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THE SOLUTION

OF

THE MILK PROBLEM

BY

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THE SUSCEPTIBILITY OF PERSONS TO ATTACKS BY DISEASE
GERMS DIFFERS GREATLY.

THE SUSCEPTIBILITY OF THE SAME PERSON TO DISEASE GERMS
DIFFERS GREATLY FROM TIME TO TIME.

AS THERE IS NO WAY TO MEASURE THE SUSCEPTIBILITY OF
DIFFERENT PERSONS, OR OF THE SAME PERSON AT DIFFERENT TIMES,
IT IS DANGEROUS FOR ANY PERSON TO EXPOSE HIS HEALTH TO
DISEASE GERMS AT ANY TIME.

EXPERIENCE HAS SHOWN THAT INFANTS AND INVALIDS ARE EX-
CEPTIONABLY SUSCEPTIBLE TO THE ATTACKS OF DISEASE GERMS;
HENCE THEY, ABOVE ALL OTHERS, SHOULD HAVE PURE, CLEAN,
GERM-FREE MILK.

1913.

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WASHINGTON.

January 25, 1913.

Dr. G. Lloyd Magruder of Washington, D. C., is peculiarly qualified to write a publication on milk. The people should have pure water and pure milk. Dr. Magruder is identified in the City of Washington with a thorough study of both. He stands high as a medical practitioner and instructor, and whatever he offers to the public is certain to be well worth reading.

JAMES WILSON,
Secretary.



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MILK UNDER THE GUISE OF ITS INNOCENT WHITE COLOR OFTEN HIDES THE PRESENCE OF DANGEROUS GERMS.

Milk must be produced by healthy cows.

Milk must be clean. Germs are few in clean milk.

Milk must be promptly cooled and kept cold. The growth of germs is checked by cold.

Milk must be properly pasteurized, promptly cooled, kept cold and covered until delivered to the consumer.

These conditions secure absolutely safe milk.

These conditions, without pasteurization, secure reasonably safe milk.

Milk delivered in good condition to the consumer soon spoils unless kept covered and cold.

Dirt and germs in milk are danger signals and warnings against raw milk.

Many diseases are caused by bacteria. Bacteria in milk are made harmless by heat.

Water with 2,000 bacteria to the teaspoonful or with colon bacilli is suspicious, and should be boiled before being used for drinking purposes.

Everybody knows that a water supply contaminated with sewage is a danger to Public Health.

Much market milk is more contaminated with germs than the sewage of many large cities.

CONTAMINATED MILK IS MANY TIMES MORE DANGEROUS THAN CONTAMINATED WATER, BECAUSE DISEASE GERMS WHICH WOULD STARVE IN WATER RAPIDLY MULTIPLY IN MILK.

Typhoid Fever is so rare in Munich, a city with a good water supply, well sewered and where all milk is boiled, that medical teachers are hardly able to secure subjects for demonstrating the disease to medical students.

Bacteria are not removed from milk by filtering.

The price of milk to the producer and the distributor should be determined by the cream, solid contents and the purity. The purity is determined by the character and number of bacteria in it.

Excessive numbers of bacteria show that milk is old, dirty, or produced under improper conditions or by unhealthy cows.

Fortunately the public is heeding the teachings of sanitarians and is seeking protection by purchasing milk from producers and dealers who recognize that milk must be free from an excessive number of any bacteria and from all disease-producing germs.

SAFE MILK SAVES BABIES AND DIMINISHES THE PREVALENCE OF TUBERCULOSIS, TYPHOID FEVER, DIPHTHERIA, SEPTIC SORE THROAT AND OTHER DISEASES.

INTRODUCTION.

Today there is not a shade of doubt that impure raw milk and cream are prominent factors in keeping up the prevalence of *Tuberculosis*, *Typhoid Fever*, *Scarlet Fever*, *Diphtheria*, *Infantile Diarrhea* and other diseases and impaired physical conditions that have been positively traced to *Contaminated Milk*.

The continued high mortality of adults and infants from these preventable diseases can be enormously reduced by heeding the teachings of modern sanitarians. This education must commence at the farm, and be continued to and include the consumer. There must be coöperation by every one who handles milk to protect it from contamination. The public must pay for this care. The farmer must give a better product for the increased price that he must receive. *Dirty* milk should not be bought at any price.

It is the object of this booklet to show the farmer and the consumer *why safe milk is necessary* and *how it can be secured*.

During the last few months the subject of the Dangers from Contaminated Milk and the Methods of Prevention have attracted unusual attention from physicians and others interested in the conservation of the public health. It is now generally conceded that *clean, cold* and *properly pasteurized milk* is one of the important means, if not the most important factor in *reducing disease and death*. These conditions furnish *safe milk* for everyone. It is the easy and safe SOLUTION of the MILK PROBLEM.

To secure this much-desired *safe milk* vigilance is required from the farm to the consumer. Fortunately, these requirements are simple and can be complied with at small additional expenditure of time and money. Circulars 131 and 170, Bureau of Animal Industry, Department of Agriculture, positively confirm this statement. Both time and money are necessary and must be supplied. The addition of one or two cents a quart should furnish every safeguard. Milk at nine cents a quart should come from herds that do not show any physical signs of disease upon careful and frequent inspection, and it should be *clean, cold* and *properly Pasteurized*. Milk at 10 cents a quart should insure the additional safeguard of being furnished from tuberculin-tested cows, and being properly capped to protect against dust.

The farmer should receive a due proportion of this increase in price. No safe milk can be produced under the conditions and at the prices that prevailed previous to 1907, the date that the Washington Milk Conference demanded better conditions and recommended the advances in the price of milk. Since then it has been repeatedly shown that the additional price of one cent per quart to the farmer will secure high-grade milk with very low germ contents.

Encouraged by the reception of my writings and addresses, the results of my former efforts in behalf of pure water and pure milk, and the influence for good of the work done here in Washington by persons in



official and private life, it seems that the time is opportune for presenting in everyday language the facts in regard to milk, that the dangers may be understood and the remedial measures may be applied.

This is desirable because even yet, notwithstanding the indisputable evidence that has been presented, there are many persons of intelligence who seem to ignore these dangers and still use and permit those under their charge to use poisonous milk. This is notable in schools, hospitals, infant asylums and hotels and other eating places.

Many publications relating to milk have been issued by the Government. They can be secured from the Government Departments, Members of Congress and the Superintendent of Documents, Government Printing Office, Washington, D. C. These publications have been prepared by persons in public and private life, sometimes as monographs and sometimes by conjoint work. They have had a world-wide influence for good. They frequently have served as the basis for national, state and municipal authorities in framing legislation and regulations for the proper production and distribution of milk and dairy products. They are repeatedly quoted by writers in this country and abroad, and have furnished most valuable data for them.

SOME GOVERNMENT PUBLICATIONS IN REGARD TO MILK.

Six of the most important of these publications, with the issue of which I was intimately associated, are:

1. "Report on Typhoid Fever in the District of Columbia," submitted by the Medical Society of the District of Columbia to the Committee on the District of Columbia of the United States House of Representatives, June 14, 1894, and published by Congress as a congressional document in 1894. This report was prepared by a committee, appointed upon my motion, and of which I was chairman.

The conclusions and recommendations of the Committee of 1894 are accepted as authoritative today.

Recommendations 9 and 10 attracted much attention.

Recommendation 9:

"Careful inspection of all dairies in the District from which our milk supply is drawn, and the enactment of a law by which no milk shall be sold in the District without a permit from the Health Office. The inspection should cover an examination at the dairies of all possible sources of infection, including the water supply."

Recommendation 10:

"The urging on the members of the profession of a careful collation of all facts bearing on the mode of infection in each case, and the advantage of reporting such facts to the Society, and the propagation of the doctrine that immediate disinfection of the stools is the first duty of the physician as guardian of the health of the community."

The results of this report were that the District Commissioners and Congress sought the aid of the Medical Society and individual members in framing the law governing the milk supply of the District.

The present attention given the pollution of water by sewage, and the contamination of oysters, thereby accentuates the Committee's recom-

mendation to promptly and thoroughly disinfect the discharges from typhoid-fever patients.

2. "Sanitary Milk Production." Report of a Conference appointed by the Commissioners of the District of Columbia. Issued August 20th, 1907, by the U. S. Dept. of Agriculture, as Circular 114, Bureau of Animal Industry. This Conference was called upon the suggestion of Mr. E. Berliner and with my coöperation. The report was published, at my request, by the Department of Agriculture.

This circular contains the Melvin Classification for Milk, and is frequently quoted, and has time and again served as the basis of State and municipal regulation and legislation. The *London Lancet*, 1907, Vol. II, No. 13, says (alluding to Circular 114) :

"This volume will be the recognized text-book of the health authorities of this country for the present. * * *"

3. "Milk and its Relation to Public Health." Issued Jan., 1908, by the Treasury Department, as Bulletin 41, of the Hygienic Laboratory of the Bureau of Public Health (revised Jan., 1910, as Bulletin 56).

