RURAL HYGIENE

ISAAC WILLIAMS BREWER, M. D.

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Courtesy of the Walker-Gordon Laboratory.

Interior and rear walk of a modern, hygienic cow house.

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RURAL HYGIENE

A HAND-BOOK OF SANITATION DESIGNED FOR THE USE OF STUDENTS IN THE AGRICULTURAL SCHOOLS AND COLLEGES, AND FOR THE RESIDENTS OF THE RURAL DISTRICTS OF THE UNITED STATES

BY

ISAAC WILLIAMS BREWER, M.D.

WITH ILLUSTRATIONS

PHILADELPHIA & LONDON
J. B. LIPPINCOTT COMPANY
1909

Published October, 1909

Printed by J. B. Lippincott Company
The Washington Square Press, Philadelphia, U.S.A.

This Book is Dedicated

to the

Country Physicians

of the

United States

men who are overworked, underpaid, and not fully appreciated, but whose work is of the greatest value to the nation

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INTRODUCTION

Our modern word hygiene comes from "Hygieia," the Greek goddess who guarded the health of the people. In our modern civilization she has become the greatest of all the gods.

Hygiene is defined as "that department of medical science which concerns the preservation of health" and as "a system of principles or rules designed for the preservation of health." Doctor Parkes, who was one of the greatest authorities on hygiene, said, "It aims at rendering growth more perfect, decay less rapid, life more vigorous, death more remote."

Rural hygiene is a system of rules designed for the preservation of the health of those who reside in the rural districts. We have been taught that the country is more healthful than the city and have accepted this without comment, but recently sanitarians have called attention to the fact that the death-rate in the cities is falling more rapidly than in the rural

districts. The cause of this is simply a matter of sanitation. When this country was first settled the population was scattered and the virgin soil was not polluted, the waters were pure, and many of the contagious diseases which now claim thousands were practically unknown. Man in a primitive state was required to pay but little attention to sanitation, but as population became more dense it was found necessary to appoint persons to advise the community in regard to the prevention of disease and to enforce rules for the conservation of the public health. Generally these officers have confined their activities to the cities and towns, leaving the smaller villages and the isolated farmers to shift for themselves. In some of the States considerable attention has been paid to rural sanitation; this is especially the case in Michigan.

The following table, compiled from the reports of the United States Census Bureau, shows the death-rates in the cities and in the rural communities of what is known as the registration area of the country (that portion where fairly accurate statistics of deaths are kept).

AVERAGE RATE PER 100,000 FOR THE FIVE YEARS ENDING WITH 1904.

Diseases	Death-rate City	Rural
Typhoid fever	25.8	27.8
Malarial fever	3.8	4.7
Smallpox	3.4	1.5
Measles	11.9	7.7
Scarlet fever	15.7	7.0
Whooping-cough	12.0	9.1
Diphtheria	42.9	20.1
Influenza	17.6	29.3
Dysentery	8.6	11.0
Consumption	189.1	129.3
Venereal diseases	4.4	1.7
Alcoholism	7.0	3.4
Nervous diseases	39.8	24.6
Pneumonia	151.6	99.7
Diarrhœa and enteritis	140.7	80.2
Violence	105.9	84.5

From the above table we learn that the death-rate from malarial fever, influenza, and dysentery is greater in the rural districts. It is also probable that many cases of death from typhoid fever which are charged to the cities were in reality contracted in the rural districts.

It is to be assumed that the average man wishes to live as long and as comfortably as possible and that he desires to enjoy good health as long as he lives. Unfortunately our educational system does not provide our people

with sufficient knowledge on the subject of hygiene to enable them to guard intelligently their health. Most of us are very ignorant of the rules of sanitation, especially those who live in regions where the population is scattered. The general works on hygiene deal for the most part with conditions as they exist in the large communities, and, where rural conditions are mentioned, they aim at the ideal. The language in these is generally technical and very confusing to the ordinary person. True, the several State Boards of Health are now issuing most admirable pamphlets dealing with rural conditions, but their form is such that they are not readily available and often those persons most in need of them are unable to obtain the reports desired. It has, therefore, seemed that a hand-book written in plain language, free from technicalities, aiming to be practical, and recognizing the limitations of rural life, would be acceptable to those who from necessity or choice reside in the rural districts.

The author has set for himself this task, hoping thereby to help some of his fellow countrymen to enjoy better health than would be possible without the knowledge contained

in this small volume. He does not claim any originality, but has drawn freely from the work of a host of physicians, scientists, and agriculturalists who, in the laboratory or in the field, have laid the broad foundations upon which the science of sanitation rests.

Some of our people have a strong prejudice against living in the country, yet there are many advantages in such a life. The principal ones are, an abundance of fresh air and sunshine, the small number of persons to a given area, more out-door life, and plainer, simpler, and fresher food. All of these tend to produce strong, healthy persons. The disadvantages are, lack of society and recreation, exposure to the weather, poorly ventilated and heated dwellings and schools, lack of medical attention, danger from polluted water, and the disregard of the sanitary laws.

Doctor Henry W. Acland, Regius Professor of Medicine at Oxford, writing in 1884, said, "The health, then, of a village depends chiefly upon these factors:

"1. The dwellings.

"2. The water supply.

"3. The removal of refuse and drainage.

"4. Education and inheritance.
"5. Occupation and recreation.
"6. Care of the sick."

Our interpretation of these requirements has changed somewhat since they were written, but it has only broadened in most instances as we have learned more of the causes of disease. Probably we do not give as much weight to inheritance as was formerly the case, but there is little doubt that it plays an important part in the predisposition to disease.

The child of American parentage born in the country may well be proud of its heritage, endowed with a strong body, a sound mind, and the blood relation of many of the leading men of the nation, who were also bred in the rural districts.

There is a steady stream of strong, healthy men and women moving from the country to the city. Among them are those destined to rule the land, but in two or three generations their race will vanish and give place to the children of the less fortunate brothers and sisters who have developed strong bodies and sound minds amid the hardships and disadvantages of the life in the country.

Introduction

In the pages which follow it is the intention to discuss the various phases of life in the country from the standpoint of the sanitarian, endeavoring to point out where we depart from the standards fixed by students of hygiene and showing how these faults may be corrected.

I am indebted to my sister Miss Kate Brewer for assistance with the manuscript; to Major P. M. Ashburn for reading the manuscript and for many valuable suggestions, and to Dr. D. S. Lamb of Washington for reading the proof.

Rural Hygiene

I.

WORK AND RECREATION

The old adage, "all work and no play makes Jack a dull boy" applies to many of the residents of the country. Excepting the few rich persons who have homes in the rural districts, most of the inhabitants are overworked and have very little time for relaxation. The farmer is constantly in the presence of his labor, and his livelihood depends upon so many things over which he has no control that he must be on the alert at all times to save his work from destruction by the elements. The city worker who dwells in the suburbs spends a large part of his time going to and from his work and has very little time for pleasure. The women of both classes lead a life of isolation, which does not conduce to the best development. All persons need a change of

surroundings and a period of relaxation each year. The residents of the city have theirs in the summer months when they are found at the resorts on the sea-shore and in the mountains. The country people should have their vacation, but as a rule it is better for them to leave home in the fall or winter when the pleasures of the city can be enjoyed. The aim should be to have as complete a change as possible. Those who live in the interior of the continent will be greatly benefited by a sojourn at the sea-board, not necessarily at the shore, but in such cities as New York, Boston, or the southern ports, where the benefits of the sea air and the sea foods may be obtained.

To overcome the isolation, each neighborhood should have its club for men and women where the community can gather and discuss the topics of the day and exchange ideas. For the younger members there should be basket ball, bowling, and other in-door sports for winter, and in summer provision should be made for tennis, croquet, and other games. The singing classes and socials are to be encouraged and there should be lectures and lantern shows. These latter can be given in any large

room and the slides can be rented at very reasonable rates. In England where such clubs have been in operation for some time the results have been most satisfactory.

The trolley lines reaching out into the country are doing great things for the communities through which they run, bringing within reach of the rural inhabitants many of the advantages of the city.

One of the best things ever done by the Federal Government was the establishment of the rural free delivery. This system should be extended so as to reach a larger number of persons.

The country stores should no longer be the political and social centres of the community; from a sanitary point they are anything but desirable gathering places.

The front-door garden has to a large extent disappeared from the farm. Those who cultivate flowers send them to the cities and the rural dwellers see but few of them. Yet bright flowers and ornamental shrubs are important factors in mental hygiene and our agricultural societies and fairs could well expend more of their energy in fostering the flower-

garden by offering prizes for the best grown for home use.

The large cities have absorbed the best of our religious thinkers, in many instances leaving the unsuccessful clergy to the country parishes. This is far from what it should be. Let the country churches be filled with strong men of action who will be a force in the community. To obtain such men they must be paid a proper salary, not in the shape of potatoes and turnips, but in the same cash which the other members of the community expect for their services. In like manner the doctor should be properly paid. In many cases at present he is overworked and underpaid and cannot devote his time to many matters which are of the greatest importance to the community at large, but which bring in no income. The local physician should always be on the school-board, and he should be paid for visiting the schools at regular intervals. He too must have his vacation. This he will not use for his own good but will spend in some medical centre fitting himself to do better work for you when he returns.

Do not look down on the "country doctor" for the world owes him much. Vaccination to

prevent smallpox was introduced by a country doctor. Some of the greatest surgeons in America have lived and practiced in small towns. Robert Koch was a country practitioner when he made some of his most important discoveries and it was while a country doctor that he evolved fundamental methods of work and observation that culminated in those classical researches that made him famous.

II.

DWELLINGS

THE experience of ages has taught the human race to build on elevated ground where the soil is comparatively dry. Generally sand or gravel is the best soil, while clay is the worst.

The exposure of the building is of the greatest importance. In the cities buildings must be erected according to the direction of the street, and the owner can do nothing to improve the facing of his house. This is often true in the suburban districts, but there the owner frequently has sufficient ground to provide for a side entrance, in which case he can usually so place the house as to have the maximum exposure to the sun.

In the United States, dwellings usually face the south, but a southeastern exposure is preferable as the sunlight will then penetrate into each room at some time of the day. In this connection the prevailing winds must be considered, it being desirable to expose the build-

ing to the cooling winds of summer and at the same time have shelter from the storm winds of winter. Generally the southern or southwestern slope of a hill will afford all the protection desired. In flat country it may be necessary to plant pines or other evergreens as wind-breaks.

The outlook from the windows is not a matter of secondary consideration but one of considerable sanitary importance. Generally speaking, the rooms which are the most occupied should command the most pleasing view; especially is this important in the case of the dining-room. A dark, unattractive room that looks out upon another building or upon parched fields does not conduce to a cheerful meal and a good appetite.

