 years and over.	Children 5 to 16 years.	Children under 5 years.
Pulmonary tuberculosis	.4%	0 %	2.8%
Tuberculous adenitis, cervical	2.7%	38 %	61 %
Abdominal tuberculosis	20 %	53 %	58 %
Generalized tuberculosis, alimentary origin	14 %	57 %	47 %
Generalized tuberculosis	0 %	16 %	8.6%
Generalized tuberculosis, including meninges, alimentary origin.....	0 %	0 %	66 %
Tubercular meningitis (with or with- out generalized lesions other than preceding)	0 %	0 %	4.6%
Tuberculosis of bones and joints.....	3.3%	6.8%	0 %
Tuberculosis of skin	23 %	60 %	0 %

FATALITY PERCENTAGES OF BOVINE INFECTIONS.

Diagnosis.	Children 5 to 16 years.	Children under 5 years.
Abdominal tuberculosis	75%	77 %
Generalized tuberculosis alimentary origin.....	57%	46 %
Generalized tuberculosis	20%	7.2%
Tubercular meningitis, secondary to tuberculosis of alimentary origin	0%	6.6%
Tubercular meningitis (other than preceding).....	0%	5.4%
Total percentages	26%	18 %

These figures are based on the bacteriological analysis of 1,511 cases.

The tables bring out clearly the following facts:
 75% of gland cases in children are bovine.
 66% of generalized tuberculosis in children is bovine.
 18% to 26% of deaths from tuberculosis in children are caused by the bovine type of bacillus.

Dr. Ravenell, Professor of the University of Wisconsin, the Director of the Bacteriological Laboratory of the Department of Health, Wisconsin, in referring to Dr. Park's figures said: "I think we are now in accord on almost every point concerning this important question. there is now a world-wide agreement that bovine tubercle bacilli can produce serious and fatal disease in human beings, and these cases are chiefly among children under the age of 16 years, and especially under the age of 5 years."

Dr. Ravenell further says that the cases cited by Dr. Park in connection with the Foundling Hospital, showing 55 per cent. of the deaths due to bovine type infection, demonstrate clearly the actual danger which exists today as regards this one disease from the exclusive use of raw cow's milk.

Professor Sims Woodhead of Cambridge University, in England, in an able and comprehensive address delivered at the International Congress of Hygiene and Demography, at Washington, pointed out that the findings of the British Commission, and the German Commission were practically the same. Professor Woodhead cited the investigations and the observations of Professor Delepine, working in connection with Dr. Niven, Medical Officer of Health for Manchester, who made a thorough examination of the sources of Manchester's milk supply, regarding the presence of the tubercle bacilli.

In no town in the United Kingdom, and practically in no city in the world, except perhaps Copenhagen up to 1912, had the milk supply been more thoroughly controlled than in Manchester. Any improvement in the mortality from tuberculosis as the result of measures taken to control the milk supply could, therefore, be better seen in Manchester and Copenhagen than in probably any other city. Professor Delepine's figures and observations, based on the reduction in tuberculosis after the control of the milk supply were most convincing. He concluded from his complete investigations that taking all this evidence into consideration "it is possible to say, without fear of contradiction, that not less than 25 per cent. of the tuberculous children under five years of age suffer from infection of bovine origin."

These figures seem to bear out in a very striking manner the experience in Copenhagen, where, under the advice of Professor Bang, greater precautions have been taken to eliminate tubercle bacilli from the milk supply than in any other large city in the world. The result was that comparing the tuberculosis mortality in Copenhagen in 1912 with that of England and Wales, it was found that the mortality from tuberculosis in Copenhagen had fallen from a point considerably above that of the English curve, for an early period, to a point then definitely below the curve, the two lines converging at a point representing the period after Bang's advice had begun to be followed. This, of course, is in addition to the general precautions against tuberculosis that had been taken in both countries. The uniformity of the findings of all these investigators is inspiring and convincing, their conclusions being that conservatively estimated, 25 per cent. of all cases of tuberculosis in children under sixteen years of age is of the bovine type.

It is apparent then, that tuberculosis, contracted from the cow, through the medium of the milk, exists in children to a degree that cannot be longer disregarded by Departments of Public Health and demands immediate action.

Furthermore, there is the additional danger of infection with the human form from someone suffering from tuberculosis handling the milk with contaminated hands or sneezing or coughing over a vessel containing milk.

In our judgment to attempt to entirely remove this element of danger of bovine tuberculosis by excluding from dairy herds all cattle suffering from tuberculosis would mean a milk famine. The cost would be prohibitive and even then, this would only control one of the many communicable diseases that are spread by ordinary market milk.

MILK AS A FURTHER SOURCE OF THE TRANSMISSION OF INFECTION.

The following table has been taken from a pamphlet issued some few years ago by Dr. Charles E. North, Director of the North Public Health Laboratories, New York City, and Secretary of the Commission on Milk Standards for this Continent. This table represents a few only of the 317 outbreaks of communicable diseases traced to raw milk.

TYPHOID FEVER.

Glasgow, Scotland.....	500 cases from one raw milk supply
Cologne, Germany.....	270 cases from one raw milk supply
Port Jarvis, N. Y.....	59 cases from one raw milk supply
Springfield, Mass.....	182 cases from one raw milk supply
Oaklands, Cal.....	262 cases from one raw milk supply
Montclair, N. Y.....	107 cases from one raw milk supply
Stamford, Conn.....	307 cases from one raw milk supply

SCARLET FEVER.

125 epidemics of scarlet fever traced to raw milk supply of which the following are a few examples.

Buffalo, N. Y.....	57 cases from one raw milk supply
Washington, D. C.....	33 cases from one raw milk supply
London, England.....	284 cases from one raw milk supply
Beverly, Mass.....	6 cases from one raw milk supply
Liverpool, England.....	59 cases from one raw milk supply
Mt. Vernon, N. Y.....	45 cases from one raw milk supply
Boston, Mass.....	195 cases from one raw milk supply

DIPHtheria.

51 epidemics of diphtheria have been examined of which the following are a few illustrations.

Brooklyn, N. Y.....	12 cases from one raw milk supply
Los Angeles, Cal.....	35 cases from one raw milk supply
Wellsville, N. Y.....	84 cases from one raw milk supply
Clinton, Ohio.....	36 cases from one raw milk supply
Highpark, Mass.....	69 cases from one raw milk supply
Warwick, R. I.....	64 cases from one raw milk supply

SEPTIC SORE THROAT.

Considerable interest has been aroused during the past fifteen years as the result of a high mortality from septic sore throat. Many of these outbreaks have been traced directly to the milk supply, partially through contamination of the handling of the milk by those who were affected with this disease or who were carriers, and partially through an organism which is found in the diseased udder of the cow. Six hundred cases of sore throat in Stockholm in 1908 were traced to an abscess in the udder of a cow, which contained the same organism that was found to be responsible for the sore throat. This animal was one of a herd that furnished milk to those that became infected. This was one of the first observations made in this connection, and different outbreaks have been traced to unpasteurized milk.