This publication is the direct result of my personal appeal to Theodore Roosevelt, then President of the United States. It is looked upon as the most complete work ever published on milk. The *New York Medical Record* considers Bulletin 56 as the most valuable work ever issued by the Government on health matters. It was the conjoint work of the Bureau of Public Health, the Department of Agriculture and the Health Officer of the City. It shows the great value of coöperative work.

In June, 1909, the Secretary-General of the International Institute of Hygiene told me, in Paris, that "this Bulletin was the best book in the world upon milk." The Countess of Aberdeen, during her recent visit, stated to me that "Sir William Osler had informed her that Bulletin 56 would give her all needed information upon the milk problem."

4. "The Dissemination of Disease by Dairy Products and Methods of Prevention." Issued April 28th, 1910, as Circular 153, Bureau of Animal Industry, Department of Agriculture. This publication is the amplification of the paper which I presented at the International Medical Congress at Budapest in 1909.

This circular has also been highly esteemed and has helped to secure appropriate legislation governing the milk supply. The *London Lancet*, June 25th, 1910, pp. 1768, 1769, in an editorial upon Circular 153, says :

"The Circulars of the Department of Agriculture have one special feature in common apart from their high scientific value, and that is their clearness. * * * This report is of particular interest in that it shows how strong is the feeling in scientific circles in America as to the danger of contracting tuberculosis from milk."

5. "Report of the Commission on Milk Standards appointed by the New York Milk Committee." Reprint from Public Health Reports. Issued May 10th, 1912.

This Commission was appointed as the result of a motion submitted by Dr. E. C. Schroeder, Mr. E. Berliner and myself, at the Conference in New York called by the New York Milk Committee December, 1910. This report shows that the Commission amplified the Melvin Classification adopted by the Washington Milk Conference in 1907. A majority

of the Commission was in favor of pasteurization of the entire milk supply. This Commission was composed of some of the most prominent sanitarians of this country.

6. "Report of A Special Committee appointed by the Washington Chamber of Commerce to investigate the Milk Situation in the District of Columbia." Senate Document No. 863, 61st Congress, 3d session. This is a most valuable work and is full of authoritative information.

The last five publications, all issued during and since 1907, give an idea of some of the health activities of the United States Government in relation to the milk supply. They show the promptness and readiness of the officials of the Department of Agriculture and the Bureau of Public Health to cooperate for the public welfare. Millions of copies of these and other most valuable Bulletins and Circulars of great educational value towards controlling and eradicating preventable diseases and conserving the purity and abundance of food supplies have been prepared and issued by officials of these two Departments, as well as other Departments of the Government.

FREE USE OF SAFE MILK ADVOCATED.

All the warnings as to the necessity of care in the use of ordinary market milk have been fully justified and the use of it was properly restricted. Now, if the teachings of today are heeded, unlimited use of it can be resumed with mutual advantage to the producer, distributor and the consumer. The farmer and the distributor must be paid for their efforts to comply with modern requirements. The consumer will receive safe milk for his additional outlay. The additional outlay by consumers will be much less than the cost of sickness and funerals caused by unsafe milk.

MILK AS FOOD.

MILK AND ITS PRODUCTS—cream, ice-cream, butter, buttermilk and cheese—are among the most important articles used for human food. They furnish quite one-sixth of the food used by mankind. The products are liable to the same risks of contamination as milk itself, hence are equally dangerous when contaminated.

Milk is the most generally employed article of diet for infants and children. It is extensively used in homes and hospitals as a part or the whole of the diet for the well and the sick.

CONSTITUENTS OF MILK.

MILK FURNISHES THE ELEMENTS essential to the sustaining of life and the growth of the body. These ingredients are the protein compounds, fats, carbo-hydrates and mineral matters.

PROTEIN COMPOUNDS are the albuminous contents—casein or curd, lactalbumin and lactoglobulin. They correspond to the lean of meat and the white of eggs. They make muscle, bone and blood.

THE FAT, after standing, rises to the surface and is known as cream. This corresponds to the fat of meat and oil. It yields heat and muscular power.

THE CARBO-HYDRATE is present in the form of milk sugar. It corresponds to the starch of cereals, and, like the fat, yields heat and muscular power.

THE MINERAL MATTER is composed of combinations of lime, potash, sodium and other chemical elements, which are essential for the building of the human body.

CARRIER OF DISEASE.

For years physicians and others interested in the public health have demonstrated that this beneficent fluid also was a carrier of disease. Repeated appeals were made to national, State and municipal authorities to remedy this condition.

As early as 1873 Congress was urged by the authorities of the District of Columbia to provide for inspection to improve the milk supply of the city. These appeals to the authorities apparently fell upon deaf ears until the summer of 1894. It is true, the year before, 1893, Dr. Coit, of Newark, N. J., did succeed, after repeated efforts for several years preceding, in inducing the State Medical Society of New Jersey to appoint the Essex County Medical Milk Commission. This Commission arranged with the proprietor of a dairy to produce milk according to the requirements and under the supervision of the Commission. This milk was known as "Certified Milk."

Milk commissions are voluntary associations formed for the purpose of securing better milk for infants and invalids. There are now in the United States 72 milk commissions. The requirements for certified milk are ideal. Constant vigilance by the highest grade of intelligent employees is essential to carry out these requirements. This vigilance is not obtainable for lengthy periods. With all precautions exercised, there are frequent reports of contaminated milk being served by certified dairies.

This is true to so great an extent that many prominent members of the Association of the American Medical Milk Commissions, who formerly believed that raw milk was a much better food for infants and invalids than pasteurized or boiled milk, now openly admit that no milk is safe for use until after it has been exposed to a sufficient degree of heat to kill disease germs.

The influence of medical milk commissions in securing an improvement in the general milk supply has been very great, exceptionally so since the organization in 1907 of the Association of American Medical Milk Commissions. Unfortunately the requirements for producing certified milk are so exacting that the cost of the product is beyond the means of the masses.

THE MILK LAW OF 1895.

The first important step in the legal control of the milk supply was initiated in Washington in 1894. It required the occurrence of cholera in Hamburg and its appearance upon a ship from that port in the harbor of New York to arouse the attention of Congress to the dangers lurking in milk. This resulted in the passing of the law, approved March 2d, 1895, which provided that no milk should be sold in Washington without

a permit from the Health Officer; and that such a permit should not be issued until after an inspection of the conditions at the farm, including the water supply. These requirements were those suggested in Recommendation 9 of the report made the year before by the Committee of the Medical Society upon the Causes and Prevalence of Typhoid Fever. This law gave Washington the honor of being the first city in the country, if not in the world, to have legal requirements for its milk supply.

WHY SAFE MILK IS NECESSARY.

Chemical examinations and bedside observations had shown, time and again, that milk was the cause of serious outbreaks of a number of diseases and the increased death rate therefrom. It was also shown that malnutrition, disease and death also resulted from much of the milk used for infant feeding.

RESULTS OF BACTERIOLOGICAL INVESTIGATIONS OF MILK.

To bacteriology, which by this time had made great progress, the world is indebted for the positive knowledge of the causes of many diseases. Bacteriology has shown that these diseases are the direct result of specific bacteria. Bacteria grow with amazing rapidity in milk, since milk furnishes the most favorable conditions required for their growth. *Bacteria are commonly known as germs.* They belong to the vegetable kingdom. In fact, they are minute plants which cannot be seen without the aid of a powerful microscope. They appear in nature in three forms, the spherical, the rod-like and the spiral. The spherical are commonly known as cocci, these include the streptococcus, the staphylococcus and other cocci. The rod-like group are called bacilli, and include the typhoid, tubercule, colon and diphtheria bacillus. The spiral group are called spirilla and spirochaeta.

Bacteria, like visible plants, may be harmless or deadly. We have the harmless and nutritious mushroom and the deadly toadstool. We have the harmless and valuable nitrogen-producing bacteria which contribute so much to the growth of plants and the deadly germs of tuberculosis and typhoid fever.

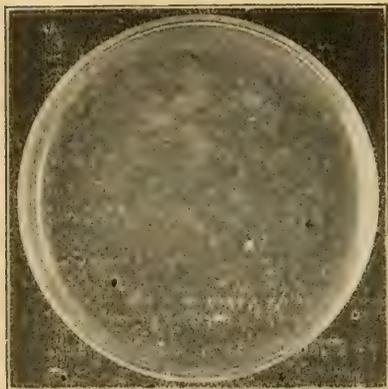
GROWTH OF BACTERIA.

Under favorable conditions *bacteria attain maturity within an hour. Milk is an ideal medium for their growth.* Their multiplication is accomplished by the simple process of transverse division, that is one bacterium becomes two, two become four, four become eight, and so on indefinitely.

Bacteria do not grow rapidly in pure water, but they do survive in it for various periods and promptly grow when subjected to favorable conditions.

IN RAW MARKET MILK as many as one billion and a quarter germs have been found in a single teaspoonful. The sample was taken from a wagon on a regular round in the summer-time. In a level teaspoonful of ice cream over two billion germs have been found. Imagine the possible result if many of these had been disease-producing bacteria!

Below 50 degrees F. the growth of many bacteria is checked, but they survive even below the freezing point. Above 50 degrees F. they begin to multiply and multiply with marked rapidity as the warmth increases. When the temperature increases above 100 degrees F. the various



Culture plate from milk carefully drawn from washed cow, handled in a sanitary manner and kept at 50° F. Only a single colony, and but 500 bacteria per cubic centimeter.