Before the foundation is laid the ground to be occupied must be thoroughly drained to a depth of at least a foot below the floor of the cellar. This may be done by the use of open-joint tile drains or by trenches partially filled with broken stone and covered with earth. The water will run through the spaces between the stones, but the trench must empty at a level considerably below that of the cellar floor

to prevent the water from backing up in the drains. There are some localities where it will be impossible to drain the ground under the house. There it becomes necessary to build upon piling.

The foundation is to be laid in concrete and the walls to the level of the ground are to be of brick or stone, which should be covered on the outside with pitch to the level of the ground. At this point there should be, in brick buildings, a layer of slate or other impervious substance to prevent the dampness from travelling up the wall.

Brick and stone are preferable for building materials, and in most parts of the country are as cheap as wood. Cement is becoming quite popular in some sections and it is claimed that a cement house can be built much cheaper than any other. If the building is of brick or sandstone it is often necessary to cover the outer wall with tar or other material to prevent dampness. Slate makes the best roofing, but it is more costly than shingles. Tin answers very well, but is hot in summer and does not last well. Shingles are cheap, but after a time have to be replaced, and where a cistern is

used they often impart to the water an unpleasant taste. Slate is the best roof from which to collect water for drinking. Eaves-troughs must be provided to conduct the water from the roof away from the foundation.

The best floor for the cellar is concrete covered with cement. Rammed clay is not so good but will answer, as will also brick covered with tar. The object to be attained is the exclusion of moisture, the ground air, and rats. This portion of the house is often insufficiently lighted and ventilated, which in some cases may cause ill health. The same relative quantity of fresh air should be admitted to the cellar as is provided for the rest of the house, and at least two feet of each window should be above grade. The windows must be so arranged as to admit as much sunlight as possible. All openings about the water or other pipes must be made rat proof by being closed with cement.

The division of the house into rooms is to be left to the individual taste of those who are to occupy it. In general no room should be smaller than ten feet by ten feet, and there should be doors communicating with the adjoining rooms. The window space must not be less than one-fifth of the floor space.

For each adult a floor space of fifty square feet, and an air space of not less than six hundred cubic feet must be provided. Smaller rooms are harder to ventilate, and a greater height than ten feet adds to the cost without adding to the sanitary condition of the building. The ventilation is much better in rooms with windows extending to the ceiling. Where the exchange of air is through the windows all the space above the top of the window is practically useless as the air in that portion of the room is rarely changed.

VENTILATION

An abundance of fresh air is absolutely necessary for the health of the body. If we lived in the open air the question would be of very little interest, but, being inhabitants of buildings, it becomes one of the greatest importance; so much so that there is a magazine published for the sole purpose of inducing people to be in the open air as much as they can, and, if this is impossible, to let as much air in the house as possible. The air that is expelled from the lungs contains many impurities derived from the body, the principal one being carbon dioxide,

a gas which is found in small quantities in the atmosphere and which is one of the foods for vegetation. That the air in the house should be pure there must be a constant interchange between it and the outer air. This exchange is called ventilation.

As a result of many experiments it has been proven that for each adult there must be not less than six hundred cubic feet of air in the room, and that this must be changed at least five times an hour if the air is to remain pure. How to accomplish this without causing draughts or unnecessarily cooling the air in the room is far from a simple problem. Elaborate mechanical apparatus has been devised to provide ventilation for buildings, but as a rule the cost precludes its being adopted in private dwellings. For many years to come the majority of our people will ventilate their homes through the windows.

Air is like water in that there must be a place for it to overflow or flow out as well as an inlet. Many persons do not appreciate this and we find them endeavoring to ventilate through only one opening. Where the air space does not fall below the standard set above it is possible to

obtain the required quantity of air by opening one window at the top and another at the bottom. These should be as far apart as possible. This method causes draughts, and many of our people prefer bad air to cold air or a draught. The draught, however, may be avoided by placing a board beneath the window that is open at the bottom. The air will then enter between the two sashes and be directed upward and diffuse itself through the room without inconvenience to the occupants. Open fires are credited with aiding ventilation very much and without doubt they do create a movement of air up the chimney, but most of the air is drawn from the lower levels and the foul air which rises to the ceiling is rarely disturbed. Where stoves are used an abundant supply of pure warm air can be had by enclosing the stove in a drum which connects with the open air through a shaft. The air is warmed as it passes through the drum and is diffused throughout the room. An outlet must be provided. Where the building is but one story high two air shafts may be extended downward from the roof into the room; the outlet should terminate at the ceiling, but the inlet must extend several feet lower or it,

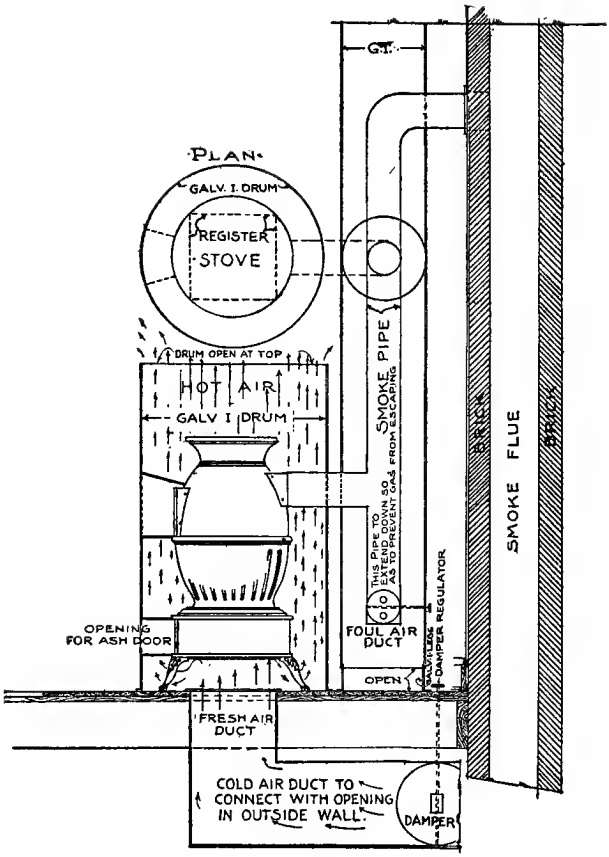

FIG. 1.—Showing method of ventilating room heated by stove.

too, will become an outlet. These may open in the wall, but wherever they are a valve must be so constructed as to regulate the movement of the air.

The senses soon become accustomed to the air in which we are, even though it be much vitiated, therefore rooms which seem stuffy at first do not appear so after a while. To determine the purity of the air elaborate instruments have been devised, but any one can form a pretty fair estimate of the quality of the air in a room by entering it directly from the fresh air or from a well-ventilated room. If the air contains less oxygen than normal it will seem stuffy.

HEATING

Closely associated with ventilation is the question of heating the house. The source of heat is governed by the fuel supply and the ability of the householder to install modern apparatus. The usual sources are open fires, stoves, furnaces, steam heaters, hot water, and gas or oil stoves.

Furnaces furnish a very dry heat that frequently has an unpleasant scorched odor from the burning of the organic matter in the air.

They aid the ventilation very much but in general they are not satisfactory for the reasons mentioned. Hot water and steam are more satisfactory, but the cost of installation is generally too great for most persons. For many years the country houses will be heated by stoves. These can be made satisfactory if properly handled. The old-fashioned Franklin heater is very satisfactory and a great saver of fuel. It has been adapted to burning coal. In the southwest the air-tight stove is much used. It is a wood burner and furnishes an abundance of heat with the minimum consumption of fuel. The fire is built of small wood which is allowed to burn to a red coal, larger sticks being then added and the stove closed up tight. Such a fire will keep all night and give out sufficient heat to warm a room. In the morning the opening of the draught causes the charred wood to blaze up.

Electricity will ultimately be the method by which we will heat our houses. It will cause a great saving of fuel and at the same time do away with many of the bugbears of the present methods.

Oil and gas stoves are objectionable because

they consume a large quantity of oxygen and at the same time generate a large quantity of carbon dioxide.

One of the most dangerous heaters is the red hot stove. It certainly causes much warmth, but at the same time carbon monoxide, an odorless but highly poisonous gas, is passing through the iron and polluting the air. This gas combines with some of the elements of the blood and causes serious illness when any considerable quantity is breathed.

LIGHTING

For a long time to come oil will furnish the illumination for the greater part of the residences of rural districts. It is important to use only the very best grades of oil, as the light is much better and at the same time the impurities given off are much less. The student's lamp furnishes a soft and pleasant light. The Rochester burners use a large quantity of oil and give a brilliant light, but it is glaring, and they also generate an immense amount of heat. A soft white light is the best for the eyes.

Where electricity can be had it is the most desirable light. The cost of installation will be

considerable, but the saving in the light and the improvement in the air of the house will in time pay it back. The light can be tempered by the use of proper globes, and the eyes should be benefited by the use of electricity.

INTERIOR ARRANGEMENTS OF THE HOUSE

The housekeeper in the rural districts is overworked, and for her sake, as well as for the health of those who live in the house, the ornamentation on doors, windows, and stairways should be reduced to the minimum. The door of the room in which this page is being written is made of fifty-three pieces. This door no doubt costs less than a solid one but it is anything but beautiful and has many cracks for the lodgement of dust and dirt.

The cracks in the floor may be filled with crack filler which will greatly reduce the quantity of dust in the house. Rugs are more easily cared for than carpets and are far more sanitary. Draperies are very unsanitary, especially when multiplied about windows and doors. Shades are needed to temper the light at times and to exclude the gaze of outsiders, but they should not be kept drawn all the time. Carpets

and rugs will undoubtedly hold their color better in the dark, but the germs of tuberculosis and other diseases live much longer in dark rooms. The sun is, in fact, one of the most efficient disinfectants known. The question therefore resolves itself into color of carpets and rugs *versus* the health of the family and we of the jury decide in favor of good health.

The housewife has to make innumerable trips to the upper portion of the house and for her convenience alone, if for no other reason, the stairs should be low and devoid of the turns which are so frequently found in modern houses.

Bedrooms must be furnished as simply as possible yet with due consideration for the comfort of the occupants. Running water in the room is very convenient, but it is not desirable from the sanitary standpoint. It is important to have as much sunlight as possible in the room and the ventilation must be as good as possible. At night the windows should be wide open. The storm windows and doors found in our northern houses in winter are an abomination and should not be used unless absolutely necessary. The principal objection to having the window open at night is that in the morning

the room is too cold for dressing. This can be obviated by using an adjoining apartment for a dressing-room. The more air in the sleeping-room the better. Many persons are now sleeping out of doors all the year round even in the severest of our northern winters, and there is no reason why healthy persons should not sleep with the windows wide open.