A very exhaustive study was given to the outbreak of this disease in Boston in May, 1911, where 1,043 cases were traced to one raw milk supply. In Chicago, Ill., an outbreak of 10,000 cases was traced to one raw milk supply; in Baltimore, 602 cases; and in Cortland-Homer, N.Y., 669 cases. This disease seems to attack adults especially.

Pasteurization would have made these outbreaks practically impossible.

SOME MILK-BORNE EPIDEMICS IN CANADA.

In Montreal in September and October of 1922 thirty-three cases of typhoid fever among which were three deaths, resulted from use of milk from a shipper who was supposed to be suffering from Grippe, but on investigation proved to be suffering from typhoid fever. Again in January, 1924, sixteen cases with two deaths resulted from a milkman adding polluted water to the milk. In Quebec City in 1924, eight cases resulted from a producer having two cases of typhoid fever in his home. In Vineland, Ontario, in 1921, twenty cases of typhoid fever were traced directly to a milk supply. In Hanover in 1923, forty-six cases with four deaths, and in Winnipeg in 1912, ninety-two cases with seven deaths were all traced directly to the milk supply.

Winnipeg has been singularly unfortunate as regards milk-borne typhoid fever, as epidemics of this disease have been traced to the milk supply in 1916, 1919, 1922 and 1925. Perhaps the saddest experience of all occurred in Regina College, in Regina, Saskatchewan, in 1920, where eighty-three cases with nine deaths occurred, although certain precautions had been taken to ensure a fairly clean supply.

The dairyman contracted typhoid fever and before his case was diagnosed he had infected at least eighty-three of the students in the college.

The aforesaid dangers of infection through milk are accentuated by the fact that most of these disease-producing organisms multiply rapidly in cow's milk at the temperature of a living room. This is especially true of the typhoid germ.

Dr. Herman Biggs, formerly Medical Officer of Health of New York City, and later Commissioner of Health of New York State, in 1910 made some investigations in connection with certain outbreaks of typhoid fever in New York City, presumably from their milk supply. He was able to trace several of these outbreaks to the milk supply. The striking feature of these cases was that they were not traceable to any acute cases, or cases of recent development, but were all traced to chronic carriers who had suffered from the disease years before. These cases were only verified after excluding every other source and then making a bacteriological examination of the excretions from the bowels and also of the urine of the suspected producers and dealers.

In one instance of an extensive outbreak, it was traced to a carrier who had suffered from typhoid fever forty-six years before. His stools were found still to contain an enormous number of virulent bacilli. As Dr. Biggs points out, when you add to this danger that of other communicable diseases, it is apparent that no system of inspection, no matter how well organized, could possibly detect these cases. To make such an intensive investigation of a city's complete milk supply, such as Dr. Biggs made in these few cases, would be as impossible as it would be unwarranted. Obviously then the only safety lies in some method of treating milk that will render the entire safety safe at all times. This method is pasteurization.

It was on these findings, together with the information already in the possession of the Board of Health of New York that they decided to pass an Ordinance in 1912, requiring all milk not coming from cattle free from tuberculosis, as determined by the tuberculin test, and not produced under conditions necessary for the production of a certified milk, to be scientifically pasteurized. This Ordinance was not rigidly enforced until 1914, but it is of interest to note the following extract taken from the Weekly Bulletin of the Department of Health of New York City, June 6th, 1914.

"The situation regarding compulsory pasteurization of all except the highest grade of milk sold in this City is extremely satisfactory at the present time, about 99 per cent. of the city's supply being efficiently pasteurized. This represents an enormous improvement over conditions a year ago, and should make milk-borne disease a rarity in this city."

MORE RECENT MILK-BORNE OUTBREAKS.

A more recent report on outbreaks of communicable diseases traced to raw milk was issued two years ago by the United States Public Health Service, which is in part, as follows:

In the City of Boston in five years there have been 4,096 cases of diphtheria, scarlet fever, typhoid fever, para-typhoid and septic sore throat traced directly to their milk supply.

In December, 1923, in Iowa there was an outbreak of typhoid fever, 41 cases being traced to raw milk.

In March, 1924, two outbreaks of typhoid fever in Portland, Oregon, 26 cases traced to raw milk supply.

In Bath, Mich., in May, 1917, there was an outbreak of typhoid fever—50 cases traced to cheese cured but a short time.

In March, 1924, an outbreak of para-typhoid—50 cases in New Rochelle, New York. This was traced to a supply of certified milk.

Sixty-one milk-borne outbreaks of communicable diseases from 1918 to 1923 were tabulated in the aforesaid report of the United States Public Health Service. Forty of these outbreaks were from raw milk; 4 from pasteurized milk, and in 17 instances the kind of milk was not stated.

Dr. Price, who made investigations of these cases, reported that in the four instances traced to pasteurized milk, it was found that the pasteurizing was imperfect and unreliable. In all of the cases investigated by the Public Health Service, that had been traced to a pasteurized milk supply, it was found that the milk had not been scientifically pasteurized and had not complied with the requirements of public health departments on this continent for pasteurizing milk.

Dr. L. L. Lumsden of the United States Public Health Service, in a Health Report of June, 1925, gives a very interesting and lengthy detailed description of their investigations in connection with an outbreak of typhoid fever in Lincoln Memorial University, Tennessee.

During this explosive milk-borne typhoid outbreak, there were at least 100 cases, with eight deaths, amongst the students of an enrolment of 430. The details of the investigations in regard to this outbreak are intensely interesting and well worth perusal by those interested, their final conclusion having been that milk was undoubtedly the source of this outbreak. In concluding their report of these investigations, the investigators emphasized the outcome to be just what might be expected from a grossly neglected dairy, a typhoid carrier, with no pasteurization.

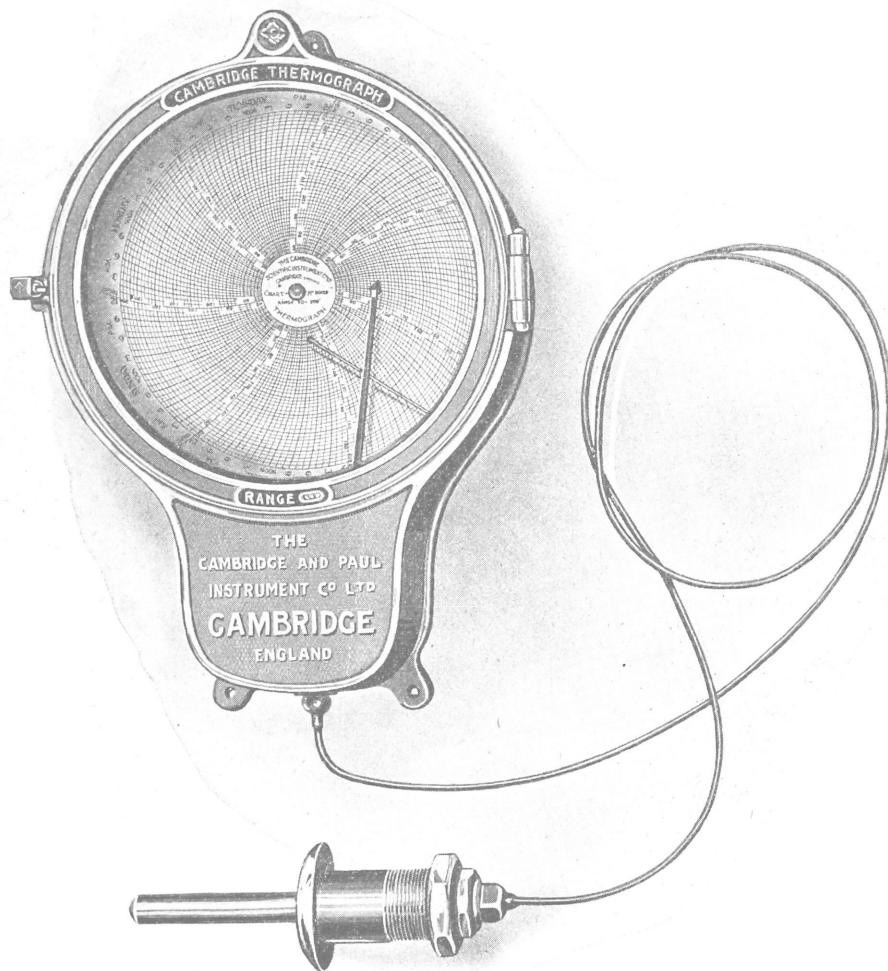
In the Journal of the American Medical Association, October, 3rd, 1925, under "Ohio News", appears a report of a typhoid outbreak in Sandusky, traced to the milk supply. In this case, the State Director of Health states that 60 cases had been reported, all of which had been using milk from the same dairy, the owner of which was found to be suffering from typhoid fever. The dairy owner was directed to pasteurize his milk supply, and was prevented from delivering any more milk to the city until that order had been complied with.