Culture plate showing bacteria in milk not cooled, kept at 60° F. for twenty-four hours. Numerous colonies; 2,800,000 bacteria per cubic centimeter.

varieties begin to die. As the result of investigations by men of the highest authority the world over, it has been found that all disease-producing germs commonly present in milk, technically called pathogenic, are killed at a temperature of 140 degrees F. maintained for twenty minutes. *This degree of heat and time of exposure do not in any way destroy either the chemical or nutritive properties of milk, nor do they alter the taste, nor do they destroy the cream line. There is no perceptible alteration in the milk.*

OFFICIAL INVESTIGATION OF THE EFFECTS OF COLD AND HEAT UPON MILK.

The Department of Agriculture is at present conducting an investigation into the effects of temperature, from the freezing point and below to the boiling point, as to the chemical and nutritive properties of milk. The report of this investigation will be of great value. German authorities have claimed that no ill effects have resulted from freezing milk. Information available in the Bureau of Animal Industry confirms the claims of the German authorities and of the above facts as to the influence of heat at 140 degrees F. for 20 minutes.

SOURCES OF BACTERIA IN MILK.

Men of high authority on the properties of milk maintain that milk may be free from bacteria when secreted from the healthy cow. Milk is rarely, however, found free from bacteria. Disease or injury to the

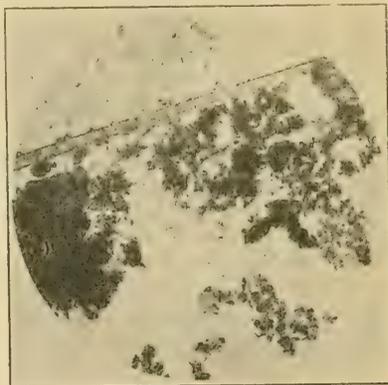
udder or bag of the cow is accompanied with the presence of bacteria. Some diseases of cows are accompanied with the discharge of germs in the milk. Bacteria even penetrate into the small openings of the cow's teat, but do not extend very far into the udder. The possible danger of contamination from this source can easily be largely averted by not collecting the first few streams of milk, which is known as fore milk.

The contamination of milk occurs from many outside sources: dirt and dust in the air of the stables, dirt and dust from the body of the cow falling into the milk pail, and dirt from the clothing and hands of the milkers.

This dirt and dust convey many bacteria: the dirt from the body of the cow is exceptionally dangerous, as much of it is cow manure, and the dirt from contaminated pools in the barnyards and pastures, which convey to the milk the colon and streptococci germs. The colon bacilli invariably comes from the intestinal canal of man or beast. Their pres-



Dirty sediment in bottom of bottle of milk.



Milk sediment magnified. This sediment consists of cow dung, hair, bacteria, etc.

ence indicate contamination with fecal discharges. Recent studies have demonstrated the existence of virulent bacteria stored under the fingernails of persons handling food products. Keeping the nails short, and careful washing of the hands with the nail brush before milking, will eradicate this source of infection. Flies are a common source of contamination. From the habits of the fly this source of contamination is most dangerous. Screens should be used to prevent access to privies and thence to milk houses.

THE PAILS, CANS AND BOTTLES used in the process of preparing and distributing milk are a constant source of contamination. Unless, before being used and being filled, these are scrupulously cleaned with boiling water, a potent source of contamination is furnished. *Cold water* should never be used in the final cleansing of milk utensils. A visit to the average distributing depot or dairy will show that here, too, are manifold and prolific sources of milk contamination.

BACCILLUS CARRIERS.

Bacteriology has shown within the last few years that persons frequently carry in their systems germs of the disease for years after having recovered from a germ disease. Cases are on record of severe outbreaks of typhoid fever being traced to handlers of milk who had had the disease many years before. Such persons are known as "Bacillus Carriers." It is also true that many persons have been known to harbor virulent bacteria of diseases, such as diphtheria, pneumonia and others, without ever having suffered with the disease themselves. Fortunately, the human system is endowed with powerful resistance to the attacks of harmful bacteria. *It is when this resisting power is low that direful results ensue.*

THE WATER SUPPLY OF DAIRY FARMS.

In the fall of 1906, at my request, bacteriological investigations, the first extended series of their kind on record, were made of the water supplies of 60 dairy farms, taken, without selection, in Maryland, Virginia and the District of Columbia, by the Department of Agriculture. The revelations of contamination were startling. In the winter and spring of 1907 290 more water supplies were examined with equally astounding results. The bacteriological examinations of the water supplies of the first 60 dairy farms showed that only 25 per cent. were under the danger line—that is, if we take 500 bacteria to the cubic centimeter (15 drops) of water as the limit of safety, 30 per cent. were suspicious, having above 500 bacteria to the cubic centimeter, and 45 per cent. were unfit for use, as they showed the presence of sewage bacteria. The bacteria counts in some instances were as high as 27,000, though they were made in November and December—that is, in comparatively cold weather.

Since these bacteriological examinations were made similar examinations have followed in other cities, with almost identical results.

No community would permit the use for any extended period of a contaminated water supply. Every careful householder should boil the water until remedial measures were furnished. *Millions have been spent to purify water supplies of cities. Why should not the same concern be exercised in regard to a contaminated milk supply? The dangers are far greater.*

In the Report of the Secretary of Agriculture for 1912, on page 139, it is stated: "*Simple directions for the improvement of farm-water supplies have been formulated.*" This is a most important and valuable announcement.

DISEASES PRODUCED BY CONTAMINATED MILK.

It has been found that a number of diseases, namely, *Tuberculosis, Typhoid Fever, Septic Sore Throat, Diphtheria, Scarlet Fever and Intestinal Disorders of Infants*, have been positively traced to the germs found in milk. Some of these have been derived from the cow, others have found their way into milk through human agencies. It will suffice to consider some of these germ-produced diseases.

TUBERCULOSIS.

TUBERCULOSIS is the one disease the germs of which enter milk almost exclusively from the cow. Upon rare occasions the germ enters the milk from the coughing, sneezing or carelessness of a milker affected with the disease. Tubercle bacilli are secreted in the milk when there is tuberculous disease of the udder. Frequently milk is found contaminated with tubercle germs for some time before the disease is detected in the cow from which the milk was obtained. The commonest source of contamination is in the discharge from the bowels of cows affected with the disease. This cow dung falls into the pail from the flanks, udder and tail of the cow at the time of milking. They do not multiply in milk, but they do survive and do grow when subjected to favorable conditions. Neither the processes of making ice cream nor butter destroy them. Schroeder found them virulent for guinea pigs in butter made from contaminated cream, which butter had been kept in storage for 161 days. Three out of four hogs, weighing over 150 pounds, fed two ounces of butter per day for thirty days, were found to have contracted tuberculosis. Butter from raw cream is often contaminated with tubercle germs. Cream is found to have many more germs than milk, since the germs adhere to the fat globules and rise to the surface with them. The Department of Agriculture found tubercle germs in the refuse from the separators in 33 per cent. of the creameries examined. This startling revelation warns that skimmed milk should not be used for man nor beast in a raw state. Tubercle bacilli are frequently found in market milk. The Bureau of Animal Industry has shown that from five to twenty-five per cent. of dairy cows responded to the tuberculin test. Tests made in 1907 of a large proportion of the herds supplying milk to Washington showed that 17 per cent. of the cows reacted.

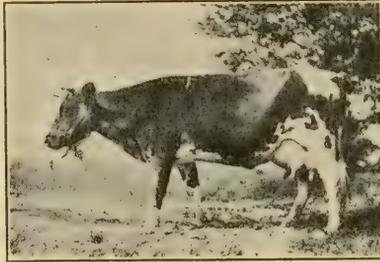
To Robert Koch we are indebted for the discovery that the Great White Plague, in its various manifestations in man and beast, is due to a germ known as the tubercle bacillus. For years he maintained that the germs for man and beast were identical. In 1901 he promulgated his opinion that the bovine tubercle bacillus was harmless to man. At once this statement aroused great interest. Numerous investigators gave much study to the question. Now it is almost unanimously maintained that this opinion, announced by Koch in London in 1901, and reiterated at the International Congress on Tuberculosis in Washington in 1908, was wrong.

The work of Schroeder and Cotton on this subject attracted universal attention. (See Bulletin 99, May 11th, 1907, and Circular 118, Dec. 21st, 1907, Bureau of Animal Industry, Department of Agriculture.) They demonstrated that tuberculous cattle discharged tubercle germs from their bowels; that these germs have their origin principally in the lungs, are coughed up, swallowed and then discharged in still virulent form with the feces. They also demonstrated that "The cattle that pass tubercle bacilli per rectum are not always visibly diseased. Many apparently healthy but tuberculous cattle which are not known to be tuberculous until they are tested with tuberculin, intermittently pass tubercle bacilli from their bodies per rectum with their feces."