The bathroom should not be tucked away in an out-of-the-way corner, but must be convenient, large, well lighted and ventilated. Place the tub in the center of the floor so that there will be no place behind it that cannot be kept clean. There is no reason why it should not be built into the room so that there will be no space beneath it to collect dust. The discharge pipe can be run out at one end and thus all the requirements of exposed pipes will be met. Enamelled tubs only should be used.

Probably the most important room in the house from a sanitary point of view is the kitchen. It should be large and as conveniently arranged as possible, and where practicable there should be an adjoining room for a laundry. A sitting-room for servants will add greatly to their comfort, making them more

contented. This is also important to the health of the family as it reduces the exposure of the food to a minimum number of persons. Have plenty of fresh air in the kitchen and provide an abundance of hot water, also, if possible, running water and a sink. Most kitchen sinks are provided with a grease trap which can be opened when it clogs up. Where this is not the case the pipe should be flushed daily with very hot water and lye.

The pantry must have sufficient shelving to hold the needed supplies and is to be made as near insect- and rat-proof as possible. In some houses the pantry is dark and poorly ventilated, the idea being that foods keep better in such rooms. This is far from the truth. Any articles that will spoil if exposed to the light should be kept in drawers or in jars with tight-fitting covers.

In the summer all the windows and doors throughout the house should be provided with wire screening of from eighteen to twenty meshes to the inch, so as to exclude mosquitoes and flies. Where there are no mosquitoes or any very small flies a larger mesh may be used and the cost will be reduced. Copper wire

costs more than ordinary iron wire, but it lasts longer and is not so readily broken. If it is impossible to screen the entire house, the kitchen, pantry, and dining-room should be screened, for it is of the greatest importance to exclude flies from these rooms. When this is impossible wire dish covers may be used, but no food should be left uncovered where flies can get at it. There is little doubt that a large number of typhoid fever cases are contracted from eating food that has been contaminated by germs from the legs of the fly.

The foregoing description of a home is as we should like to have it, but the majority of our people do not build their own homes and must make use of the buildings that are on the farm. In such a case it is well to remember that the cardinal sanitary points about a house are freedom from dampness; light and sunshine in every room; large windows, sufficient air space, good ventilation, and sufficient heat. These should be had at any cost. The air space is generally insufficient, but that can be met by limiting the number of persons to the room. Sometimes several small rooms can be merged into one room, thereby improving the venti-

lation and reducing the cost of light and heat. Not infrequently the stairs are dark and without ventilation and this should be remedied by some means or other.

The all-important room is the kitchen. It must be kept free from flies and should not be the place for hanging the outer garments of the family. These are generally dusty and in some cases smell of the stable or soil. Running water is very desirable, and where it cannot be had provision must be made for an abundant supply from some other source. A large hot-water tank is a necessity.

The surroundings of a country house should be well kept, the garden being filled with ornamental shrubs and flowers. There should be no backyard littered up with cans, ashes, and other refuse, but there should be some portion of the grounds, close to the house set apart for the use of the children. There they should be allowed to dig and build to their heart's content. Encourage them to spend their time at home where they will be under the eyes of their elders and they will learn less that is undesirable. Their morals will be on a higher level and there will be fewer wild oats to harvest

in later years. Children, however, should be taught the rudiments of sanitation at an early age, and should learn how to keep their playground free from cans, broken bottles, and other refuse. These things must be burned or buried. There is a great difference between the sanitary playground and the useless city park with its "keep off the grass" placards. Let us increase the former but diminish the latter.

III.

SCHOOLS

In the "little red schoolhouse" many of our greatest men began and completed their school education, yet there can be no doubt that there were others who would have been great but for the limitations of the rural school. It is a sad fact that the instruction in many of our rural districts is far behind the times, that the school buildings are in many instances far from sanitary, and that the work imposed upon the teachers is greater than they can perform without losing their health. Our statesmen boast very much of our schools. We frequently hear it said that the "public schools are the bulwark of the nation" and yet the nation has done very little for the public schools.

TEACHERS

Most of the rural school teachers are women, many of them not physically fit for the task before them. Their pay is very inadequate and

a disgrace to the nation. They receive less than the man who works with the pick and shovel, and very much less than the politicians who in many cases return little or nothing for the money paid them. Often the salary does not allow them to live properly. I know a young woman who teaches a lot of unruly negroes in a district school in the middle west for twenty-five dollars a month for ten months, in all two hundred and fifty dollars a year. Out of this she pays twenty a month for her board, or two hundred dollars a year, leaving but fifty dollars for clothing and for her support during the summer months. There are many worse cases than this. In some schools the teachers are paid less than the farm hands but are boarded around among the farmers.

The work of the rural teacher is harder than that of the city teacher. She is generally required to teach all grades, and not infrequently has to manage grown boys and unruly men. Overworked and underpaid, she cannot render the best service to the community.

If the rural communities cannot properly support their schools, and it seems that such is the case, then the State or Federal Govern-

ment must do so. The States are limited in the amount of money they can raise by the direct tax, while the Federal Government, by indirect taxation, can raise an unlimited amount. There are many economies which the Federal Government can practice without in any way embarrassing its efficiency, and the farmer, who holds the balance of power, should see that they are made and the funds thus released used for the betterment of the rural schools.

The isolated country school can no longer furnish adequate accommodations for the children of the rural districts and in some of the States school districts are being consolidated in order to provide larger and more modern buildings and laboratories. This should not be done with an idea of economy but rather to obtain better instruction, to lighten the work of the teachers, and at the same time to pay them better. Where the consolidated district covers a large area it may be necessary to provide free transportation for those children who reside in the more remote parts of the area.

The ideal consolidated school will provide a suitable building for instruction and a home for the teachers. It will be surrounded by ample

grounds which will include playgrounds and a flower garden tended by the children.

In some of the public schools hot lunches are being provided for the children. This is not so much needed in the rural schools, but there are without doubt many children who will be able to do better work during the afternoon session if they have a good meal at noon.

The view from the school should be as pleasing as possible. A north light is said to be the best for the eyes, but a south light is about as good, and besides allows the sunlight to penetrate the rooms, a much desired feature from a sanitary point of view. This exposure will generally be recommended. The exterior architecture should be rather plain but pleasing. The interior decorations are to be considered as one of the object lessons and should be in good taste but free from the "fancy work" which adds nothing to the beauty and only collects dust.

The tendency is to make the rooms too large and too high. Each pupil requires about twenty square feet of floor space and not less than two hundred and fifty cubic feet of air space. Oblong rooms are best suited to school pur-

poses and those that are between thirty and forty feet in length are the most satisfactory. Thirteen feet is about the proper height. Increased height only adds to the cost of heating without adding to the comfort or efficiency of the pupils. The window area must not be less than one-fifth of the floor space. It is best to place the windows at the back and on one side, the object being to have the light come from the rear and over the left shoulder of the child. The sill of the window should be five feet from the floor and the window should extend to the ceiling no matter what the architects say about beauty. Inside blinds are needed to shut off the light when excessive. They should slide down into the space below the sill so as not to cut off the light on dark days. This space must be entirely open or it will accumulate dirt. Storm windows may be needed in very cold climates but they cut off much of the air required for the ventilation of the room. The furthest desk should not be more distant from the window than one and one-half times the height of the window.

The ventilation should be as perfect as possible, the aim being to keep the air as pure as

that outside. It has been ascertained that not less than thirty cubic feet of fresh air must be furnished each pupil per minute if the air in the room is to be kept free from impurities. Where there is a mechanical ventilating system this will be comparatively easy to secure, but in most of the country schoolhouses no provision has been made for ventilation, and the only way to introduce fresh air and get rid of the bad is through the windows and the cracks about them and the doors. In such rooms the problem is very difficult because of the draughts which are created. The methods of ventilating buildings have been considered under housing, and as the methods of providing air for schools are the same the question will not be considered further in this place. During recess all the windows should be open and all children made to leave the room.

The heating is a matter of great importance. In the consolidated schools it will be possible to heat from a central plant in the basement and so dispense with the dust and dirt incident to stoves or fireplaces. For such plants steam or hot water will be found the most satisfactory. The heat from furnaces is too dry and often

contains carbon monoxide, a most dangerous gas which is given off from red hot iron. There is a popular belief that steam- and hot water-heat are moist. This is not so, as none of the steam or the water comes in contact with the air of the room, the heat being radiated from the heated pipes.

The small country school will for many years be heated by a stove. To have this a success the teacher must give it constant supervision. It must never be allowed to become red hot, but must furnish sufficient heat without having any of the ventilating openings closed. Stoves require a large quantity of air, and where they are used some provision for extra air must be made. A good way is to enclose the stove in a sheet iron drum, leaving an air space of from six inches to a foot around the stove. The top of the drum is left open, while the bottom is connected with the open air by means of a flue, which must run as straight as possible. This flue should never be beneath the floor of the cellar, nor should it open on the level of the ground or where the air is befouled from any cause. Such stoves greatly aid in the ventilation of the room and furnish warm air with-

out causing draughts. The flue will not work unless some outlet is provided for the foul air of the room. Some of this will pass out through the stove, but most of it must escape through the windows or through a shaft in the ceiling.

The blackboards are to be placed on the wall opposite the windows and are to be of a dull black color so as to diminish the reflection. They must not be further than thirty feet from the most distant seat. If kept very clean the writing will be more readily seen and the strain on the eyes will be much reduced.

It is generally recommended that the walls be neutral in color, but the greens and blues are most restful to the eyes. Painted walls are the most satisfactory, as they can be cleaned with soap and water.

It is not uncommon to find schoolhouses with such thin floors that the children's feet are always cold during the winter months. This undoubtedly accounts for some of the colds and catarrhs from which so many children suffer. Double floors are just as necessary in the school as in the home. All the cracks should be filled with crack filler, which will reduce the

dust in the room to a minimum. A room that is so dusty that the children cannot sing while marching is not fit for a school.

The cellar under the building should be as clean and dry as the rest of the school. Under no circumstances should it be a storage place for broken furniture, ashes, and other rubbish.

A separate locker or closet should be provided for each pupil's wraps, and must only be used by the occupant of the desk to which it belongs. It should be warm and dry and well ventilated. Daily inspection should be made to insure its cleanliness and to prevent its becoming the storage place for all kinds of rubbish. Once a week it should be washed with hot water and soap and left standing open from Friday night until Monday morning. These precautions will reduce the amount of sickness in the school and be a direct financial saving to the community.

All desks and benches should be adjustable. The desk should be an inch higher than the elbow of the child when standing, and the seat at such a height that the child's feet will rest flat on the floor when the thighs are horizontal.

FIG. 2.—School room showing desks and benches that are not fitted to the pupils. Many of the pupils' feet do not touch the floor. (By permission of the *Boston Herald*.)