The Health Officer of Orange, N. J., states that from 1914 to 1919 there were 5 epidemics of scarlet fever in Orange. All of these outbreaks were controlled by the pasteurization of the milk supplies, investigation of each case having revealed the source of infection.

In April, 1924, there occurred an outbreak of 38 cases of scarlet fever in Helena, Montana, in which raw milk was reported to be the vehicle of infection. The state Health Officer made a thorough investigation of these cases, with the result that they were traced directly to the source of production. In this case a more or less definite variety of streptococcus hemolyticus was isolated from milk in large numbers, and also from the throat of the producer. Beside the 38 original cases of scarlet fever in this epidemic, there were 17 contact cases.

The Health Officer of Knoxville, Tenn., states that since his taking charge of the Department of Health of that City in May, 1924, they have had three small but definite outbreaks of typhoid fever traceable to contaminated milk. In all of these cases the milk supplies were suspended until such times as they had made arrangements for efficient pasteurization.

Previous to the enforcing of the regulations for the pasteurizing of Toronto's milk supply in 1915 we had different outbreaks of communicable diseases, including two of typhoid fever, which were traced directly to the source of milk production.



*Type of Recording Thermometer used by the
Department of Public Health,
Toronto, Canada*

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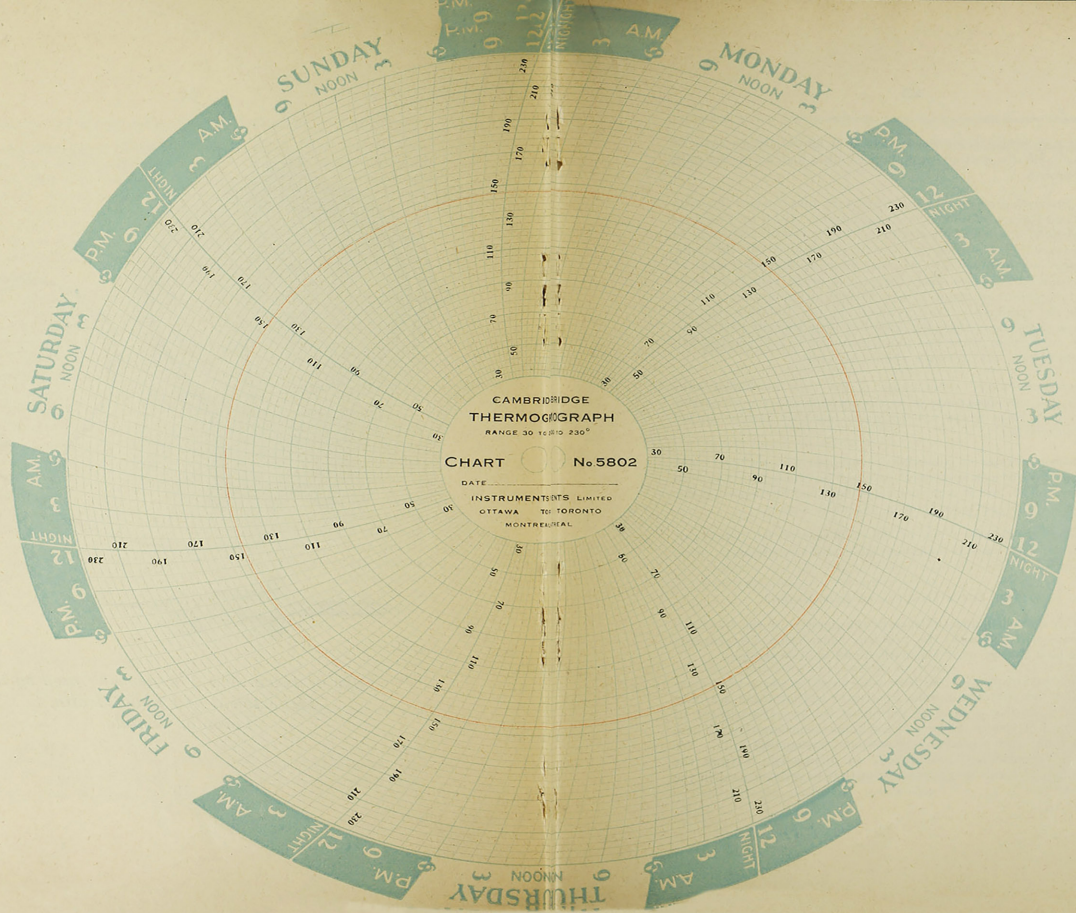
In the Journal of the American Medical Association, October, 3rd, 1925, under "Ohio News", appears a report of a typhoid outbreak in Sandusky, traced to the milk supply. In this case, the State Director of Health states that 60 cases had been reported, all of which had been using milk from the same dairy, the owner of which was found to be suffering from typhoid fever. The dairy owner was directed to pasteurize his milk supply, and was prevented from delivering any more milk to the city until that order had been complied with.

The Health Officer of Orange, N. J., states that from 1914 to 1919 there were 5 epidemics of scarlet fever in Orange. All of these outbreaks were controlled by the pasteurization of the milk supplies, investigation of each case having revealed the source of infection.

In April, 1924, there occurred an outbreak of 38 cases of scarlet fever in Helena, Montana, in which raw milk was reported to be the vehicle of infection. The state Health Officer made a thorough investigation of these cases, with the result that they were traced directly to the source of production. In this case a more or less definite variety of streptococcus hemolyticus was isolated from milk in large numbers, and also from the throat of the producer. Beside the 38 original cases of scarlet fever in this epidemic, there were 17 contact cases.