Some of these cows were affected with tuberculosis of the udder and secreted tubercle bacilli in their milk. Several hundred guinea pigs were inoculated with this milk in a raw state. Every one of them showed general tuberculosis. Over 200 guinea pigs were injected with milk from the same cows after it was pasteurized for 20 minutes at 140 degrees F. Not one of these showed any signs of tuberculosis.

The investigations made relative to the use of pasteurized milk from tuberculous cows and from cows actually affected with udder tuberculosis, prove that it has no objectionable influence on the body and that it does not injure the health in any determinable way.

The safety secured by pasteurizing the milk is a very important fact from an economic standpoint. The milk of every one of these apparently healthy cows could be used with absolute safety in the raising of children, calves and hogs, and for household purposes after being brought to and held at the proper heat for the destruction of the tubercle germ. No



An apparently healthy but dangerously tuberculous cow. Her milk, after it has been properly pasteurized, is safe. Hence it is not necessary to kill her.

complicated apparatus is necessary to accomplish this much-desired result. What a boon to mankind if this fact would be accepted and applied! The farmer, in time, would thus secure a healthy herd and healthy hogs. His resources would be promptly augmented. There would be less destruction of live stock and condemnation of food products derived from this source. The experiments and conclusions derived therefrom by Schroeder and Cotton have been repeatedly confirmed. *“The practicability of eradicating bovine tuberculosis and of building up herds of sound animals from the progeny of tuberculous cattle was demonstrated at the Ohio Experiment Station of the Department of Agriculture. (Report of Secretary of Agriculture, 1912, page 99.)*

The British Royal Commission to inquire into the relation of human and animal tuberculosis confirmed the experiments of Schroeder and Cotton in every particular, and so reported in January, 1909, in its “Third Interim Report.” Their report was based on the information obtained from these repeated experiments.

Influenced by this report the Board of Agriculture and Fisheries of Great Britain issued in May, 1909, “The Tuberculosis Order of 1909.” This order provided that after January 1, 1910, milk sold in Great Britain should come from *tuberculin-tested cows, or should be sterilized.* These two paragraphs from this order are very positive:

"As your local authority are doubtless aware, the subject of tuberculosis in man and in animals, and the relations between the disease in human beings and in animals, has been under careful investigation during recent years in this country and abroad, and various phases of the question have been inquired into by successive royal commissions. So far as regards the possibility of the transmission of the disease from affected bovine animals to man, the board are satisfied that it must now be accepted as a fact that tuberculosis is transmissible by the agency of milk used for human consumption. The Local Government Board concur in this view, and a bill was introduced in the House of Commons by the President of the Local Government Board on the 25th inst. designed, *inter alia*, to afford protection to the public health from the risk of the spread of tuberculosis by the means of milk used for human consumption.

"In considering the question in relation to animals, the fact that the disease is communicable to man by milk has a material bearing on the measures to be adopted. Any action which results in the reduction in the number of tuberculous bovine animals in the country must reduce the risk of the spread of tuberculosis amongst the community, and if it were possible to *eradicate from this country the disease in animals, a material step forward would have been taken in the campaign against the disease in man.*"

The position of the British Royal Commission as to the material benefit to mankind of the control of the tubercle germs in milk is sustained and strengthened by the data taken from a publication of the Research Laboratory of New York City, based on 1,220 cases of tuberculosis examined by Park and Krumweide.

The following table graphically shows the data:

PERCENTAGE FREQUENCY OF TUBERCULOSIS CAUSED BY INFECTION WITH TUBERCLE BACILLI FROM TUBERCULOUS COWS.

Diagnosis.	Adults 16 years and over.	Children 5 to 16 years.	Children under 5 years.
	<i>per cent.</i>	<i>per cent.</i>	<i>per cent.</i>
Pulmonary tuberculosis,	0.0	0.0	4.1
Tuberculosis adenitis, cervical,	3.6	36.0	58.0
Abdominal tuberculosis,	22.0	46.0	59.0
Generalized tuberculosis,	2.7	40.0	23.0
Tubercular meningitis (with or without generalized lesions),	0.0	0.0	13.6
Tuberculosis of bones and joints, . . .	3.5	7.3	0.0

Reliable evidence has shown that more than 25 per cent. of all cases of tuberculosis in children under 16 years of age are of bovine origin, and 12½ per cent. of fatal cases of tuberculosis among children under five years of age are due to bovine tubercle bacilli. These facts have so impressed the authorities of France that it has been recommended, with a view of saving the infants of France from tuberculosis and diarrhoeal diseases, that all milk be heated to 176 degrees F. Disease germs in milk heated to 176 degrees F., even for a few minutes, will be killed.

There are the disadvantages that at this temperature the cream line is destroyed and the milk acquires a cooked taste. The available evidence gives us no reason to believe that these changes are accompanied by a lessening of the food value or the digestibility of the milk. This temperature of 176 degrees F. has been selected because it is known to be beyond the death point of disease-producing germs, and a test is available to ascertain promptly whether such a temperature has been used with the milk. The test is derived from the fact that the chemical Paraphenylenediamine (for short, called the Para Test) immediately changes the color of the milk to blue, if it has not been heated beyond 175 degrees F.

The Washington Association for the Prevention of Tuberculosis gave especial attention to milk as an important phase of the tuberculosis situation at two meetings in 1912. Strong resolutions positively endorsing the necessity of the *pasteurization of the entire milk supply* by the holding process were adopted. Amongst others, the following persons discussed and voted for the resolutions:

- George M. Sternberg, Surgeon General, U. S. A., Retired;
- Dr. Harvey W. Wiley, Chemist and Chief Bureau of Chemistry, U. S. Department of Agriculture;
- Dr. E. C. Schroeder, Superintendent Experiment Station, Bureau of Animal Industry;
- Dr. R. W. Hickman, Chief of Quarantine Division, Bureau of Animal Industry;
- Dr. George M. Kober, Professor of Hygiene and Dean of Georgetown University Medical School;
- Mrs. John McLaughlin;
- Dr. Jesse Ramsburgh;
- Dr. A. D. Melvin, Chief of Bureau of Animal Industry, U. S. Department of Agriculture;
- Dr. John R. Mohler, Chief of Pathological Division, Bureau of Animal Industry;
- Dr. Wm. C. Woodward, Health Officer, District of Columbia;
- Dr. G. Lloyd Magruder, Emeritus Professor of Materia Medica and Therapeutics, Georgetown University;
- Dr. Wm. C. Gwynn;
- Mr. Emile Berliner, and other prominent sanitarians.

In face of this mass of most authoritative evidence in England, France and this country, should not the recommendations as to pasteurization at once be heeded and steps taken to eliminate the dangers so imminent in milk?

In the year 1912, according to the estimates of the National Association for the Study and Prevention of Tuberculosis, nearly nineteen million dollars (\$19,000,000.00) were spent for the support of patients in sanatoria and hospitals. Spend more money to enable health officers to secure competent employees to disseminate the importance of safe milk throughout the land, and the funds necessary for hospitals, asylums and sanatoria, will be decreased rapidly in much greater proportion than the

initial outlay to add to the efficiency of the efforts of health officers. A great step will be made towards eradicating the *Great White Plague*, which is universally held to be a preventable disease.

SEPTIC SORE THROAT.

In the last three or four years Bacteriology has added important additional data to the dangers from contaminated milk.

Repeated outbreaks of virulent sore throat accompanied with high mortality have been traced to the presence in milk of a streptococcus. This streptococcus may get into the milk from a human source or from the presence of streptococci in diseased udders.

The occurrence of over 600 cases of sore throat in Stockholm in the year 1908, was traced to a streptococcus abscess in the udder of a cow in a herd that furnished milk to those who became infected. The characteristics of the two streptococci were identical.

Since this outbreak in Stockholm careful study has been made of a number of such outbreaks in Chicago, Boston and Baltimore. Uniformly has the cause been traced to the presence of a streptococcus. It has been found that the disease does not stop at the throat.

Serious diseases of other parts of the body, as the heart, the brain and the joints, have been traced as resulting from the throat infection.

Most exhaustive study was given to the outbreak in Boston in May, 1911.

Sedgwick, Winslow, Rosenau, Prescott and many others took part in the investigations. The investigation by Winslow was most thorough. He found the cause to be a streptococcus, and traced the origin to the most carefully conducted dairy in Boston. There were cases of sore throat in a family on one of the farms that supplied milk to the dairy and also in a family of one of the employees at the dairy.

These outbreaks of septic sore throat furnish a most powerful argument for the pasteurization of the entire milk supply. It is reported that now all milk furnished by this dairy in Boston is properly pasteurized in the final container.

The Baltimore epidemic was studied by Dr. Frost, of the Bureau of Public Health. He found that this outbreak was also due to a streptococcus, which survived flash pasteurization. The outbreak ceased as soon as proper pasteurization was installed at the dairy plant.

Much study is now being given to the significance of streptococci in milk.

TYPHOID FEVER.

Germ of typhoid fever grow with amazing rapidity in milk and soon increases the danger arising from this infection of milk. A few germs will soon multiply to such an extent that the whole supply with which it comes in contact will be contaminated. Mohler and Washburn found that the typhoid bacillus survived 21 days in milk kept sweet and 151 days in butter kept in cold storage.

This draws attention to the fact that the variety of germs in milk is more to be considered than the actual numbers.