These precautions are necessary, as too high or too low desks and benches are often the cause of deformities, such as curvature of the spine. The illustration, which shows desks and seats at improper heights, was taken in a school but nine miles from one of the largest cities in the country.

An abundance of pure water is necessary. It is not advisable to keep the drinking water in the school room, but it should be placed in the corridor convenient to the class rooms. There is no doubt that many of the diseases from which children suffer are transmitted by means of the common drinking cup at the school. To prevent this each child should provide a cup or glass, which should be kept in the desk and be used by no one else. It must be cleaned and sterilized by boiling at frequent intervals. Under no circumstances should a glass or cup be dipped into the water; it should be filled from a spigot. Where there is sufficient running water piped into the building, a bubbling fountain is the most sanitary method of supplying drinking water, and, where installed, the individual drinking glasses or cups may be dispensed with.

DISPOSAL OF EXCRETA

The disposal of excreta of the pupils is a matter of great importance. The general principles are the same as for disposal elsewhere, and in this section we will not go into the details which can be found under another heading.

Where water is piped into the building the water carriage system, combined with the septic tank and sewage farm, should be used. This will be impossible in many of the schools, and earth closets will have to be substituted. They should be provided with some automatic device for distributing the earth, similar to the one shown in Figure 11. The closets are best located in a detached building which is connected with the school by a covered passageway. Separate buildings are to be provided for boys and girls. The seats should be arranged to accommodate all sizes of children, care being taken that they are not too high for the smallest pupils. In winter the building must be heated, and at all times it must be kept clean. The teacher should make daily inspection to insure this. If neglected it will soon become filthy and, worse still, will be the

depository for the vilest language imaginable. No scribbling on the walls should be allowed and loitering in or about the closet must be prevented.

MEDICAL INSPECTION

The school is the point of contact between the families of the district and it is often the distributing point for many of the contagious diseases. Medical inspection is a new feature which has been introduced into many schools, and which should receive the hearty support of all who are interested in the health and education of children. In Massachusetts, in 1906, 432,937 children were examined and 27,342 were found diseased, and this does not include those with defective eyes or ears.

The following table, taken from a paper on school hygiene by G. A. Martin, shows the result of the examinations made in Massachusetts in 1906.

Diphtheria	238
Scarlet fever	313
Measles	637
Whooping-cough	973
Mumps	267
Chicken-pox	548
Influenza	276

Syphilis	36
Tuberculosis	115
Erysipelas	17
Adenoids	2525
Other diseases of the oral and respiratory tract	5103
Otitis (inflammation of the ear)	407
Other diseases of the ear	363
Conjunctivitis	779
Other diseases of the eye	2159
Scabies and pediculosis	8745
Skin diseases	3453
Nervous diseases	146
Deformities	142
Total	27,342

Although many of the cases in the table probably were found in the schools of the crowded sections of the cities, the number from the rural schools are sufficiently large to warrant careful inspection in order to detect them.

Vaccination is now required in most of the States before a child can enter the public schools. In some instances this regulation is not strictly enforced. This is so important that each child should be required to present a certificate from a physician, showing the date of the last successful vaccination, before being entered in the school. Those who cannot produce such a certificate should be vaccinated at once or refused admission. Revaccination is

of such great importance that it would be wise to make regulations requiring revaccination before the child enters the grammar or the high school. This matter is more fully discussed under smallpox.

Recent examination of over four hundred thousand children in Massachusetts showed that 22.7 per cent. had defects of vision and that 6.3 per cent. had imperfect hearing. The difference between the city of Boston and the rest of the State was slightly in favor of the latter.

There is no doubt that many of the defects of vision are caused or exaggerated by improper lighting of the school rooms, copying from blackboards, and night study in poorly lighted rooms. The light should come over the left shoulder. Night study should be prohibited except in the high school, and then only a very limited amount should be allowed. The teacher should not be required to spend her evenings in correcting papers. She works hard enough during the day, and every moment after school closes she requires for relaxation and sleep.

The teeth of school children should receive

the attention of the medical inspectors. The examination of fifteen hundred children by a dental surgeon in Massachusetts showed that about one-third had bad teeth. In examining recruits for the army I have been struck by the large number of young men having bad teeth. It is rare to find one with perfect teeth, while the number who have bad teeth extracted is very large. A defective tooth eventually causes great suffering and the loss of many teeth will surely be followed by ill health. Among certain classes visits to the dental surgeon are rarely made unless the person suffers from "toothache," and many children are not aware that they have defective teeth until these are damaged beyond repair. The regular inspection of the teeth of school children will certainly result in a great reduction in the number of teeth that have to be extracted.

BACKWARD CHILDREN

It is now known that many of the backward children have physical defects which can be relieved by simple means. Defects of vision and hearing and adenoids in the nose (making the child a mouth-breather) are the most

common. These can usually be remedied by proper treatment and, where this has been given, the child has improved in its classes.

INSTRUCTION

What shall be the nature of the instruction in the primary schools has been much discussed and is apparently not settled. Most of the schools in this country so arrange their instruction as to bring the pupil to the doors of the college at an early age. As a matter of fact hardly 2 per cent. of the children ever enter college, and 94 per cent. leave before entering the high school. It would therefore seem that the course should be arranged on some other basis. What seems a more satisfactory arrangement would be to introduce into the instruction more that will be of practical importance to the pupil during the working years of life. In the rural schools instruction in scientific agriculture with an agricultural high school at the end of the graded schools would seem to better meet the requirements of the community. The subject of economics should also receive attention, and the mechanical pursuits must not be neglected. Instruction in

hygiene should be given to all during the school course. In the lower grades the teaching should be by example, the teacher explaining in very simple language why this should be done and that not done. In the higher grades a text-book should be used. Most of those now in use are largely devoted to physiology and anatomy and contain very little hygiene. We can get along very well with very little knowledge of anatomy or physiology but not without a pretty good knowledge of hygiene. The teaching of hygiene in the schools is of importance, not only to the individual but also to the nation. A very little knowledge of hygiene would have prevented the terrible epidemic of typhoid which prevailed in our army in 1898.

Children should come to school with their hands and faces washed, and otherwise neat and tidy, yet it does not seem advisable to send a dirty child home the first time it comes to school in this condition. A child's self-respect is easily injured and it would be better to send a note to the mother at the close of the school. This note could be so worded as to make the mother see that it is to the child's advantage to be clean. A second warning

should be given by the truant officer, who should explain the matter to the parents. After this the child should be sent home to be cleansed and be no longer allowed to come to the school in an untidy condition.

It is important to prevent children from learning bad habits in the early days of their education, and the Massachusetts Association of Boards of Health recommends that they be taught the following: not to spit, especially on the slate or the sidewalk; not to put the fingers in the mouth; not to pick the nose; not to wet the finger with saliva in turning the leaves of a book; not to put pencils into the mouth or moisten them between the lips; not to put money or pins into the mouth; not to put anything into the mouth except food and drink and the toothbrush; not to exchange apple cores, candy, or chewing gum.

The nature studies are of importance as they create a desire for healthful amusement in the open air, something our people need to cultivate as much as possible. In some cases the modern teacher has carried this to the point of ridicule and made it rather a burden than a pleasure. The aim should be to cultivate obser-

vation and a love of animals and flowers rather than to furnish the child with a great number of facts regarding which he cares little or nothing. Towards the end of the school year when the days are hot and the schoolhouse is far from comfortable, the time can be profitably spent in giving instruction in the fields, reviewing or elaborating the studies of the previous winter.

WHEN TO SEND THE CHILD TO SCHOOL

In determining when to send the child to school we are governed by age rather than by the growth and development, the proper guides in this matter. Many children begin as early as five years of age, but if the age limit is to be the standard it should be put at seven. A large number of children who are sent to school too early overtax their brains and become tired out long before they reach the upper grades. We educate the mind at the expense of the child's health in a great many cases. Notice a little boy of seven, a sad little fellow, with all marks of a delicate constitution who has begun school. He has to be up at six each morning and leave home at seven-thirty. He attends one of the public schools but has no place to go

during the noon recess, so sits in the schoolroom. After his day's work he reaches home after dark during the winter months, and frequently says he is just a little tired.

During the first month of school he contracts diphtheria, and before the year is over will have had any other disease that comes his way; perhaps he contracts tuberculosis. He should be at home where he can run about and get the fresh air. If educated he must be, his mother and father, who have time for their social duties, should teach him for a few hours a day.

Young children should be confined to school but a very short time, three hours daily at the most. This time should be broken by an intermission of fifteen minutes, when, weather permitting, all the pupils should go out. At the end of each hour it is advisable to have the children march two or three times around the room. This prevents them from getting cramped in the position occupied at the desk.

IV.

WATER

WATER is of the greatest importance to the human race. It comprises about 70 per cent. of the body, and for drinking and cooking alone each of us uses about six and a half pints per day, while to provide for baths and other domestic purposes not less than sixteen gallons are required. A modern city needs, for all purposes, not less than one hundred and twenty-five gallons per person.

Water for domestic uses must be clear, pure, abundant, and conveniently placed. Of these, purity is of the greatest importance. Not only must water be free from impurities which can be detected by the eye, the smell, or taste, but it must contain neither chemical, animal, or vegetable impurities which are injurious to the health of those who use it.

The purest natural water is that which falls from the clouds in the form of rain or snow. At the moment a rain- or snow-drop forms it

is very pure, but as it descends to the earth it collects a considerable quantity of impurities. Whether these are injurious or not depends upon the condition of the air through which it falls. In the vicinity of our manufacturing cities it would be very impure, while on the western plains or on the tops of high mountains the impurities are not of a serious nature.

A considerable portion of the rainfall runs directly into the rivers or other water courses, carrying with it all manner of impurities. A smaller portion is absorbed into the earth, where it remains as ground water or appears at some distant point as a spring. In its passage through the soil, it absorbs mineral and other substances, some of which are highly undesirable, but most of them are in no way detrimental. The most dangerous water is that which contains animal or human excrement. With the increase in the density of population in this country there has been a steady decrease in the purity of our waters, until, at present, there is very little really pure water. In Vermont the examination of 231 samples of water from wells, springs, and ponds showed that 22 per cent. of the springs,

50 per cent. of the wells, and 41 per cent. of the ponds were impure or of doubtful purity.

The importance of pure water to a community is shown by the following table taken from the Monthly Bulletin of the New York State Department of Health for April, 1908. The table shows the average death-rate per 100,000 from typhoid fever for cities in New York over a period prior to the improvement in the water supply, the average typhoid death-rate per 100,000 since the change in the water supply, and the percentage of reduction caused by the improvement.