The Health Officer of Knoxville, Tenn., states that since his taking charge of the Department of Health of that City in May, 1924, they have had three small but definite outbreaks of typhoid fever traceable to contaminated milk. In all of these cases the milk supplies were suspended until such times as they had made arrangements for efficient pasteurization.

Previous to the enforcing of the regulations for the pasteurizing of Toronto's milk supply in 1915 we had different outbreaks of communicable diseases, including two of typhoid fever, which were traced directly to the source of milk production.



For the past twelve years there have been absolutely no cases of any communicable disease that we have been able to trace to the milk supply in Toronto.

A very interesting report in connection with tuberculosis appeared in the American Review of Tuberculosis for October, 1924, by Professor C. E.-A. Winslow, in which he states that: "It is found, according to our investigations, that among the group of children of the milk consuming age, one to four years, in cities where a high percentage of the milk consumed is pasteurized, there is a death rate from non-pulmonary tuberculosis of about 75 per 100,000 of population, as contrasted with the pulmonary rate of about 25 per 100,000. On the other hand, in cities where there has been but little efficient pasteurization, there is an increase in the non-pulmonary rate to 100 per 100,000, where the pulmonary rate remains about the same."

The "non-pulmonary" tuberculosis is the type associated with milk, and is, for the most part, of bovine origin, and the wonderful reduction in these cases where pasteurization has been rigidly carried out is very interesting.

The number of cases of tuberculosis in Toronto in the past eight years that could be even suspected of being of bovine origin, has been practically negligible, and it is gratifying to feel that this record is due almost entirely to the pasteurization of our milk supply.

The foregoing are but a few of the evidences of the dangers of transmission of the various communicable diseases, through non-pasteurized milk.

HOW CAN THESE DANGERS BE ELIMINATED?

With such overwhelming evidence of the dangers of the transmission of disease through milk, the problem confronting Departments of Health is how can we most efficiently remove these dangers.

The consensus of opinion of those who have for years been carefully studying the relation of milk to disease is that there are only two kinds of milk that should be permitted by any Department of Health or Board of Health, to be sold for human consumption. These are certified milk, and inspected, scientifically pasteurized milk. We use the term "scientifically pasteurized" to distinguish it from the various commercial forms of pasteurization that have been used in the past.

The following are the definitions of "certified" milk and "pasteurized" milk, as contained in the Ontario Milk Act.

Use of the word "Certified".

"It shall be unlawful to apply the term 'certified' to any milk which does not comply with the following standard:"

(a) It shall be from cows semi-annually subjected to the tuberculin test and found without reaction.

(b) It shall contain not more than 10,000 bacteria per cubic centimetre from June to September, both inclusive, and not more than 5,000 bacteria per cubic centimetre from October to May, both inclusive.

(c) It shall be free from blood, pus, or disease-producing organisms.

(d) It shall be free from disagreeable odor or taste.

(e) It shall have undergone no pasteurization or sterilization, and be free from chemical preservatives.

(f) It shall be cooled to 45 degrees Fahrenheit or under, within half an hour after milking, and kept at that temperature until delivered to the consumer.

(g) It shall contain twelve to thirteen per cent of milk solids, of which at least three and one-half per cent. is butter fat.

(h) It shall be from a farm the herd of which is inspected monthly by the veterinarian, and the employees of which are examined monthly by a physician.

Use of the word "Pasteurized".

"It shall not be lawful to apply the word 'pasteurized' to any milk unless all portions have been subjected for at least twenty and not more than thirty minutes to a temperature of not less than 140 and not more than 150 degrees Fahrenheit, and then at once cooled to 45 degrees Fahrenheit or under and kept at that temperature until delivered to the consumer; and the process of pasteurization shall be subject to inspection by the local Medical Officer or such inspector as he may designate; provided always that all such milk shall in all other respects be subject to all the terms and conditions of this Act."

However, we will not have reached the ideal in pasteurization until we have it done in the final containers. This is being done by a firm in Brooklyn, N. Y., and in some smaller places, but not in sufficient quantity to meet the needs of any municipality. The only places where this method is used in Canada are in the Hospital for Sick Children, Toronto, and in preparation of infant's milk at the City Dairy, Toronto. The Hospital for Sick Children buys high grade milk and then pasteurizes it in the bottles in which it is delivered to the baby. This removes every possible chance of infection.

OBJECTIONS TO CERTIFIED MILK.

It is quite apparent that the high cost of production of certified milk will prevent its ever being extensively used in any municipality. This quality of milk had been offered for sale for from fifteen to twenty years in New York City, but in 1914, and for some years previous, it constituted only three-quarters of one per cent. of the entire milk consumption of that city. In the City of Toronto though we have had certified milk produced for the last seventeen years, the consumption of this milk in the City last year was only one-half of one per cent. of the entire milk supply. Then there is a feeling of uncertainty even in regard to certified milk, as different epidemics have been traced directly to this source. These have been in most cases due to carriers handling the milk.

Furthermore, the cases of tuberculosis that develop in even certified herds during the course of the year, have been found to range from 5 per cent. to 25 per cent. A striking example of this occurred in November, 1914, when it was found that 191 tuberculous cows were taken out of a herd of 632 animals. This was one of the most celebrated certified herds in the United States.

The extent to which tuberculosis exists in all dairy herds is much greater than is generally supposed. In one herd in the United States in December, 1914, 72 tuberculous cows were found in a herd of 86. This was a "model" dairy where every expense and precaution had been taken, but was not a certified herd. Our Department of Public Health veterinarians advise us that from 25 per cent. to 35 per cent. of the cattle supplying milk to Toronto are tuberculous. Approximately 30 per cent. of the dairy cattle in New York State are suffering from tuberculosis and about 40 per cent. in Europe.

It is, therefore, now the consensus of opinion of health authorities that even certified milk should be scientifically pasteurized before being used as food for infants. It would, therefore, seem that we are

left no alternative. If we are to safeguard our entire milk supply it must all be scientifically pasteurized.

PASTEURIZATION.

The history of pasteurization dates back to the studies made by Louis Pasteur from 1860 to 1864, in connection with wines and beer, which revealed the fact that the diseases of wines were caused by yeast and bacteria, and that this yeast and bacteria could be killed by the heating of the wines to from 50 to 60 centigrade, for a few minutes. In 1868, under Pasteur's instructions, a cargo of wine that had been submitted to this treatment, was sent around the world on a ship and returned to Paris without any of it having spoiled.

In 1870 Pasteur studied the disease in beer, and found that the organisms causing this were destroyed at a temperature between 50 and 55 centigrade.

In 1886 Soxhlet in Munich, recommended that all cow's milk fed to infants should be boiled or sterilized for at least thirty-five or forty minutes, to kill the germs contaminating the same, he having observed that in the process of milking and the handling of milk, particles of manure and barnyard contamination of different kinds, together with disease germs, gained access to the milk and rendered it unfit and unsafe for infant and child feeding.

In 1892, the late Professor Jacobi, and Professor Roland Godfrey Freeman of New York, advised Mr. Nathan Straus, a public philanthropist, who had manifested a great interest in the ways and means of reducing the infant mortality, to adopt this Soxhlet method for sterilizing the milk in the infant milk depots that he was about to establish in the tenement house districts of New York.