Typhoid germs enter milk entirely from sources outside of the cow. The cow's flank and udder may become infected from the cow having waded in streams polluted with the discharges from fever patients. The washing with cold water of the utensils used in the handling of milk is a prolific source of the germs. The fact that typhoid fever is eminently a rural disease, occurring two and a-half times more frequently in the country than in cities, and the known contamination of the water supplies of farms, point to the necessity of exercising great care to avoid these sources of danger.

In two counties in Maryland, large milk producing counties for Baltimore and Washington, there were 33 deaths from typhoid fever in the year 1905. Counting 10 cases to a death, there were 330 cases of typhoid fever in these counties—a serious menace to these two cities.

Everyone is familiar with the common custom, in the country, of throwing the discharges of the sick, without proper disinfection, upon exposed places, from which they may be washed into the nearby water supplies, or permit flies easy access thereto, which carry the germs to and infect the pails of milk.

The milkers and handlers of milk also infect the milk. They frequently have the disease for days before being compelled to take to bed. Typhoid fever is a disease that is especially spread by germ or bacillus carriers. In the fall of 1908 over 50 cases of typhoid fever in Washington, D. C., were traced to the supply of milk from a single farm. The owner was a bacillus carrier. The supply of milk from this farm was stopped.

Many reports of outbreaks due to this case have been made in this country and Europe, and are being made with increased frequency.

The contention for pure water, pure milk, and the avoidance of contact, outlined in 1894, as preventive measures against typhoid fever, is further sustained in Bull. 44 of the United States Public Health Service, as follows:

“Thus far our studies indicate that typhoid fever will cease to be a problem in any community having clean water, an uninfected milk supply, and in which cases of the disease are treated as dangerous and contagious.

“In drawing up the conclusions and recommendations of this report, we have had the benefit of consultation with the advisory board of the hygienic laboratory, composed of eminent scientists and sanitarians.”

ADVISORY BOARD.

Prof. William H. Welch, Johns Hopkins University, Baltimore, Md.; Prof. Simon Flexner, Rockefeller Institute for Medical Research, New York; Prof. Victor C. Vaughan, University of Michigan, Ann Arbor, Mich.; Prof. William T. Sedgwick, Massachusetts Institute of Technology, Boston, Mass., and Prof. Frank F. Westbrook, University of Minneapolis, Minn.; Lieut. Col. Walter D. McCaw, Surgeon, U. S. Army; Medical Inspector E. R. Stitt, U. S. Navy; Dr. A. D. Melvin, Chief of U. S. Bureau of Animal Industry, and John F. Anderson, U. S. Public Health Service, *ex-officio*.

EPIDEMICS TRACED TO THE MILK SUPPLY.

In May, 1901, Dr. George M. Kober reported a series of 195 epidemics of typhoid fever. In 148 of the 195 epidemics of typhoid fever there is evidence of the disease existing at the farm. At the same time he reported 136 outbreaks of scarlet fever and diphtheria.

Kober says:

"It is interesting to note that of the 330 epidemics analyzed by me 243 have been recorded by English authors, 52 by American, 14 by German, 11 by Scandinavian, and 5 each by French and Austrian writers. This is probably due to the fact that the English and Americans usually consume raw milk, while on the Continent the milk is rarely used without being boiled."

Surgeon Trask, of the United States Public Health and Marine Hospital Service, in Bulletin 56, has added a large number of similar outbreaks to Dr. Kober's list.

Edward O. Jordan, of Chicago, in an address before Section VI, International Congress on Hygiene and Demography, in September, 1912, has added a large number of similar outbreaks.

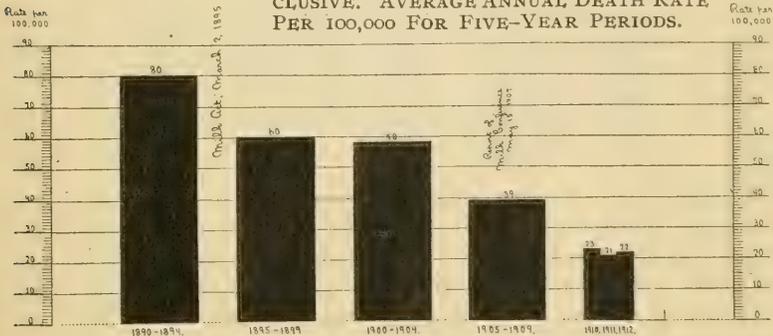
In an interview with Mr. E. Berliner, of Washington, Dr. Heineman, the Health Officer of Cassel, Germany, reported the occurrence of over 300 cases of typhoid fever in the summer of 1909, as the result of the use of contaminated raw milk.

Boston had an outbreak of 1,000 cases of typhoid fever in 1908 from a single source of contaminated raw milk.

In the summer of 1910 nearly 500 cases occurred in Budapest, Hungary. These were traced to infected raw milk.

In 1890 there occurred in City of Washington 135 deaths per 100,000 of population from typhoid, so-called typho-malarial and malarial fever combined. It is safe to say that these deaths were nearly all from typhoid fever. The population then was nearly 300,000. Assuming the usual proportions of 10 cases to one death, there were nearly 4,000 cases in Washington in 1890. In 1912, with a population of 354,000, there were but 585 cases with 78 deaths, giving a ratio of 22 per 100,000 of population. The diagram prepared for me by the courtesy of Dr.

MORTALITY FROM TYPHOID FEVER IN THE DISTRICT OF COLUMBIA, 1890 TO 1912, INCLUSIVE. AVERAGE ANNUAL DEATH RATE PER 100,000 FOR FIVE-YEAR PERIODS.



Woodward, the Health Officer of the District of Columbia, graphically shows the data in regard to this disease. It is interesting to note the decrease in mortality after the passage of the Milk Law of 1895 and the work of the Milk Conference in 1907. Another factor must be considered towards contributing to the drop in mortality since 1901, both from typhoid fever and infantile diarrhoea. This factor is the continuous publication by Mr. E. Berliner in two of the Sunday papers of Bulletins warning of the danger of raw milk and advising home pasteurization or the scalding of milk used for infants and invalids.

This appalling prevalence of typhoid fever and high mortality of infants as shown by the census of 1890 prompted me to enlist in the campaign for *Pure Milk and Pure Water*.

THE GERM WHICH CAUSES THE PREMATURE BIRTH OF A DEAD CALF.

Bacteriology has recently demonstrated that the affection of the dairy herd, long recognized as contagious to animals, is the result of a germ which has been carefully studied. In addition to causing great loss by the birth of dead calves, it has been found that it produces in guinea pigs and other animals diseased conditions of their organs, closely resembling those produced by the germs of tuberculosis. These germs, like those of tuberculosis, are found frequently in market milk, without any evidence of disease in the herds of cows from which the milk is supplied.

Schroeder, in May, 1911, at the meeting of the Association of American Medical Milk Commissions, announced the results of the investigations made by him and Cotton. They distinctly described the germ. The work was confirmed by Theobald Smith and Fayban. They reported their results in January, 1912.

The discovery of this organism in milk, since there is no prompt method of recognizing it, furnishes an additional argument for the proper pasteurization of all milk. It, too, like the other disease-producing germs frequently present in milk, is killed when exposed to a temperature of 140 degrees F. for twenty minutes.

EFFECTS OF CONTAMINATED MILK UPON INFANTS.

There is no specific germ that causes malnutrition and the gastrointestinal troubles of infants. It is the general observation that the presence of streptococci and colon bacilli in milk does augment these disorders. Excessive numbers in milk of any germ, even those at times considered to be harmless, has been found also to be productive of these troubles. The presence of colon bacilli is the source of great danger to children.

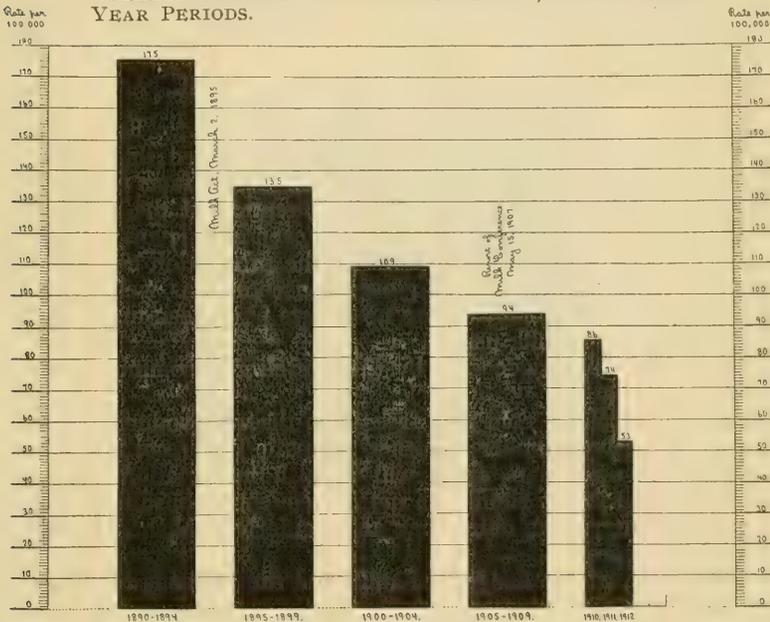
THE EFFECTS OF CONTAMINATED MILK have been shown by the prevalence of diarrhoeal diseases and the occurrence of numerous cases of malnutrition amongst infants raised upon cows' milk. One has but to observe the mortality tables during the summer months and compare the bacteriological reports of milk ordinarily used for infant feeding to be convinced of the direful influence of such milk.