Place	Average before improvement	Average after improvement	Percentage reduction in death-rate
Albany	88.8	23.7	73.0
Binghamton	39.3	11.7	72.2
Elmira	54.9	41.5	24.4
Hornell	42.2	24.7	41.4
Hudson	64.3	31.9	50.5
Ithaca	67.2	14.6	78.3
Rensselaer	95.5	54.4	43.0
Schenectady	25.0	14.4	42.6
Troy	58.2	31.0	46.8
Watertown	94.7	36.9	61.8

Water for domestic use in the rural districts is generally derived from the following sources: wells (shallow dug wells), springs, rain water, rivers, lakes, ponds, or artesian wells.

FIG. 3.—Filthy privy showing a well so placed that it receives the seepage from the privy and adjoining stable.

WELLS

The most common source is the well. This ordinarily is badly situated and is almost always polluted.

The usual country residence is located on a slight elevation, the barn and other out-houses being placed as near as possible. In order to save digging, the well is not infrequently placed at a much lower level than the privy or the stable and receives the drainage from both. In not a few cases it is located in the barn-yard. It is rare to find one that is curbed or with a tight-fitting cover. Pumps are not used as often as they should be. The old-fashioned well sweep is very picturesque and the "Old Oaken Bucket" sounds very well in the poem, but to have this the well must be open and be a collecting place for all the filth that blows, and, not infrequently, for the washings from irresponsible persons who may use the well. In India the well-bucket is a fruitful source of the dissemination of cholera, and what is true of cholera is generally true of typhoid fever. Without doubt there are many wells in this country that are infected with typhoid fever through the same medium.

The purity of the water in the well also depends upon the geological formation in which it is located.

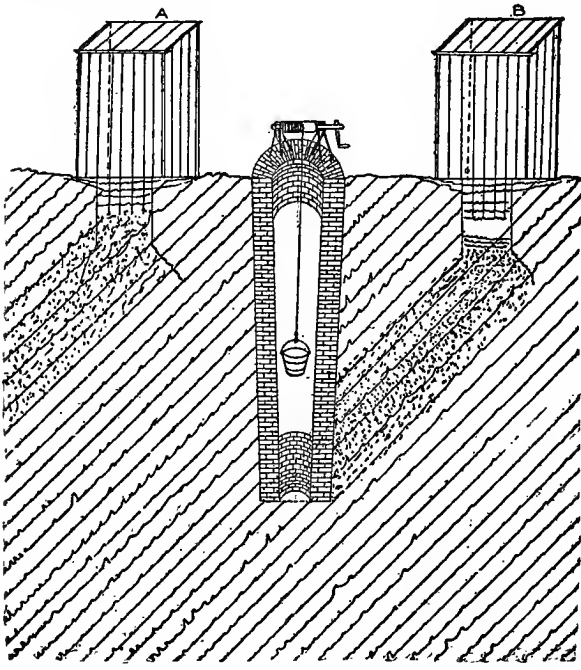

FIG. 4.—Showing relation of purity of water in well to the geological formation.

Ground water, which is the source of the water in the well, is found in the sand or the gravel which overlies clay or impervious stone,

Where the impervious strata are horizontal and the water is drawn from a layer of water-bearing gravel or sand that is separated from the surface by a layer of impervious material, the water will generally be pure. If there be no such layer between the water and the surface, its purity depends upon the condition of the ground about the well. If the strata be tilted on end, the character of the water will depend upon the location of the well with regard to the source of possible contamination. This is shown in the illustration. The tilt of the strata is such that the seepage from "A" will not contaminate the well, but anything thrown into "B" will eventually find its way into it.

Wells which are sunk into limestone formations are to be looked upon as suspicious. They are not infrequently fed from underground reservoirs that draw their water directly from polluted sources through the rifts and crevices which abound in such regions.

A good well is one that is sunk into a water-bearing stratum that is separated from the surface by an impervious layer of clay, slate, or similar material. It is to be curbed, lined with

cement from top to bottom, and provided with a tight fitting cover that has sufficient pitch to throw off all rain-water. The cover must be kept locked at all times, and the water should be drawn through a pump, located several feet away and provided with a gutter through which the waste water will run off. The curb should extend several feet above the grade, and the ground around the well should slope away from it and be covered with cement or with well-rammed clay. A fence had better be built to exclude chickens and other animals, and the watering trough for the cattle should be placed at a distance and, if possible, much lower down than the well. In some localities the latter is lined with boards, but this is objectionable as they soon rot and always harbor rats and insects.

There are places where, for many reasons, it is impossible to obtain water from other than polluted wells. In such a case the natural question is, what can be done to improve the water supply and render it reasonably safe? The answer should be, boil or otherwise sterilize the water. Doctor Koch has suggested the following method of improving the well: Thor-

FIG. 5.—A well in the suburbs of Washington from which a large number of persons draw their drinking water. It receives the surface drainage from the track of a branch of the B. & O. Railroad.

oughly clean it out and as far as possible empty it of water. Next fill it with clean sand to within two feet of the lowest water-level. A large iron pipe with an expanded end is now passed down until it rests upon the sand. The space around the pipe is now filled to the water-level with gravel and the remainder of the well is filled with clean sand. A smaller iron pipe is now passed down the large pipe into the water and a pump attached. This is in reality a sand filter and usually furnishes pure water, but is not always reliable. A somewhat similar method is to use a Norton tube, which consists of a large iron pipe pointed and perforated at the end. This is driven into the water-bearing strata.

In India suspicious wells have been rendered pure by the following method: Dissolve two ounces of permanganate of potash in a bucket of water and lower it into the well. If after an hour the water from the well has a delicate pink color it is fit for drinking, but, on the other hand, if it be clear, the procedure must be repeated until a delicate pink color is obtained. This is not a very safe method of purifying, as the polluted water is continually entering and

will sooner or later use up all the chemical and then the water will be as impure as before.

SPRINGS

Springs are very commonly used for domestic supply, especially in hilly or mountainous country. The water, as it issues from the ground, is generally pure; but very often it is infected from the washings of the surrounding ground, or from dirty vessels which are dipped into it. The purity of the spring depends upon the source of the flow and upon the surroundings. Instances are on record where large springs have communicated directly with polluted marshes on the other side of a mountain.

The appearance of the water is no guarantee of its purity, for not infrequently the most sparkling waters contain impurities of an animal nature very injurious to man. The surroundings of the spring must be under constant inspection lest some privy or cesspool be located over the channel through which it receives its water. Only recently I inspected a spring that had a local reputation for purity and found a most filthy yard and privy located not a hundred yards up the hill.

A properly protected spring should have a curb on all sides and a cover. The curbing should be cement lined and extend several feet above the surface of the ground. A pipe should pass through the wall and carry the water several feet from the spring and be at such a height that a bucket can be placed beneath it. Springs that are walled up on three sides and are approached on the fourth by a flight of steps are no doubt very picturesque but they are most dangerous as they are liable to become polluted by filth carried on the feet of those who draw water.

RAIN-WATER

From the earliest times rain-water has been recognized as pure. This is probably the safest supply for rural districts, provided the rainfall is sufficient. In making estimates for the storage of rain-water we must consider not only the annual fall of rain and snow, but also its distribution throughout the year. Fairly exact data upon this subject can be obtained from the Chief of the Weather Bureau in Washington. The following table shows the quantity of water that will be collected per square foot, for different depths of rainfall.

Rainfall in inches per square inch of surface	Yield in gallons per square foot of roof
.01	.006
.10	.060
1.00	.600
2.00	1.200

A less accurate method of arriving at the probable yield of the roof is to multiply the area of the roof, without regard to slope, by half the average rainfall. The result will be the probable number of gallons the roof will yield. The error in this calculation will amount to about 20 per cent. In all calculations of the area of the roof the slope is not considered.

The cistern in which the water is to be stored may be made of iron, wood, or, as is usual, of stone. If of the latter the walls must be at least eight inches thick and covered on the inside with cement. The bottom is to be of brick laid in cement, and the inside divided into two compartments by a wall, the communication being through an opening in the lower portion. One compartment communicates with the roof, the other with the delivery pipes. The bottom of each compartment is filled with layers of clean sand, coke, and gravel for the purpose of filtering the water, the gravel being on the bottom and the sand on top.

Such a filter, if properly managed, will remove all the suspended dirt and the germs from the water. A gate must be introduced into the pipe leading from the roof to the cistern so that the first portion of the water, which contains the washings from the roof, may be excluded. The overflow pipe must not connect with a sewer or with a cesspool.

We have so far only considered the cistern which is located beneath the ground, this being the usual location. The disadvantages of such a position are many and the only advantage is that it furnishes cooler water. It is at all times liable to have cracks in the wall and thereby become contaminated from the ground water or the cesspool or privy. Trees are also liable to penetrate the walls with their roots. It is strongly advised to place the cistern above ground. At times it is more desirable to place it in the garret. In such a case a wooden or iron one is used, and in making calculations it is to be remembered that a gallon of water weighs 10 pounds, otherwise the load may be too great for the floor. A cistern located in an upper floor allows of modern water fixtures and running water throughout the house. This is

very desirable, but a greater quantity of water must be provided for.

Results just as good can be had by pumping the water to a tank in the garret or to a level higher than the floor in which it is to be used. This may be done by a windmill, but some idea of the velocity of the wind must be obtained before it is installed or it may not be sufficient for the task. The number and duration of calms should be known also. These data can be obtained from the Chief of the Weather Bureau.

Hydraulic rams are cheap and require little attention. They will work even if the water head is as little as eighteen inches. They may be substituted for the windmill.

One of the most satisfactory methods of elevating water is by the pneumatic tank. This consists of air-tight steel into which water is pumped. This compresses the air in the tank and when the pressure becomes sufficient it will force the water to a higher level. Fifteen pounds pressure to the square inch will force the water to a height of thirty-three feet. A pressure of ten pounds will elevate the water twenty-two feet. The pumping may be done

by hand, by a windmill, hydraulic ram, or small engine, depending upon the forces available and the financial condition of the householder.

The advantages of this system are that the water can be supplied to all portions of the house at a low cost and without placing too great a load upon it. The tank may be placed in the cellar or under the ground.

The quantity of water to be stored depends upon the conditions under which it is to be used and the size of the family. Twelve gallons per person is what is generally required for domestic purposes, but where baths are included the quantity should not be less than sixteen gallons per person per day. Where water-closets are used twenty-five gallons will be required. Each cow and horse will use from six to ten gallons per day. Allowing twenty-five gallons per person for a family of five, provision will have to be made for the storage of 3750 gallons per month. The length of time the water will have to be stored depends upon the distribution of the rainfall. Where the number of rainy days and the fall per day is evenly distributed throughout the year the

time will be much less than where there is a well-marked dry season.