It might be mentioned in this connection that Professor Jacobi and Professor Roland Godfrey Freeman of New York were two of the most outstanding authorities on the diseases of children on this continent. Freeman was the first physician on the continent to be identified with the establishment of infant milk depots, in New York City.

Through the influence of these outstanding authorities and guided by their scientific knowledge, Mr. Straus was the pioneer in establishing infant milk depots, and in the use of pasteurized milk for infants, on this continent. Although Mr. Straus was engaged in a large business enterprise, a merchant prince, yet he devoted a large part of his time to the establishment and operation of the infant milk depots

in New York, and has since established them in other cities, not only in America, but also in Europe and Palestine, for the distribution of pasteurized milk for infants.

The first depots were established by Mr. Straus in New York City in 1893, for the distribution of pasteurized milk to infants in the poorer districts of that City. He states that in the months of July and August alone in 1890, 1891 and 1892, there died 13,201 children under five years of age, of which 6,122 died from infant cholera or diarrhoeal diseases. Wherever Straus' milk depots were established, the infant mortality was greatly reduced. Mr. Straus continued these depots at his own expense until 1919.

The example set by Mr. Straus in turning to practical account the scientific knowledge and advice which he had received from Jacobi and Freeman has unquestionably been a great force throughout the civilized world, and is, in itself, enough to immortalize his name.

The New York Milk Committee also gave a great impulse to the work of reduction of infant mortality in New York City. This Committee was established in 1907, by the Association for Improving the Condition of the Poor. The average infant mortality for the previous ten years in New York City was 153 per thousand births. The Committee announced as its chief object the reduction of infant mortality, and as its second object the organization of the milk supplies of New York City. It was composed of a number of prominent philanthropic men and women who freely gave of their time to the good work. During the first year of its existence this Committee established four infant stations, which it operated at its own expense. These stations dispensed milk in quart bottles and sent nurses into the homes to instruct the mothers how to prepare the feeding for infants and how to care for them. During the following years these infant milk depots were increased, until 1911, when they were operating, in all, 31 depots. Their opening was followed by a wonderful reduction in the infant mortality. During the period of the Committee's Milk Depot Work extending over four years, the infant mortality of the City was reduced from 153 per thousand to 111.

I, therefore, refer to the advisability or inadvisability of pasteurization with apologies to my colleagues, with whom the discussion of this problem is practically ancient history. No one who has been making a scientific study of the milk problem, and who is, therefore, in a position to give an intelligent opinion, has, within the past fifteen years at least, questioned for a moment the advisability of the pasteurization of all milk that does not come from herds that have been shown

to be free from tuberculosis or that has not been procured under conditions necessary for the production of certified milk. However, I presume it is a matter of history repeating itself. In all advances of science there are always a few who cannot keep pace with advancement, and they expect others to wait for them. It is, therefore, necessary to repeat and repeat, over and over again.

I am reminded here of Lord Cromer's address at the Annual Conference of the British Research Defence Society in London in July, 1910, when the question of inoculation of animals was under discussion, in which he said: "It seems unfortunate that we should have to waste time on problems that are so self-evident, in order to meet the objections of those who value the life of a guinea pig higher than that of a baby." He consoled himself by quoting the statement made by Mr. Cobden in the British House of Commons when endeavoring to bring about the repeal of the Corn Laws, which was as follows:

"I have come to the conclusion," said Cobden, "that the only way to get an idea into the heads of the British public is to repeat the same thing over and over again in slightly different language."

This finds a fitting application in our educational campaign for pasteurization of milk.

EFFECTS OF PASTEURIZATION ON MILK.

It was fully demonstrated in 1907 and 1908 in the Hygienic Laboratories of the Public Health and Marine Hospital Service at Washington, that heating milk to a temperature of from 140 degrees to 145 degrees F., and holding it at that temperature for thirty minutes, would destroy all disease-producing germs, including the tubercle bacillus, which was found to be the most resistant of all, and at the same time would produce no appreciable injurious effect upon the milk.

The work done at that time by Schroeder and Cotton in connection with the experimental stations of the Bureau of Animal Industry was most valuable and has frequently been quoted since. They demonstrated that tuberculous cattle discharged tuberculosis germs from their bowels almost constantly—at times to the extent of tens of millions per day. They also demonstrated that the cattle that passed tubercle bacilli by the bowels were not always visibly diseased—many were apparently in perfect health and were not known to be tuberculous until the tuberculin test had been used. In demonstrating the efficiency of pasteurization, so far as the tubercle bacillus is concerned, they inoculated several hundred guinea pigs with the milk in its raw state

from these tuberculous cattle. Every one of the little animals developed general tuberculosis. Over 200 guinea pigs were injected with milk from the same cow, after it had been pasteurized at a temperature of 140 degrees for thirty minutes. Not one of these developed any signs of tuberculosis. This work has been confirmed by Professors Rosenau, Conn, Theobald Smith, North, Russell, Hastings, and many other investigators both on this continent and in Europe.

The investigations made by General Sternberg, former Surgeon General of the United States Army, have also demonstrated that a temperature from 140 to 145 degrees for 30 minutes will destroy all disease-producing germs and 99 per cent. of all other bacteria, and does not affect the taste or in any way interfere with the nutritive value or digestibility of the milk. This has been repeatedly confirmed by the most skilled investigators, both in Europe and America.

Much of the difficulty experienced in securing the adoption of universal pasteurization of all milk is due to the deeply seated misconception of what efficient or scientific pasteurization really means. This is the result of the various commercial methods, or so-called flash methods, that have been used for years. They have no scientific value and oft-times accord a false security—the only object being to prolong the keeping properties of the milk. These methods are now illegal, only the holding method, or scientific pasteurization, now being permitted.

Bulletin No. 166 of the United States Bureau of Animal Industry, 1913, prepared by Dr. Rupp, demonstrates very conclusively that pasteurization does not produce any chemical change in milk. Consequently the nutritive value of milk is not diminished, as demonstrated by the following:

- 1st. Milk pasteurized by the holding process at (145) degrees F. for 30 minutes does not undergo any appreciable chemical change.
- 2nd. The soluble phosphates of lime and magnesia do not become insoluble at 155 degrees F. The quantity of phosphoric acid, lime and magnesia in the serum of both raw and pasteurized milk is practically the same.
- 3rd. The albumen does not coagulate at 145 degrees F., but at 150 degrees F. 5.75 per cent. of the albumen is rendered insoluble. As the temperature increases the amount of coagulated albumen increases, so that at 155 degrees F. the quantity increases to 12.75 per cent., and at 160 degrees F. the amount coagulated is increased to 30.78 per cent.

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- 4th. The time required for coagulating the casein by rennin is slightly less in milk pasteurized up to 140 degrees F. than it is in raw milk. At 150 degrees F. there is a slight retardation while at 167 degrees, the time is almost doubled.
 - 5th. The acidity as determined by titration is slightly diminished in pasteurized milk.