For more than twenty years philanthropists, sanitarians, physicians and others interested in child welfare have been struggling to educate the public to the importance of a safe milk supply as the greatest factor in the saving of infants' lives.

The value of an improved milk supply has been strikingly shown in Washington since the passage of the Milk Law in 1895, more strikingly from 1907, when renewed activity towards the improvement of the milk supply was started, and most strikingly in 1912, when again increased activities took place.

There was a steady improvement in the milk supply in Washington from 1895 to 1907, a more marked improvement each year since 1907. There has also been a steady diminution in the death rate of children under two years of age from diarrhoeal diseases. In 1894, the death rate was 190 per 100,000 of population, in 1912 it fell to 53. There is every reason to believe that a much lower record would have been secured had more attention been given to the character of the milk fed to babies.

MORTALITY FROM DIARRHEAL DISEASES UNDER TWO YEARS
IN THE DISTRICT OF COLUMBIA, 1890 TO 1912, INCLUSIVE.
AVERAGE ANNUAL DEATH RATE PER 100,000 FOR FIVE-
YEAR PERIODS.



The diagram prepared by the Health Department plainly shows this steady diminution of infant mortality.

This experience has prevailed whenever and wherever improved conditions have been secured. During 1912 cleaner milk and better pasteurization were more general in many cities. In New York City extraordinary improvements were made. There were nearly 1,000 less

deaths of infants under one year of age than the year before. Twenty per cent. were attributed directly to the better milk supplied at the milk stations and by the dealers. In my opinion this estimate is too conservative. Supply better milk at once throughout the country and it will be seen at the end of the year 1913 that nothing like 300,000 babies will be dead. The experience in Washington coincides with that in New York.

More heed has been paid to the findings of bacteriology and greater efforts have been made to remedy the existing conditions. The progress for good from 1895 to 1907 was great, from 1907 to 1912 it was marvelous. The movement for the improvement of the milk supply the world over has spread with amazing rapidity. The campaign of education is bearing fruit. The benefits of proper pasteurization are now admitted. More milk is subjected to the process and far better results are now obtained by the improved methods. It has been observed that 35 per cent. of infants admitted to public institutions die. It is also well known that hospitals and public institutions have been exceedingly careless about the milk purchased. (See Bulletin 56, Bureau of Public Health, pp. 439, *et seq.*) The experience of milk stations and dispensaries, hospitals and homes in saving lives, where strict supervision is exercised over the raw and pasteurized milk used, should warn those in charge of institutions with high mortalities to at once carefully supervise their milk supplies.

HOW MILK CAN BE MADE SAFE.

Milk should be *clean, cold and properly pasteurized*. From the data furnished in the preceding pages it must be conceded that dairy products are prolific causes of disease and death. These facts cannot be too forcibly nor too frequently brought to the attention of the public. Persons of high intellectual attainments, and even physicians of superior ability, constantly ignore the conditions of the production and the distribution of the supplies used in their own households, as well as by their patients. Instances are many where no efforts have been made to ascertain the quality of the milk used.

Milk can be readily made safe by the exercise of common sense and ordinary care.

Milk should be clean, cold and free from disease-producing germs as well as an excessive number of other germs. The records of Health Departments of up-to-date cities will furnish information upon these subjects. These records should be more frequently consulted than they are. In some progressive cities they are regularly published in bulletins and the daily papers.

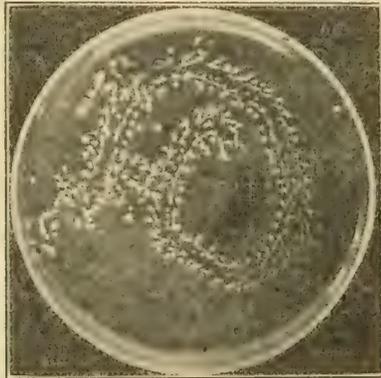
The knowledge of the dangers of milk and the methods of prevention should be widely disseminated.

This dissemination of knowledge should commence in the schools, especially in those of rural communities. The value of safe milk should also be kept before the dwellers in the cities. At the meeting of the Association of Medical Milk Commissions held in June, 1910, at St. Louis, report was made of the splendid results accomplished at Galesburg, Ill., by having students examine in their classes the milk supplied to their homes. This example should be followed in every city.

RESULTS OF INSPECTION OF DAIRIES.

The authority given by the Milk Law of 1895 for the inspection of dairies has produced admirable results from an educational standpoint. This inspection has been made the means of acquiring knowledge of existing conditions at the farms and dairy depots and of imparting instruction as to the removal of defects and the addition of appropriate improvements. Inspection has revealed many unfavorable conditions both at the farm and at the city depot. Insanitary houses, milk houses and barns were common. The attendants on cattle were careless of their personal habits and were frequently suffering from disease, sometimes of a contagious character. Cattle were frequently found covered about their flanks, legs, udders and tails with manure and other dirt, which readily dropped into the pails while the milking was being done. Cattle were many times found to be suffering from constitutional diseases as well as local affections of the udder. Flies swarmed about the premises. Frequently dead and dying flies floated on the surface of the milk in the pails.

Dr. L. O. Howard, in a publication by the Department of Agriculture, suggests that the common house fly be known as the "typhoid fly." Recent experiences in Wilmington, N. C., and Jacksonville, Florida, justify this suggestion. The presence of sediment in the milk containers was a common occurrence. This is especially dangerous, since it has been



Colonies of bacteria transplanted by a fly's feet.

shown that the ingredients are pus cells, blood, epithelium, barn-yard manure, and varied bacteria, including the streptococcus and colon bacilli. Few, if any, facilities were found for boiling the water to clean the utensils used in the handling and transportation of milk, the hands of the milkers or the udders of the cows. Polluted water readily contaminates milk. Heat destroys the pollution.

A health official of Indianapolis, speaking of inspection, says:

"While at first we met with serious opposition, producer and dealer have become convinced that, instead of persecution, the work is for their betterment. Numbers

have thanked us for insisting that they improve their conditions, stating that they do not see how they could have produced milk under the conditions that they did."

The experience of Richmond, Va., with inspection has been most gratifying. Inspection began in May, 1907. The average rating of the farmers was 41.5 out of a possible 100. But 15 per cent. of the dairies scored above 60. In December, 1911, not one was rated below 70. Of all supplying Richmond, 67.4 were rated between 80 and 90; 5.5 per cent. were rated above 90. In his report for 1911 the Health Officer says:

"The inspector has been enabled to give sound practical advice to our dairymen, thereby assisting them in many ways. * * * Practically all our dairymen have come to regard him as a real friend and helper."

Washington City also furnishes an excellent illustration of the effects of intelligent inspection. The inspectors and the producer have learned to understand each other. Many of the farmers welcomed the criticisms and proceeded to remedy the defects, as it was found that much could be done at an insignificant outlay of time and money. Much higher ratings were given in many cases on the second inspection. As a result of this educational inspection much raw milk is delivered to the distributing depots with less than 2,000 bacteria to the cubic centimeter and without either streptococci or colon bacilli.

The President of the Milk Producers Association of Maryland, Virginia and the District of Columbia, in one of his addresses, says: "that the day was past when the milk inspector was looked upon as an irreconcilable enemy." Such expressions show the spirit with which intelligent inspection is met. The educational inspection means much to both producer and consumer. It contributes not only to the health of the families of both, but also to that of the dairy herd.

THE IMPORTANCE OF THE EXTENSION OF INSPECTION AND OF UNIFORM REQUIREMENTS.

Wherever intelligent inspection has been practiced satisfaction has been experienced.

The American Public Health Association and the Association for the Study and Prevention of Infant Mortality at the 1912 meetings passed resolutions urging uniform ratings for the results of inspection.

Many States and cities have diverse requirements. This necessitates at times repeated inspections of the same dairy. Milk rejected by one city will be received by another with less rigid requirements. Uniform requirements exercised by well-trained, competent inspectors would secure a much more reliable product. Health officials should be qualified for their work by proper training. Their tenure of office should be divorced from politics, as are the United States Government Services.

THE HEALTH ACTIVITIES OF THE GOVERNMENT ARE GREAT FACTORS IN SHOWING *HOW* SAFE MILK CAN BE SECURED.

A great step forward would be made if more health officials and those interested in the public health, would avail themselves of the privilege to attend the Hygienic Laboratory of the Bureau of Public Health, as

well as the laboratories of the Department of Agriculture. They would soon learn of the health activities of the Government; that these activities are against the causes of disease, and for their prevention; that there is no truth in the common slogan that "the sick hog receives more attention than the sick woman or child."