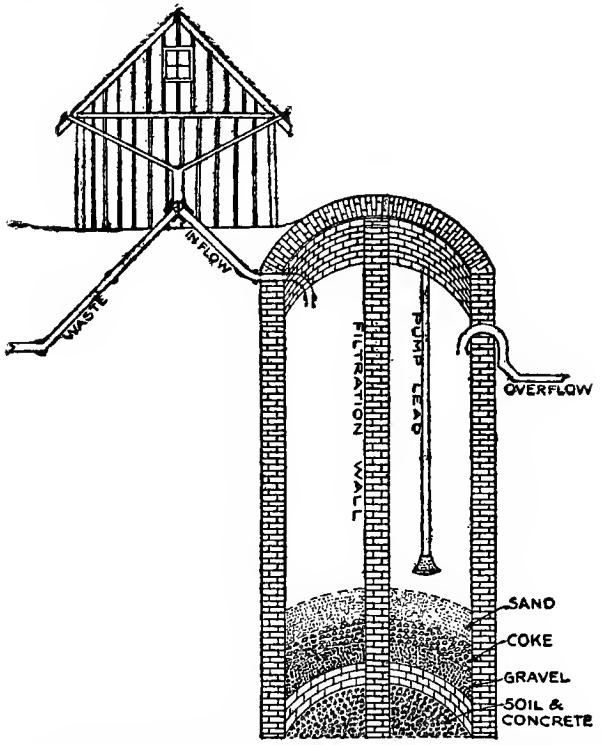

FIG. 6.—Sketch of cistern and filter. There is an open arch in the central wall through which the water after filtering through the sand, coke, and gravel enters the side connected with the pump and ascends through layers of gravel, coke, and sand.

The above sketch shows the manner of constructing a cistern and filter.

ARTESIAN WELLS

These are drilled into the ground until they penetrate a stream of water under sufficient pressure to force it to the surface. They usually furnish pure water but much depends upon the geological formation of the country. In limestone regions one is liable to tap waters that come from polluted sources without the filtration which usually takes place as water passes through the soil. It is well to consult a geologist before beginning such a well, for there are many formations from which it is impossible to obtain water. The depth of the well is no indication of its purity. In the city of Washington, where the dug wells are always polluted, artesian wells which are but one hundred feet deep furnish pure water.

These wells are recommended where it is possible to have them at a cost that is not greater than pure water from some other sources.

SURFACE WATERS

A considerable proportion of our people obtain their water from rivers, lakes, and ponds. In America few of these can be considered pure, and it is wise to consider them all as polluted

unless their purity has been established by careful chemical and bacteriological examination and by a careful inspection of the watershed from which the water comes.

We have been most careless of our streams. As arteries of commerce we have long recognized their value and have spent large sums to keep them navigable, but to assure their purity practically nothing has been spent. But a few years have passed since the Federal Government allowed the city of Chicago to change the course of a small stream and by digging an extensive canal to dump her refuse almost into the water-mains of a rival city. Learned judges and scientists have considered this matter and allowed it, and yet the fact remains that the Mississippi is being polluted by the sewage from Chicago and that the dwellers on the banks of the canal are in danger of contracting typhoid fever and other diseases from what Chicago calls a great improvement. Reports from Chicago would lead us to believe that there is no danger to the dwellers on the banks of the canal, and yet recent studies made in the city of New York have shown that it is not safe for a community to dump its unpuri-

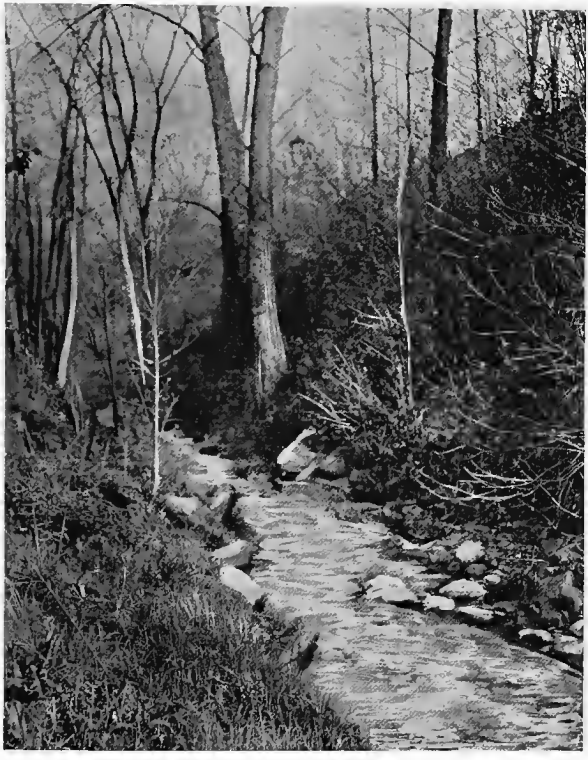

FIG. 7.—The babbling brook. Cool and inviting the wayfarer to quench his thirst. This stream receives the drainage from a number of privies and manure piles but a short distance above this point.

FIG. 8 —Railroad crossing Cochituate Lake from which comes part of the water supply of Boston. The drainage from the tracks is directly into the lake.

fied sewage into neighboring watercourses. D. D. Jackson, working for the Merchant's Association, found that there is a belt of the city in the vicinity of the openings of the sewers where typhoid fever is especially prevalent. He trapped flies in this area and found that they carried the germs on their bodies. That flies are one of the most usual ways of spreading typhoid fever is no longer doubted.

The dumping of sewage into running water, or any water for that matter, is not only a danger to the health of the community but also a direct loss to the community. The refuse from our bodies represents fertilizer, which, if applied to the land in a scientific manner, would make many of the abandoned farms rich. This can be done without great expense and without danger to the community, and it is time the rural voters, who hold the power in the affairs of this country, should insist on legislation that will prevent the cities from polluting the waters of the rivers which flow past their homes. That this may not seem an idle dream I may say that the health officer of the Philippine Islands tells me that not one drop of polluted water from the sewers of

Manila is emptied into any watercourse until it has been purified.

Water from rivers, lakes, and ponds is usually stored in reservoirs before being used. It has been proven that water stored in such places tends to purify itself if allowed to stand for sufficient time. It is rarely possible to keep water long enough to accomplish this, but its quality is decidedly better for even a short storage. Reservoirs are not practicable for small communities because of their cost, but by combining resources the inhabitants of a thickly populated district should be able to provide such a system. The communities in the vicinity of Boston are supplied in this way.

Before work is begun on a reservoir it is necessary to have the entire question gone over by a competent engineer, who should study the drainage area from which the supply is to come and also the character of the water. In many instances pure water will not be obtained without the use of a filter bed. This latter furnishes the best water in the world.

Not infrequently scum of different colors forms on water that is stored in reservoirs, and at times it forms in the pipes and closes

them entirely. This is caused by a minute plant which generally does no harm, but in some instances imparts an unpleasant odor to the water. There are reasons to believe that the use of such water for drinking may cause or aggravate diseases of the stomach or intestines, especially in young children. This growth may be gotten rid of by dissolving in water sufficient sulphate of copper (bluestone) to make a solution of the strength of one part of the copper to four million parts of water, or about one grain to sixty gallons. In practice this may be accomplished by placing several pounds of the bluestone in a sack and drawing it over the surface of the water. The quantity of copper is so small that there is no danger of poisoning.

Many communities and private individuals are obtaining impure water from ponds or rivers, when by extending the intake pipe further from the shore a much better water could be obtained. In general, drinking water should be taken from a point where there is a swift current, and eddies should be avoided.

In regions where irrigation is practiced there is more typhoid fever than in similar sections where there is no irrigation. This is without

doubt due to the rather common practice of drinking from the ditches. Irrigation also raises the level of the ground water to such a height that it is more readily contaminated, thus rendering the water from wells in such regions less pure.

There is little doubt that the tramps and other vagabonds who wander about the country, spending the night wherever darkness overtakes them, not infrequently contaminate the water supply. They are liable to relieve themselves upon the banks of the reservoir and many of them must at some time or other be infected with typhoid. Camps of workmen and soldiers are also a danger, and the community, through its health authorities, should see that this danger is reduced to the lowest possible terms. Each community has a right to protect itself and each should see that any campers who come into the neighborhood observe proper precautions regarding the disposal of their excreta and refuse. A recent epidemic of typhoid fever in Poughkeepsie, N. Y., was traced to a camp of workmen on the water-shed of the reservoir from which the town was supplied. In 1903 there was an epidemic of typhoid

fever in Ithaca, N. Y., about 10 per cent. of the people were attacked and it cost the citizens of the town about two dollars each to suppress it. The New York Department of Health believes that this epidemic was started from a case which occurred in a camp of laborers stationed on the bank of one of the streams from which the city obtained its water.

Our military camps in 1898 spread much typhoid among the civilian population in their vicinity.

The present method of disposal of the excreta from our railroad trains is a constant danger to the community. One can very readily imagine a person in the early stages of typhoid fever or one with cholera using the closet and scattering the germs along the track for miles. Probably some of the excrement will find its way into a water supply. The railroads should be made to adopt some better and safer method of disposal.

WATER FOR ANIMALS

Pure water is also a necessity for cattle and other domestic animals. It has been proven that hog cholera can be disseminated by impure water. The following diseases of animals

are said to be transmitted through the agency of impure water: twisted stomach worm, nodular disease, paper skin, liver flukes, lung worms in sheep, and worms in horses, hogs, and cattle.

SIMPLE TESTS FOR PURE WATER

There are a few simple tests which give some idea of the quality of water.

One of the simplest is to partially fill a bottle with water that has a temperature of from 70°–80° and shake it vigorously for several minutes. If on removing the cork there is an unpleasant odor, the water is to be condemned.

A more reliable test is to make a solution of one part of permanganate of potash to one thousand parts of water and place a few drops of the solution in the water to be tested. If the water remains pinkish, it is free from organic matter, but if, on the other hand, the color entirely disappears, the water is to be condemned.

These tests are only rough and are intended to be used in emergencies. It is now possible in almost every State to have the water examined by the State Board of Health.