In Report No. 17 of the British Ministry of Health, issued in 1923, on public health and medical subjects, we find under the title "Notes on pasteurization of milk", the following significant statements:

"When milk is pasteurized at a temperature of 145 degrees Fahrenheit, for thirty minutes, no appreciable change takes place in the milk proteins. The soluble calcium and magnesium phosphates in the milk do not become insoluble or separate out when the milk is pasteurized at the aforesaid temperature for thirty minutes. This treatment has, furthermore, only a slight effect upon the enzymes which may be present in the milk."

The British Ministry of Health further states: "The problem, therefore, arises, as to how such milk can best be rendered safe for the consumer, and its keeping qualities maintained so that it will remain fresh and sweet for a reasonable time after delivery, without at the same time unduly increasing its cost or materially altering its nutritive value. This problem can be solved by pasteurization."

In further reference to this subject of pasteurization, in this report, the Ministry of Health, in referring to the effects of pasteurization on the vitamins, says:

"Milk is rich in fat soluble "A" vitamin, and also contains water soluble "B" vitamin, and the anti-scorbutic or water soluble "C" vitamin. Both fat soluble "A" vitamin and water soluble "B" vitamin have a relatively high resistance to heat so that pasteurization has practically no effect on them whatever. The anti-scorbutic vitamin, however, is sensitive to heat above 122 degrees Fahrenheit and there seems to be little doubt that pasteurization at 145 degrees Fahrenheit weakens the anti-scorbutic properties of milk."

However, this is the only loss that milk suffers during pasteurization, and inasmuch as all recognized pediatricians strongly recommend orange juice to be given to all babies after the second month, and to constitute a part and parcel of their daily nutrition whether they are

nursed at the mother's breast or on cow's milk, and as that fruit juice is rich in the anti-scorbutic vitamin, it matters little whether or not this vitamin "C" is entirely destroyed. It is important to bear in mind, however, that all the orange juice that we could drink will not destroy the disease producing germs that are destroyed by scientific pasteurization.

The following extract taken from a pamphlet on milk, by Professor H. Kenwood, Professor of Hygiene and Public Health in the University of London, England, is of interest, in this connection:

"So far as we know, the changes which result when milk is sterilized or boiled, do not occur in low temperature pasteurization, which implies the heating of milk to a temperature of only 145 degrees Fahrenheit for 30 minutes, and then rapidly cooling it, but a great reduction of micro-organisms takes place, so that the milk keeps better and is always completely free from risk from any harmful germs which may have gained access to it. The available evidence in this and other countries supports the view that the heating of milk to a temperature of 145 degrees Fahrenheit does not materially reduce the nutritive value to the infant.

The foregoing is a full endorsement of the statement in Bulletin No. 56, of the Bureau of Public Health at Washington, in which Professor Kastle states that proper pasteurization does not exert any deleterious influence upon the chemical or nutritive value of milk.

These facts have been demonstrated in many places by actual feeding experiences. One occasionally hears the statement made, even yet, that pasteurized milk produces scurvy or rickets. To this we may say that thousands of children under the supervision of careful and competent observers have been reared successfully on milk so treated without the slightest sign of scurvy or rickets.

Professor Roland Godfrey Freeman of New York demonstrated some years ago that such instances of scurvy and rickets have, in his experience, invariably been traced to mixed feedings and that heated milk has, in his judgment, no bearing on this matter.

However, there are a few physicians even yet who hold the opinion that raw milk has valuable properties that are destroyed by heat, and, therefore, oppose pasteurization. Their objections are antiquated and have long since been disapproved. Of interest in this connection is

a recent publication of the Local Government Board of England on "Public Health and Medical Subjects," in which a summary is given by Dr. E. J. Lane-Clayton: "Of the available data in regard to the value of boiled milk as food for infants and young animals." In this report the following conclusion, which is absolutely in harmony with the data obtainable from both experimental and clinical observations, is presented: "When an animal is fed upon the milk of another species (which is precisely what is done when we feed human babies on cow's milk) such small differences, as have been found in the nutritive value of raw and boiled milk, have been in favor of boiled milk."

These observations have been recently confirmed by investigators in Europe and America, and yet boiling is going considerably further than we deem necessary—the boiling point being 212 degrees and our method of pasteurization being only 145 degrees.

Professor Winslow in 1915, in referring to the objections raised to pasteurized milk, on account of its digestibility having been affected, states: "This seems again to be an absolutely unfounded supposition. Within the last five years the milk supply of New York, Boston and Chicago has been transformed from 90 per cent. raw milk supply to 90 per cent. pasteurized milk, with no recorded increases in nutritional diseases of children. Even if scurvy were caused by pasteurized milk, it could at once be cured by adding orange juice to the diet, but it is not so caused."

In a careful study carried on in Washington 351 babies fed on raw milk gained on an average of .4030 oz. a day, while 557 babies fed on pasteurized milk gained on an average of .4077 oz. One hundred and ten babies were fed for part of the time on pasteurized milk. During the raw milk period they gained on an average of .4312 oz. and during the pasteurized milk period an average of .4607 oz. Some of the leading authorities in England and the United States are now even advocating the use of boiled milk, the digestibility of which one might possibly suspect as being unfavorably affected.

Dr. Charles E. North, Director of the North Public Health Bureau, in a report dated 1912, in referring to the digestibility of pasteurized milk gives the following practical evidence:

"Fortunately New York City has for several years carried out a gigantic experiment in infant feeding at its fifty-five (55) municipal milk depots, where babies are fed the year round, to the number of 18,000 daily in summer and 16,000 daily in winter. For three years all of this milk has been scientifically

pasteurized. Records have shown that the babies have gained weight; have kept well; have shown no signs of rickets or scurvy, and in every way gave evidence that pasteurized milk is not inferior in food value or digestibility to raw milk.

Numerous other instances could be quoted of the unchanged nutritive value of pasteurized milk, but the foregoing are more than sufficient to demonstrate this fact.

OBJECTIONS TO PASTEURIZATION.

(1) It has been claimed that, all the lactic acid bacilli having been destroyed by pasteurization, the milk will not sour but rot. This is incorrect, as has been repeatedly demonstrated by bacteriological tests. Pasteurized milk will keep longer than unpasteurized milk, but when decomposition starts it sours the same as unpasteurized milk—all the lactic acid bacilli *not* having been destroyed.

It is interesting to note what the British Minister of Health has to say in his report, which in substance, is as follows:

“In properly pasteurized milk the lactic acid bacilli which survive, ensure that the milk on being kept will go sour like ordinary milk before pasteurization occurs.”

(2) Some have expressed the fear that pasteurizing will have a tendency to influence people to relax in their efforts to secure an absolutely clean milk. This is another fallacy. No municipality should countenance the pasteurizing of milk of an unknown source or quality. Milk must be up to a certain standard and free from barnyard contamination, as determined by the dirt test, before being accepted as fit for pasteurization. This is the method used in the Department of Public Health in Toronto. In fact I can say, without fear of contradiction, that no city on this continent approaching the size of Toronto has a better organization for safe-guarding its milk supply.

(3) Then we occasionally hear the objection to the taste of pasteurized milk, but we hear this proportionately as frequently about certified milk. The complaint usually is, that none of the milk tastes the same as it used to. This complaint is for the most part well founded, but the change in taste is due to the absence of dissolved cow manure, which for generations—until recent years—has been an almost constant ingredient of market milk.