They would find that, in addition to the universally recognized valuable work against disease and death of the Bureau of Public Health, a large proportion of the work of the Bureaus of the Department of Agriculture is along the same lines; they would also find that the Medical Officers of the Army and Navy are active with the problems of preventive medicine. Millions of the money appropriated for the Department of Agriculture are expended for purposes bearing directly upon the conservation of the public health, whilst only thousands are used for diseases of animals. They would find skilled officials ready to immediately respond to calls from State, county and municipal authorities for aid in forming plans for education to prevent disease and in repelling invasions by disease; that these officials have as willingly laid down their lives in battles against disease as have the Army and Navy in attacks upon the flag.

They would also find that Public Act No. 236, approved July 1, 1902, "to increase the efficiency and change the name of the Marine Hospital Service to the Bureau of Public Health and Marine Hospital Service," is an excellent foundation upon which to build a Department of Public Health.

This Act provides for an Advisory Board. The composition of this Board, being of eminent scientists and sanitarians from the Federal Departments and civil life, makes the Board authoritative upon public health matters. For the names of the present Board see page 18. The section providing for this Board was framed with my assistance and was inserted at my suggestion. The idea of such a Board was practically endorsed in 1909 by a special committee of the National Academy of Sciences, appointed at the request of Congress. See special message sent to Congress by President Roosevelt January 18, 1909, House Document No. 1337, 60th Congress, 2d Session. The last section gives power to the President to prescribe rules for the conduct of the service.

The laboratories of the Federal Departments have been the training schools for some of the most brilliant teachers, investigators and officials of the great universities, colleges, State and municipal governments, as well as experts for many private business concerns. Numerous investigations in regard to the public health are constantly being conducted. Authority for additional men in these corps of health workers, and funds for their investigations and the publication of the results of these investigations, is imperatively needed. Congress should be generous to those branches of the Government service.

HOW THE HEALTH ACTIVITIES CAN BE GREATLY INCREASED.

Congress, at a very little cost, can immediately multiply the benefits of Federal efforts for the public health without favoring any special school of medicine. The causes and the prevention of diseases are factors inde-

pendent of those points on which different schools of practice disagree. The work will soon show such great value that no one will object to an additional Department devoted to the public health. Such a department should be evolved rather than created.

The following few provisions would more or less contribute to this much needed and desired end:

Provide for a Committee on Public Health in the House of Representatives;

Provide that the Advisory Board should be for the Public Health Service, not alone for the Hygienic Laboratory, and that they should have meetings at certain stated periods of the year;

Add to the Board the Chief of the Bureau of Chemistry, who administers the Pure Food and Drug Laws;

Strike out the ten-day limitation in any one year for their services;

Change the compensation for the Advisory Board of ten dollars per day to an honorarium that would entitle the Government to consult them in person or by letter whenever necessary;

Provide a School of Instruction for Health Officials of the country, after the pattern of the School of Instruction upon Roads provided by the Department of Agriculture. The faculty of teachers could be secured from the experts of the Government Services;

Provide an additional Assistant Secretary skilled in Public Health Matters. This recommendation has had the endorsement of many prominent members of the American Medical Association and the Committee of One Hundred.

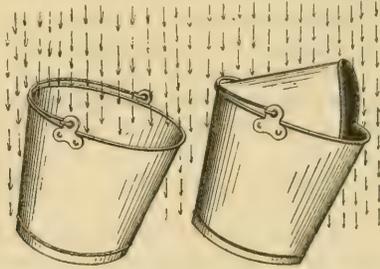
At the hearings before the Interstate and Foreign Commerce Committee of the House of Representatives on Bills relating to the Health Activities of the General Government, Miss Mabel Boardman, of Washington, D. C., member of the Sub-committee on Legislation of the Committee of One Hundred, said:

"I thought it was unfortunate that when the Department of Agriculture was formed it should not have had a much broader scope; that it should have been a department of national resources, and that under such a department the human resources would have the most prominent importance, because it would be for the benefit of the human resources of the country that all other resources were of value; that in such a department there should be a bureau of public health. * * *"
(Pages 126 *et seq.*, part II of the Hearings held June 3d, 1911.)

I heartily endorse her idea that the Bureau of Public Health should be an integral part of the Department of Agriculture. This Department is now in close touch with the authorities in many of the States and Colonies of the country, through its Inspection Services, Experiment Stations and Laboratories located therein. Much of the work is related to the Public Health. It would be a wise move to transfer the Bureau, preserving its autonomy in toto, to the Department of Agriculture, and to appoint an Assistant Secretary, skilled in Sanitary Science, to cooperate with the Surgeon-General of the Public Health Service. A minor part of the duties of the Bureau of Public Health are connected with the Treasury Department, hence there is no cogent reason for continuing it in that Department. Sanitation is not alluring to the officials of this Department. There have been five Assistant Secretaries of the Treasury, in the last four years, who have had supervision of the Bureau of Public Health.

IMPORTANCE OF CLEAN AND COLD MILK.

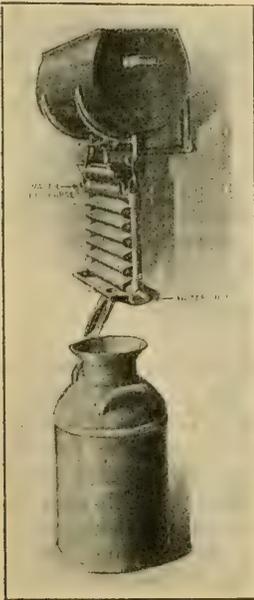
CLEAN MILK can easily be secured by the exercise of care. The methods should be now known by everyone. The importance of using the hooded milk pail cannot be too forcibly urged. W. A. Stocking, Jr., made tests in a stable where but little care was given to cleanliness. Under the same conditions he found the milk drawn in the open pail contained 10,317,600 bacteria to the teaspoonful, whilst that drawn in



the hooded pail contained 310,800. The hooded pail costs but twenty-five cents more than the open pail. Dr. Woodward, the Health Officer of Washington, so highly appreciates the value of this protected pail, that he now allows a rating of 10 for it instead of 1, as he did when he instituted the registration of dairies upon cards known as score cards. The Department of Agriculture has advanced the rating to 5 points.

COLD MILK CHECKS THE GROWTH OF GERMS.

The checking of germs is eminently desirable from both sanitary and monetary points of view. Diseases arising from germs are avoided. The loss of milk by souring, being prevented, insures financial return for the entire output. A low count of germs, secured by exercising care to produce clean milk, is kept almost stationary by a temperature at and below 50 degrees F. To secure the best results, milk of each cow must be *cooled immediately after milking, in a house separated from the cow-barn, and well protected from flies by screens.* This cooling must be accomplished by pouring milk over coils through which running water passes, iced if necessary. The placing of large shipping cans of milk in receptacles of water is unsatisfactory, from the slowness of the process of cooling and the prevention of the ready escape of contaminating odors. Moreover, there is a great danger of contamination should stirring be practiced without the greatest care. An efficient cooler can be secured for \$15.00 or less.



All the efforts of the most careful producer are nullified unless the milk is transported and

handled so as to be kept cold and free from dust and dirt. The custom of handling milk in ordinary baggage or freight cars without provision for refrigeration and allowing it to remain exposed on the station platform to the rays of the sun and clouds of dust and dirt, favors rapid deterioration.

The present method of placing milk outside the doors and windows of houses hours before occupants are awake is another serious menace. It is well worth trying to revolutionize the methods and time of delivering milk. If milk could be delivered soon after its arrival at the distributor's depot the consumer would secure much fresher milk, at times milk of the same day. The large majority of consumers are prepared to properly care for it. For it is now recognized that the consumer must contribute his effort toward conserving a wholesome milk supply. Milk must be kept cold and covered until used. *Clean, cold milk furnishes reasonably safe milk.*

PASTEURIZATION OF MILK.

PASTEURIZATION is a term applied to the process of heating milk to an appropriate temperature and holding it at that temperature for a sufficient time to destroy the disease-producing germs found in milk. Ayres has shown that all of the lactic-acid germs, which cause the souring of milk, are not destroyed. Pasteurization should not be confused with sterilization. Sterilization means the destruction of all germs, and requires heating to the boiling point on three successive days. The term Pasteurization is derived from the experiments made by Pasteur for the purpose of preventing the souring of wine and beer. He found that temperatures ranging from 122 degrees to 140 degrees F. were sufficient to prevent abnormal fermentation in them. The investigations of General Sternberg, confirmed repeatedly by investigators of the highest authority in Europe and America, have shown that disease-producing germs are made harmless by a temperature of 140 degrees maintained for 20 minutes or more. It has also been established that this degree of heat and time of exposure do not change the taste nor exert any appreciable deleterious effects upon the nutritive value of milk. This is conclusively shown by Kastle and Roberts, in Bulletin 56, Bureau of Public Health. The cream line is not destroyed. It requires a much higher temperature to prevent the rising of the cream to the surface, the visual test of the richness of the milk. The higher temperatures keep the cream mixed with the milk.

METHODS OF PASTEURIZATION.