PURIFICATION OF WATER

The most satisfactory way to purify a water is to pass it through a sand filter. These filters are costly and the individual who has to use a suspicious water must adopt some other method. The domestic filters, of which there are a large number on the market, are very satisfactory in the laboratory but in actual use they are not to be relied upon. The most satisfactory way to purify water for domestic purposes is to heat it to 212° (boiling point of water). This can be accomplished by boiling for twenty minutes (not heating but actually bubbling). The Forbes sterilizer is a machine which boils water at the lowest possible cost with practically complete destruction of all germs. The following description is furnished by the manufacturers:

PRINCIPLE OF OPERATION OF THE FORBES WATER STERILIZER

The workings of the sterilizer are shown in the following diagram: 1 shows a water tank with a pipe (2) through which the raw or unsterilized water enters and is allowed to fill the tank up to the level x, but no higher, as it is restrained by the float-actuated valve

shown in the tank. Should the water for any cause whatsoever, rise above the level *x*, the excess will flow off through the waste pipe 3. Starting from the water tank 1, in which the water has a fixed level, the raw water flows

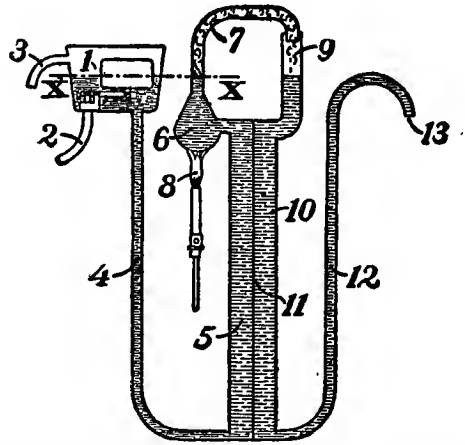

FIG. 9.—Forbes water sterilizer, from a cut furnished by the Forbes Company. (From Brewer's "Personal Hygiene in Tropical and Subtropical Countries.")

down through pipe 4, then up through compartment 5 into the heater 6, and up the tube 7 until it reaches the level *x*. Above this it is impossible for the water to go under natural conditions.

The burner 8 is now lighted and heat is applied under the heater 6, which causes the water

in the heater to boil and in boiling to rise in the tube 7 and overflow into cup 9. It is impossible for any raw water to pass from 7 to 9. The water is boiled for a fraction of a second, and once the water has passed through the tube 7 it is removed from where heat can reach it.

When the water has boiled over as stated above, the level in the heater 6 and in the tank 1 is lowered, and more raw water flows in, filling the tank to the level *x*.

The water continues to boil over into cup 9, quickly filling compartment 10, where it loses its heat to the cold water on the other side of the thin metal partition 11. When 10 is filled the water rises up in the pipe 12 and flows away through the pipe 13.

The manufacturers claim that the water discharged through 13 is but three degrees warmer than the water that is supplied to tank 1.

Where kerosene oil costs eight cents per gallon one hundred quarts of water can be sterilized for one cent.

Water that has been sterilized by heat must be cooled, but it is not wise to place ice in it. Even though the ice be made from distilled

water it is more than likely that it has been polluted before it reaches your box. By placing the water in bottles on the ice, it will be cooled sufficiently to make it suitable for drinking. Water that contains ice is too cold and not healthful.

SUMMARY

We may summarize what has been said in the previous pages about water as follows:

Use cisterns where the rainfall is sufficient.

Use artesian wells when possible.

Use springs if from deep sources, when properly protected and when they have been shown to be pure by official tests.

Use river, lake, or pond water when it has been passed through a filter bed or when it comes from a sparsely inhabited area and has been shown to be pure by official test.

The well is to be condemned.

In all cases where there is uncertainty as to the purity of the water boil it or otherwise sterilize it.

V.

DISPOSAL OF EXCRETA

THE disposal of excreta of the human race has been a question before the public since the Jewish exodus from Egypt. At that time Moses, the great sanitarian of the Children of Israel, instructed them to void their excrement without the camp and to cover it with earth. Under the same conditions, at the beginning of the twentieth century, we can find no better system for a nomadic people.

True economy demands that all the excreta from man and animals, both liquid and solid, should as soon as possible be returned to the soil to replace the nitrogen and other elements abstracted therefrom by the growing vegetation. The Chinese and the Japanese have long recognized this and have developed their methods of disposal so that none of these valuable fertilizers are lost. In our country the reverse is the case. At great expense our people construct sewers which dump their refuse into

the nearest watercourse, thereby losing its value as fertilizer and at the same time polluting the waters, turning the bays, rivers, lakes, and ponds, which should be for the refreshing and recreation of the people, into huge cesspools.

This pernicious system has grown year by year until nearly all of our waters are polluted. The sanitarians have apparently been satisfied with this method until the last few years, when we have occasionally heard a word against it. During the past year the Merchant's Association of the city of New York began to look into the matter. As a result of their study of the conditions that obtain in New York Bay, it has been learned that the practice of discharging sewage into rivers is not only dangerous to those living further down the stream, but that the city itself suffers from the pollution. Their expert found areas around the mouths of the metropolitan sewers where typhoid fever was very prevalent. Further investigation showed that the shores and the piling under the docks near the mouths of the sewers were covered with excrement, and that flies caught in such localities swarmed with germs derived from the human intestines.

Disposal of Excreta

The Hudson River, which we look upon as picturesque and attractive, is in reality a great sewer, carrying the excrement of over 210,000 persons, and one part in every three hundred parts of water is derived from the sewers which empty into it. Many of the smaller streams in the country are as bad and some are much worse.

In the endeavor to solve the problem of the proper disposal of the excreta from human beings we must aim to conserve as much of it as a fertilizer as possible, and at the same time the health of the community must be guarded with greatest care. The method of disposal must vary with the local conditions, and it is therefore impossible to recommend any one system which will answer for all cases. We shall therefore in this section discuss the methods usually employed, endeavoring to point out their good and bad features, condemning those which are unsanitary, and leaving to the individual the choice of the one which is most suited to the needs of his particular locality. The following will be considered: privies, cesspools, water carriage system, sewage farming, Waring's system, septic tanks, dry earth system, pail system.

Savage races have no fixed place for voiding their fæces; each individual chooses the place most to his convenience and passes his fæces on the ground regardless of the rest of the community. Where the inhabitants are widely scattered this causes but little nuisance, but there is always danger of polluting the water and infecting food through the medium of flies.

PRIVIES

The privy is the first improvement that makes its appearance as man becomes civilized. Every one is more or less familiar with it. It is to be condemned from every point of view. It is offensive from the odor, it is the breeding place for millions of flies, and a source from which the wells and cisterns become polluted. Particularly dangerous is the privy which is placed over running water or an abandoned well, especially the latter, as the connection with the water supplying the other wells is direct. The flies which breed in the privy will sooner or later find their way into the dining-room or kitchen, bringing on their feet any germs that may have been in the fæces. Should a person with typhoid fever, cholera, or dysen-

tery use the privy, there would without doubt be cases among the inhabitants of the house.

CESSPOOLS

These are also condemned because they are very dangerous. Frequently they are but excavations in the ground, bricked up to prevent the sides from caving in; in other cases they are built of stone or brick and lined with cement. In the first class the liquids drain away and eventually find their way into the wells in the vicinity. In the latter case they have to be emptied at frequent intervals, which means soiling the ground in their vicinity and a most disagreeable odor. In many cases the walls become cracked and the fluids leak away, polluting both the ground and the water.

WATER CARRIAGE

This presupposes that there is running water and modern plumbing in the house, properly trapped and ventilated. These methods are too well understood to require repetition here. In this system the sewage leaves the house in pipes, being carried a longer or shorter distance and discharged into some running water, a

lake, or the sea. This method is neither to the advantage of the individual nor the public. By its use we have turned our rivers, lakes, and bays into great cesspools. From an economical point of view it is the means of impoverishing the nation to the extent of thousands of tons of the most valuable fertilizer. The time is not far off when our people will have to recognize this and prohibit the waste.

SEWAGE FARMING, WARING'S SYSTEM, AND SEPTIC TANKS

These are considered together for they are now generally combined in all the modern sewage farms.

Sewage farming, in some of its different forms, is the most satisfactory method of disposal of the excreta of human beings. It is the nearest approach to the ideal, both from the sanitary and from the economical standpoints.

For its operation, running water must be introduced into the house and modern plumbing is required. An expert must make the installation and only reliable workmen should be employed. Work that is done by first-class workmen and of first-class materials will

last a long time and the cost of repairs will be reduced to a minimum.

The system that goes by the name of the late Colonel Waring was first used by the Rev. Mr. Moule but was extended and perfected by Colonel Waring. He conducted the drain

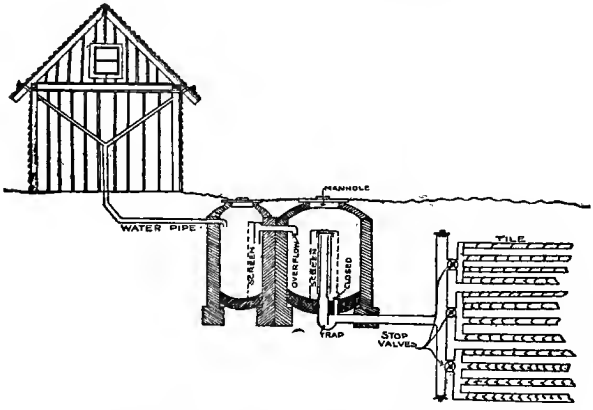

FIG. 10.—Sewage disposal plant, septic tank, and irrigation plant.

pipes into a reservoir provided with an automatic siphon by which it is emptied. From the reservoir the sewage is conducted by open joint pipes, placed ten inches below the ground, to a garden or field. To provide for an intermittent flow through the pipes, three sets are laid and the flow regulated by a gate, so that

the soil fed by each set of pipes can have at least twenty-four hours to dispose of the sewage distributed to it. On either side of the pipes the ground is made into a garden or lawn and planted with grass or root crops. The success of the system depends upon the capacity of the soil to absorb moisture and upon the power of the bacteria of the soil to break up the organic matter in the sewage. A rich garden soil is the most suitable. Where there is plenty of land the pipes may be dispensed with and the sewage conducted through open trenches. The reservoir should provide storage for fifty-nine gallons per person, and in the best soils one hundred feet of piping is to be provided for each fifty gallons to be disposed of.

The system works well in winter as the liquid is warm enough to keep from freezing and to melt frozen soil.

Not all soils are suitable for irrigation and it is often advisable to combine the septic tank with the Waring system. In fact the septic tank is desirable in all cases unless the quantity of sewage to be disposed of is very small.

When this is used the water from the house

passes into a large covered tank where the solids are deposited and slowly broken up. The liquids fill the tank and overflow into other tanks, finally passing into the flushing tank. The rest of the system is similar to that previously described. In the tanks the organic matter and the germs of disease are destroyed by the bacteria which grow in the sewage.

The cost of such a plant depends upon the price of the materials used.

DRY EARTH SYSTEM

If properly managed this is a most satisfactory system, from a sanitary as well as from an economical point of view. Unfortunately the management requires more attention to details than the ordinary person is willing to give to it. In cold weather the liquid portion of the excreta is liable to freeze, which seriously interferes with the working of the closet. It can, however, be managed even in a cold climate so as to cause no nuisance and at the same time be perfectly convenient and sanitary. Doctor Bashore has used one for many years and has always found it satisfactory.