The following narrative is a practical illustration of how this flavor has become fixed on the human palate. The incident occurred in a dairy in the United States a few years ago, soon after certified milk began to be extensively talked about. The owner of one of the largest herds, in a spirit of profound indignation, called upon one of the firms that dealt in certified milk only, and asked for a glass of this new "fandangled" milk, that they called "certified". After tasting it he smacked his lips and said: "Do you call that milk? That's not cow's milk; you can't fool me." The proprietor, knowing that this man was coming, had prepared for him, and asked him if he would like to try another kind of milk. He replied that he would. The attendant going into an adjoining room returned in a few minutes with another glass of the certified milk taken from the same bottle, but to which he had added two or three drops of liquid cow manure. After tasting this the man smacked his lips and said: "That's milk." It is difficult to get away from the association of this flavor with cow's milk, but once the public know to what this flavor is due they will no longer be desirous of adhering to it.

The other objections that have been raised have all been dealt with in this report, such as "the ill-effects of pasteurization on the chemical composition and digestibility of milk, etc."

ALMOST UNIVERSAL ENDORSATION OF PASTEURIZATION.

The facts presented in this report concerning the dangers of ordinary market milk and the value of pasteurization have been known to all students of the milk problem for several years. It was with a knowledge of the foregoing facts in regard to the dangers of bovine tuberculosis and human tuberculosis being transmitted to children through milk, that the Washington Association for the Prevention of Tuberculosis, at a convention held in 1912, was prompted to pass resolutions endorsing the necessity of the efficient pasteurization of the entire milk supply of municipalities.

It was with a knowledge of these facts that the International Congress of Tuberculosis held in Washington in 1908, unanimously passed a resolution that all milk not coming from herds shown to be free from tuberculosis, should be scientifically pasteurized. The National Association for the Prevention of Tuberculosis, the Canadian Association for the Prevention of Tuberculosis, and the Canadian Medical Association, subsequently passed similar resolutions.

It was a knowledge of the dangers of transmission of tuberculosis, together with the dangers of the transmission of other communicable

diseases and of the dangers of diarrhoeal diseases through raw market milk, that prompted the Committee on Milk Standards, and subsequently, the American Public Health Association and the American Medical Association, as well as the Association of State and Provincial Health Officers, to pass resolutions that all milk not coming from herds free of tuberculosis, as demonstrated by the tuberculin test, and not obtained under conditions corresponding to those required for the production of certified milk, should be scientifically pasteurized before being used for human consumption.

Professor Dean, of the Ontario Agricultural College, says that he regards pasteurization of milk as the greatest possible aid to life saving.

At the International Pure Milk Congress held in Brussels, in 1907, the use of raw milk for infant feeding was officially condemned and pasteurization advocated.

Dr. Amyot, Deputy Minister of Health for the Dominion of Canada, eighteen years ago advocated this method of controlling our milk supply, and still claims that it is the only safe method.

It was with a knowledge of the foregoing facts that the late Dr. Torrance, Veterinary Director General for the Dominion of Canada, unhesitatingly said that all milk not coming from herds shown to be free of tuberculosis by the tuberculin test should be scientifically pasteurized, and that in his judgment it was the only means by which we could efficiently safeguard our milk supplies.

It was with a knowledge of these facts that Dr. H. A. Harding, Professor of Dairy Husbandry of the University of Illinois, in an address before the Industrial Milk Dealers' meeting at Chicago, in October, 1914, said:—"The proper pasteurization of milk is a simple and inexpensive process which leaves no objectionable influence upon the milk, and which takes from the milk not only the danger of transmitting tuberculosis, but also the danger of transmitting all of the long list of other diseases which are frequently transmitted by milk. The requirement of the universal pasteurization of the public milk supply is endorsed by the leading students of milk problems, regardless of whether they approach these problems from the avenues of science or of practice."

It was with a knowledge of these facts that the Minister of Agriculture for France, in 1912, had legislation passed prohibiting the sale of any milk in France that had not been properly pasteurized. The

Minister of Agriculture had behind him in this move a solid block of all the scientific and legislative powers, including Professor Bordeau, of the College of France, Professor Metchnikoff of the Pasteur Institute, the President of France, the Deputies, the Senators, the Ministers, the Pasteur Institute, the College of France and the Medical Faculty.

Denmark, the country that practically leads the world in dairying and in efforts to control tuberculosis amongst cattle and hogs, goes so far as to require that all skimmed milk and buttermilk required for the feeding of animals must be pasteurized, and also all cream used in the manufacture of butter or ice cream.

One of the latest pronouncements on the subject is that of the Hon. J. M. Uhrich, Minister of Public Health, Saskatchewan, who in the course of the budget debate in the legislature of Saskatchewan on January 12th of this year quotes: "I make the claim and I have no hesitation in making it that the pasteurization of 100% of the milk sold in the cities of the Province is a health necessity."

Perhaps the most striking testimony which has ever been given this Dominion in favor of pasteurized milk is that of Dr. E. W. Stapleford, President of Regina College, at a public meeting called by the City Council of Regina a few months ago to hear the views of citizens and persons interested in dairying, previous to its decision being reached as to the passing of a compulsory pasteurization by-law in the City of Regina.

Dr. Stapleford described how the directors of the College in their desire to supply a high grade milk for the resident students arranged to obtain the college milk supply, not from one of the City pasteurizing plants, but from a raw milk dealer who had an excellent farm a few miles outside of the City and who was willing to deliver it daily to the college. The directors of the college were not then educated in the matter of milk pasteurization as they are now and Dr. Stapleford, in appealing to the Council of the City and to the raw milk dealers present at the meeting said: "If you people here tonight had seen nine coffins being carried from Regina College, nine young men and women cut down on the threshold of their lives, and could realize the responsibility which we felt in having permitted the sale of raw milk in the college, you would never wish again to drink an ounce of raw milk." The outbreak of typhoid fever to which Dr. Stapleford referred has been mentioned earlier in this report.

No intelligent stock-raiser or agriculturist thinks of feeding his calves or hogs, milk from cattle that are not known to be free from tuberculosis, without first pasteurizing it. Are not our infants entitled to at least the same consideration?

One of the most valuable advances towards the more general control and safeguarding of the milk supply in the United States and Canada was the appointment of the "Commission on Milk Standards" of which I have the honour to be a member. The appointment of this Commission was the direct result of the observations of the New York Milk Committee, that there was great incompleteness and lack of uniformity in the milk standards, milk ordinances and rules and regulations protecting public milk supplies. There was a need that health officers be furnished conclusions drawn from much experience and matured judgment, and that ordinances should be free from erroneous statements and as uniform as possible.

A special committee of the New York Milk Committee was appointed to consider names of more than 200 men of prominence in medicine, sanitation, public health and laboratory work, particularly those recognized as authorities on the milk question. Since regulations are based on standards and standards are based chiefly on laboratory analyses, the sub-committee selected 20 names of men distinguished for their knowledge of the bacteriological and chemical examination of milk to comprise a committee to formulate standards of milk production and handling which could be incorporated in the regulations of a state, provincial or municipal department of health.