The two methods of pasteurization are the flash and the holding processes. In the flash process the milk is heated to the required temperature and held at it for 30 seconds to 1 minute. This is not at all satisfactory and should not be allowed. In the holding process the milk is heated to 140 degrees or higher, and held at that temperature for 20 minutes or longer. To insure reliable pasteurization, that is, complete destruction of disease-producing germs, progressive milk dealers hold the milk at 145 degrees F. for 30 minutes. By the holding process properly conducted it is usual to destroy 99.93 to 99.99 per cent. of the

bacteria. Bulletin 56, Bureau of Public Health, and the records of the Health Department of the District of Columbia, show that counts as low as 2,000 per cubic centimeter have been secured by this method. From the fact that all bacteria are not killed in the process of pasteurization, it is equally as imperative that pasteurized milk, too, should be promptly cooled and kept cold with the same care that raw milk should be treated to check the growth of germs.

The splendid results obtained at infant-milk depots in securing exceedingly low counts, where milk has been properly pasteurized in the feeding bottles, has drawn attention to the desirability of pasteurizing milk in the bottles in which the milk is to be delivered to the consumer. This method of pasteurizing in the final container has many points of merit. It pasteurizes the bottle at the same time that the milk is pasteurized; it eliminates the possibility of re-infection from the handlers of the milk and dust settling upon the surface of the caps.

Dr. Charles E. North has shown that this process is practical from a commercial standpoint. He experimented by placing the milk in bottles, capping them with metal caps similar to those used for beer bottles, immersing them in water heated to 148 degrees for 15 minutes, and then cooling them to below 50 degrees.

The results obtained were most gratifying. About three-fourths of the bottles used showed counts of germs not exceeding 500 to the cubic centimeter; some were as low as 100; several were free from germs; the cream line promptly appeared. Ayers, of the Dairy Division, Department of Agriculture, expresses approbation of this method of pasteurization and is making investigations as to the feasibility of bottling and capping milk whilst it is hot. This will enable those who have large investments in other machinery to avail themselves of the metal caps.

IMPORTANCE OF PROPER PASTEURIZATION.

Experience has taught that the process of pasteurization can not be trusted to unskilled and untrained hands. Carelessness at a single point in the process may vitiate the entire product of an establishment. The Washington Milk Conference in 1907 recognized this fact and earnestly advocated the importance of official supervision of pasteurizing plants and their outputs. The Conference did not countenance the use of pasteurization to cover up the age nor the dirt in milk.

Pasteurization was urged as a safeguard against the disease-producing germs that have long been known to exist in milk. The world has endorsed this position. There is not a sanitarian in Washington, in private and official life, who does not today demand the proper pasteurization of the entire milk supply under official supervision. They do not consent to the least abatement of the most rigid requirements for *clean milk*. The heads of six of the great Departments of the Government in Washington have endorsed pasteurization by demanding that all milk used for lunch by the employees should come under the classification of the Washington Milk Conference.

The Government employees are not able to purchase the high-grade raw milk that corresponds to the "Inspected Milk" of the classification

of the Washington Milk Conference. They are served only "Pasteurized Milk." The quality of it is frequently passed upon by the Dairy Division of the Bureau of Animal Industry. This Bureau also inspects the butter purchased for use by the Navy. The Navy Department requires that all butter must be made from *pasteurized cream*. This action of the six Secretaries has greatly aided the campaign of education. The Army will soon require standards similar to the Navy.

Progressive men engaged in the distribution of milk, cream and ice-cream in many cities have established well-equipped pasteurizing plants. In order to secure a *safe milk* they employ skilled bacteriologists. They require that their supplies prior to pasteurization, should show a low bacterial count and be as free as possible from disease-producing germs.

It frequently happens that properly pasteurized milk cannot be secured on the market. The observance of the following directions for the home pasteurization of milk, by L. A. Rogers, of the Bureau of Animal Industry, can then be practiced:

"Milk is most conveniently pasteurized in the bottles in which it is delivered. To do this use a small pail with a perforated false bottom. An inverted pie-tin with a few holes punched in it will answer the purpose. This will raise the bottles from the bottom of the pail, thus allowing a free circulation of water and preventing bumping of the bottles. Punch a hole through the cap of one of the bottles and insert a thermometer. The ordinary floating type of thermometer is likely to be inaccurate, and if possible a good thermometer with the scale etched on the glass should be used. Set the bottles of milk in the pail and fill the pail with water nearly to the level of the milk. Put the pail on the stove or over a gas flame and heat it until the thermometer in the milk shows not less than 150 nor more than 155 F. The bottles should then be removed from the water and allowed to stand from twenty to thirty minutes. The temperature will fall slowly, but may be held more uniformly by covering the bottles with a towel. The punctured cap should be replaced with a new one, or the bottle should be covered with an inverted cup.

"After the milk has been held as directed it should be cooled as quickly and as much as possible by setting in water. To avoid danger of breaking the bottle by too sudden change of temperature, this water should be warm at first. Replace the warm water slowly with cold water. After cooling, milk should in all cases be held at the lowest available temperature.

"This method may be employed to retard the souring of milk or cream for ordinary uses. It should be remembered, however, that pasteurization does not destroy all bacteria in milk, and after pasteurization it should be kept cold and used as soon as possible. Cream does not rise as rapidly or separate as completely in pasteurized milk as in raw milk."

OBJECTIONS TO PASTEURIZATION.

The objectors have been mostly persons who have not followed the developments of recent years. They frequently maintain that pasteurized milk produces scurvy or rickets. Thousands of children under the eyes of careful and competent observers have been reared successfully on milk so treated without the slightest signs of scurvy or rickets. Rowland G. Freeman has shown that such outbreaks have been traced to mixed feeding; that heated milk was an insignificant factor. His observations were strengthened by those of numerous observers in Europe. There boiled milk was almost exclusively used.

In this connection, as many physicians are still of the opinion that raw milk has valuable properties that are destroyed by heat and therefore

oppose pasteurization, attention is called to a recent publication of the Local Government Board on Public Health and Medical Subjects of London, in which a summary is given by Dr. E. Janet 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 values of *raw* and *boiled milk* have been in favor of boiled milk." These observations have been recently confirmed by investigators in Europe and America.

Boiling milk is going somewhat beyond what is recommended when pasteurization is urged. Conditions like scurvy and rickets are shown in the report to be related to over-feeding and the use of farinaceous food too early in life, but not, as has been claimed again and again without any satisfactory evidence, to the use of either pasteurized or boiled milk.

GOVERNMENT INVESTIGATION AS TO THE RELATIVE VALUE OF RAW AND PASTEURIZED MILK FOR INFANT FEEDING.

This evidence is generally considered conclusive. Yet, in order to satisfy the doubters, the Bureau of Public Health and the Bureau of Animal Industry have been conducting for over six months, and will continue to conduct, an investigation into the Relative Value of Raw and Pasteurized Milk for Infant Feeding.

A STRIKING EXAMPLE OF THE BENEFITS OF MILK IMPROVEMENT.

From the annual report for 1912, of Dr. A. D. Melvin, Chief of the Federal Bureau of Animal Industry:

A remarkable instance of the value of a wholesome milk supply in promoting health is afforded by the experience of the past two years at the United States Naval Academy, at Annapolis, Md.

A few years ago, at the request of Paymaster Samuel Bryan, United States Navy, who was and is charged with the provisioning of the Naval Academy, the bureau tested with tuberculin some of the dairy herds from which milk was being obtained under contract. The discovery of tuberculosis in some of the herds, together with other bad sanitary conditions, led Paymaster Bryan to undertake the establishment of a dairy herd for the Academy. By his request the bureau selected the animals for such a herd early in the past fiscal year, and has continued to give assistance and supervision in the management of the herd. Since October 1, 1911, this herd has been supplying milk to the Academy. For the first two months of this period it was necessary to continue a portion of the contract supply, but since then the entire supply has been furnished by the Academy herd.

Paymaster Bryan has compiled figures showing the health of the midshipmen for one year before and one year since the installation of the Academy herd. Taking into account only illness of a digestive or intestinal character, and counting each day that a midshipman was sick or excused on this account, it is found that during the year from October 1, 1910, to September 30, 1911, with milk from



outside sources, the sick days numbered 1,598, or an average of 133 a month; while for the following year, with milk from the Academy herd, there were only 296 (sick days) averaging less than 25 a month. For more than two months (including September and October, 1912) there has not been a single case of illness of the character mentioned. The number of midshipmen at the Academy was practically the same each year, ranging from about 750 for the greater part of the year to about 250 during the summer. The great decrease in illness from digestive disturbance is attributed entirely to the better quality of milk, as other dietary conditions have remained unchanged."

The milk at the Naval Academy may now be said to be produced under military discipline with the aid of the Scientists of the Department of Agriculture. It is a grade of milk that is rarely obtainable by the public except at a prohibitive cost.

CONCLUSION.

If the lessons taught by these observations be heeded a great step will be made toward the control of many preventable diseases and an immediate diminution in deaths from tuberculosis, typhoid fever, diphtheria and other milk-borne diseases will be secured. The slaughter of infants will also be arrested.

Dollars spent by the hundred for prevention will save millions needed for those afflicted with disease, to say nothing of the days of suffering and pangs of grief that will be avoided.

Mothers, arise, and demand with one voice that your physicians and law-makers secure **SAFE MILK TO SAVE YOUR BABIES.**

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