In a report issued by this Commission on Milk Standards, standards were published to govern milk supplies in the various municipalities, permitting of modification to meet local conditions. The one recommendation, however, which was universal was that all milk not coming from tuberculin tested cattle and procured under conditions necessary for the production of certified milk, should be efficiently pasteurized. The majority of the committee were of the opinion that regulations should require that all milk, including the certified milk, be pasteurized, before being used for infant feeding, but inasmuch as it was not unanimous, it was decided to forego the regulation governing the pasteurization of certified milk, leaving this optional.

These standards have been accepted and endorsed by the American Public Health Association, which is representative of the public health administrators throughout Canada, United States, Mexico and Cuba. They have also been approved by the American Medical Association; the Association of State and Provincial Health Officers; the National

Tuberculosis Association; the Canadian National Tuberculosis Association; the Canadian Medical Association; the Canadian Public Health Association; the Provincial Health Officers' Association; the Minister of Health for Canada and the Ministers of Health for the Provinces of the Dominion of Canada, and by all recognized authorities on Public Health administration; so that there is now practically no second intelligent opinion as regards the absolute necessity for municipalities securing a clean milk, free from barnyard contamination, and then making it bacteriologically clean by scientific pasteurization. As already indicated, by "scientific pasteurization" we mean the heating of the milk to a temperature of 145 degrees Fahrenheit, and holding it at that for thirty minutes, and then promptly cooling it to a temperature of 50 degrees Fahrenheit, and holding it at that until delivered to the consumer. This temperature has been demonstrated by all the leading laboratories on this continent, to destroy all disease-producing germs, and practically 99 per cent. of all the other organisms in the milk. The bovine tubercle bacillus is the most resistant of all, but it is destroyed at a temperature of 140 degrees, so that in pasteurization we have an absolute safeguard of our milk supply as delivered to the consumer.

How Can We Guarantee Efficient Scientific Pasteurization?

This has been one of the difficulties that we have had to contend with, and that all other municipalities that were endeavoring to keep close supervision over the various pasteurizing plants for which they were responsible, no doubt have had to contend with. We found on different occasions when fuel was scarce and high in price, that there was a tendency of some of the dairies to cut short the period for holding the milk at a temperature of 145 degrees and in some cases they did not even raise it to 145 degrees, so that we concluded that if we were going to have an absolutely reliable system of pasteurization, we must have it removed from the frailties of human nature. We, therefore, have secured from Cambridge, England, self-recording thermometers. These are owned and controlled by the Department of Public Health and are placed on every pasteurizing plant in the city. Our inspectors carry the key, and therefore, we know that they cannot be tampered with. We can see at a glance whether or not the requirements of the department for pasteurization are being complied with.

This, I feel, is advisable, and in fact, imperative, if a municipality wants to be sure that its milk is at all times rendered safe by the process of pasteurization.

CONTROL PRECEDING PASTEURIZATION.

The only two objections worthy of note, raised as to pasteurization, and these are untenable, are—first—that pasteurization of milk tends to diminish the activities of a municipality to provide a clean milk; second that pasteurization interferes with the nutritive value and digestibility of milk. The first of these objections has I think been thoroughly dealt with by describing how the City of Toronto continues despite compulsory pasteurization to ensure that only clean milk reaches the pasteurizing plant.

It would be difficult to understand any municipality not requiring milk to be absolutely clean and free from barnyard contamination or gross contamination of any kind, before considering it fit for pasteurization.

Since the passing of our Ordinance for the Pasteurization of Milk, we have not relaxed in the slightest degree as regards the safeguarding of our milk supply from the cow to the consumer, our system of inspection consisting of specially trained veterinarians who inspect the dairy farms, and inspectors of the dairies within the city, who have had special training in connection with milk and all dairy products. There are many possibilities for contamination from the cow to the consumer. Therefore, the activities of our inspectors in connection with the dairy farms begin with the cows. A careful examination is made of the animals and all those suffering from any disease are excluded from the herd. We do not require the tuberculin test, inasmuch as the exclusion of all cattle reacting to the tuberculin test from our dairy herds would result in a milk famine, and while the procedure of testing the herds and segregating those that react is essential in the interest of animal industry, it is not essential so far as the safeguarding of the milk is concerned. Our inspectors having satisfied themselves of the healthful condition of the animals, then investigate the environment, the stable, as regards ventilation, proper light and air conditions, degrees of cleanliness surrounding the animals at all times; the careful clipping of the hair from the flanks and udders of the cattle, so that they will not constitute a harbor for impurities picked up when the animal is lying down.

Extreme care must be exercised in regard to milking methods. The milkers are required to wash their hands carefully before milking, wiping off the udders and flanks of the cows with a clean damp cloth, milking into a partially covered pail or one in which the opening is just sufficiently large for them to milk into, the object of this being to safeguard the milk as far as possible from surrounding contamination.

The milk is then required to be immediately transferred from the stable to the milk house, which is specially provided and which must be separate from the stable. Here the milk is strained and promptly cooled, and as far as possible held at a low temperature until delivered to the dairy in the City.

Milking utensils must all be carefully cleansed and sterilized as determined by the regulations of the Department.

The next procedure is that of careful supervision of the milk from the producer to the dairy in the city during the time of transportation. One of the most important advances that we have made which has been in force for the past twelve years, was that of requiring all milk cans to be owned by the dairies in the city. They were required to have proper sterilizing devices installed and it is now possible for our inspectors to see that all these utensils are efficiently washed, sterilized and sealed after the milk is emptied out of them, before being returned to the producers. This seal has to be broken by the producer immediately preceding his straining the milk into the can, and then after it is filled, he is required to seal the can again with his own identification seal.

After the milk reaches the dairy, it comes under the observation of our inspector, who after thoroughly mixing the contents of any can from which he intends to take a sample, draws off one pint for sedimentation test. These samples are forced through discs of absorbent cotton, which show any evidence of barnyard contamination. As is quite obvious, the slightest speck will be revealed. If such evidence is found, the producer is notified that in the event of a second occurrence of this kind he will be prohibited from contributing further to our milk supply.

At the dairies the milk is received into a milk well, where it is weighed after which it is scientifically pasteurized.

As already stated, the process of pasteurization is made absolutely fool proof by the installation of self-recording thermometers which are owned and controlled by the Department of Public Health.

The milk after pasteurization is filled into sterilized bottles, capped by machinery so that the human hand does not touch either the upper part of the bottle, the cap, or in any way come in contact with the milk after it has been pasteurized.

It is then promptly cooled to a temperature of not higher than 50 degrees, and as far as possible held at that until delivered to the consumer.

THE PRODUCER

IS THERE A WEAK LINK IN THE CHAIN?

THE CONSUMER

FARM, MILLERS, ELECTRIC, CANS, COOLING, WATER SUPPLY, TRANSPORT, QUALITY INSPECTION, REPAIRS, EQUIPMENT, FACTORY OPERATOR, DISTRIBUTION, INFORMATION, VALUES

The daily consumption of milk in Toronto at the present time is 256,000 quarts; the number of farms supplying the City, 2,666. The number of dairy cows averages about 32,000. The approximate value of these dairy cows is \$2,879,280.

Respectfully submitted,

Toronto, Canada.