This is one of the oldest methods of disposal

of which we have any record. As developed by modern sanitarians the excreta are passed into galvanized iron drawers or buckets which contain a few inches of dry earth, each person covering his stool as soon as passed. Some closets aim to have separate containers for

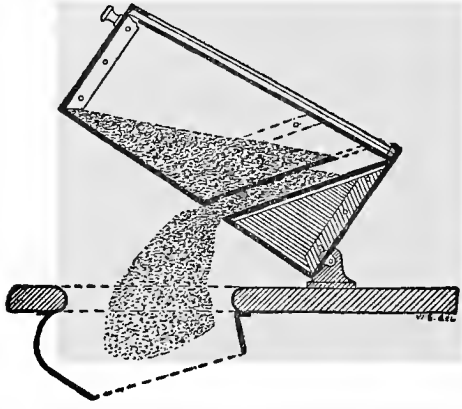

FIG. 11.—Self-acting peat-dust closet. The lid is replaced by a hinged reservoir containing the peat dust. Whenever this is let down a certain quantity of peat dust is discharged automatically and thrown upon the night soil. (From Weyl's Handbuch der Hygiene. II, p. 315.) (From Smith's "Sewage Disposal on the Farm," Farmer's Bulletin 43, United States Department of Agriculture.)

liquids and solids, but this is not necessary provided there is sufficient earth placed in the drawer to absorb all the urine.

The drawers must fit close up under the seat and be several inches larger than the hole. An automatic device, as shown in the cut, may

be provided for distributing the earth, but this is not necessary if each person will at once cover his or her stool. The earth can be kept in boxes or buckets, a tin can with handle or grocer's scoop being provided for distributing it.

The best substance for covering the stool is peat or loam from a well-cultivated garden. Clay, ashes, and sand are the least desirable. Whatever the substance used, it must be finely pulverized and very dry, but under no circumstances should artificial heat be used since it kills the nitrifying germs of the soil upon which the efficiency of the system depends. For the same reason no disinfectant is to be used.

It has been ascertained that about a pound of earth per person per day will be required to successfully operate the closet. This means nine hundred pounds per year for a family of five. The quantity sufficient for the needs of the house should be collected, dried, and stored during the dry season. Where peat can be had it should be used, provided the cost is not too great.

The drawers should be emptied at least once daily, the contents being buried under not more

than ten inches of soil. Doctor Bashore has used a plot of ground twenty by sixteen feet for the past ten years, burying in it the fæces and kitchen refuse from a family of four without causing odor or in any way polluting the water supply.

There should be duplicate drawers or buckets so that the soiled ones may be thoroughly washed and sunned before being used again.

The system looks nice on paper but there are many disadvantages about it. The most important is the inability to get all persons to cover their stools. The freezing of the urine can be obviated by placing the closet in a room that is heated. Did the system work automatically it would be ideal, but as it requires the co-operation of so many users, it generally fails.

The disposal of urine is a matter of considerable importance, especially where there are many workmen. In such places it is necessary to provide urinals apart from the closets used for the solid excreta. Doctor Poor has apparently solved this problem by filling a bag with six pounds of sawdust and having the urine passed into it. In the course of two

months thirty-nine pounds of urine were passed into the bag, which became very rotten but was free from odor and the liquid which filtered through it caused no nuisance. This sawdust could be buried in the garden and would be a valuable fertilizer, as urine contains a large amount of nitrogen.

PAIL SYSTEM

In this system the drawers of the dry earth closet are replaced by pails which are removed once or twice daily, dumped, and sunned, a clean pail being substituted for the soiled one. It is open to many of the objections of the dry earth closet and lacks some of its advantages.

The pails are made of galvanized iron, zinc, or wood, and should be oval in shape. They are to be washed with milk of lime each time they are emptied.

The contents of the pails are to be disposed of in the same manner as the excreta from the dry earth closet.

This system does not seem to meet the requirements of our civilization.

There is one danger to which the rural and the city dwellers are exposed, over which at

present they have no power. That is the contamination of the ground and the water supply by the excrement of persons travelling by train. To say the least the present method in use by railroads is most filthy, and when we consider that in many instances the tracks cross streams which feed reservoirs and that not a few trains pass through the streets of cities and villages, it can be readily seen how such practices may be the starting point of serious epidemics of typhoid or similar diseases. The rural voters hold the balance of power in this country and if they will insist upon it the corporations interested will be compelled to adopt a more sanitary method of disposal of the refuse and excreta from their trains.

The disposal of the excreta from animals will be considered under the heading of manure.

VI.

FOOD AND DIET

Food is anything which, when taken into the body directly or indirectly, builds up its structure, repairs waste, or produces energy in any form.

In order to determine the value of foods students of the subject have established certain standards of measurement which have for their basis the calorie or the amount of heat required to raise the temperature of one cubic centimetre (one-fourth of a teaspoonful) of water one degree. It has been ascertained that a strong man at hard work requires sufficient food to produce 3054.6 calories per day.

The foods available for the nourishment of the body are divided into four classes: proteids, or tissue formers (eggs, beef, fish, and a large part of beans and peas); carbohydrates, or heat and energy producers (sugar, starch, cereals, and the root crops); fats, heat and energy producers (the fat portion of beef, the oils both

from the animal and vegetable kingdoms); inorganic substances, such as salt and water, which aid the body in utilizing the other foods.

No one of the different classes of food is alone able to support life. Man has learned by experience that a mixed diet only will maintain the body in perfect condition and science has confirmed these practical observations. Recently certain students have stated that, as a nation, we consume more food than is necessary, especially meats. They have kept men at hard work and in perfect health for many months on a diet which would seem starvation to most persons. Convincing as these experiments appear, it seems best that each man should regulate the amount of food eaten by the nature of the work done, and that the appetite regulated by reason is, at present, the best guide for the diet of the individual. There is no doubt that many of our people eat more than they require, especially those whose work is sedentary. In this class are the excessively fat and corpulent, who, by their over indulgence in food, are shortening their lives, besides depriving themselves of much pleasure.

The following table shows the relation be-

tween height and weight at different ages, based on the results of life-insurance examinations. These are not to be considered hard and fast, but any marked departure therefrom should put the person on guard. The heights are with the shoes on and the weights with the clothing on, but without overcoat.

Height.	Age.—15–24	30–34	40–44	50–54
5 ft. 0 in.	120	128	133	134
5 " 1 "	122	129	134	136
5 " 2 "	124	131	136	138
5 " 3 "	127	134	139	141
5 " 4 "	131	138	143	145
5 " 5 "	134	141	146	149
5 " 6 "	138	145	150	153
5 " 7 "	142	150	155	158
5 " 8 "	146	154	160	163
5 " 9 "	150	159	165	167
5 " 10 "	154	164	170	172
5 " 11 "	159	169	175	177
6 " 0 "	165	175	180	182
6 " 1 "	170	181	186	188
6 " 2 "	176	188	194	194
6 " 3 "	181	195	203	201

As a nation we eat too fast, drink too much water at meals, and do not chew our food sufficiently. All these errors cause indigestion, but of the three failure to chew is probably the most serious. The first step in the digestion of food is accomplished in the mouth, the

secretions of which help to soften the food and also change the carbohydrates into products that are absorbable by the tissues. Mr. Horace Fletcher has for years been preaching to us about chewing our food. He maintains that by so doing the quantity eaten will be reduced and at the same time the body will be better able to do its work. After nine years on a restricted diet, during which time he has chewed persistently, he was tested in the gymnasium of Yale University and his endurance was double that of the best trained men there, although he had not been in training and was fifty-nine years of age. Whether others can equal his work on the same diet or not, there is no question of the beneficial results of thoroughly masticating the food.

ECONOMY IN DIET

This is a matter of little importance to a few of our people, but to the great majority it is necessary to make their money go as far as possible. To them it is a matter of great importance to obtain the best diet possible and that most suited to the needs of the family with the least expenditure. Doctor O. W. Atwater,

who made this question an especial study for many years, speaks in the following language:

"Scientific research, interpreting the observations of practical life, indicates that a fourfold mistake in food economy is very commonly made. First, the costlier kinds of food are used when the less expensive are just as nutritious and can be made nearly or quite as palatable. Second, the diet is apt to be one-sided, in that foods are used which furnish relatively too many fuel ingredients (*fats*, *sugars*, and *starches*) and too little of the flesh-forming material. Third, excessive quantities of food are used; part of the excess is eaten, often to the detriment of health; part is thrown away in the table- and kitchen-waste. Finally serious errors in cooking are committed."

The Department of Agriculture has for some years been studying the foods available for use by our people and in the "Year Book for 1902" will be found a summary of the results, giving the values of our food products as regards the nutriment they furnish. In these studies it has been shown that ten cents spent for flour, beans, or salt fish will nourish the body better than fifty cents expended on

tenderloin steak, lobsters, or fresh salmon. In this connection it must be remembered that man's appetite must be taken into account and that it is impossible for him to live on the same kind of food day after day, and that the desserts and many other articles which furnish very little nutriment are of value in stimulating the appetite.

Faulty cooking is one of the greatest evils under which our race lives. The poor have their food undercooked or improperly cooked, while the rich live on highly seasoned and delicately prepared foods which very often produce serious disturbances of the digestion. Fried foods and other greasy dishes cause a great deal of indigestion. There is little doubt that much of the drunkenness in the world is the direct result of lack of proper nourishment, caused by bad cooking and unpalatable food.

Ignorance and improper methods are responsible for much of the faulty cooking. Mr. Edward Atkinson, who made a study of cooking, found that a large portion of the time devoted to it was consumed in endeavoring to overcome the faults of the modern stove. In general the great fault was found to be the

inability to regulate the heat and the tendency to have the fire too hot. He therefore applied himself to the problem of overcoming the faults of the stove, and as a result devised a method of cooking by a moderate degree of heat in an insulated oven. The heat in his method is applied by means of a lamp placed under the oven, the latter being enclosed in an insulated box. The oven when constructed costs considerably more than an ordinary stove, but one can be improvised from a tin box placed inside a packing box that is lined with tin. The name of the stove is the Aladdin and it can be operated at a cost very much below that of any other stove. This invention has not been used as much as it should, but with the development of electricity this, or a similar method, will undoubtedly become popular.

The fireless cookers, of which there are a great number on the market, are great labor-saving devices and an aid to those who cannot afford an expensive cook. With further development they will become very popular. The name is not correct, for it is necessary to partially cook the food over an ordinary fire, after which it is placed in an air-tight box

lined with a substance that will not radiate heat. Food placed in such a box will slowly cook and at the same time retain all the aromas which are lost in the ordinary methods of preparing food. Any person can make such a cooker from articles on the farm, straw being a most excellent insulating material.

The great difficulty with the fireless cooker and other similar devices is that there is no provision for hot water, which is a necessity in the modern household. In the winter months the kitchen fire also heats a portion of the house and for that reason it cannot be dispensed with until some other source of heat is provided.

MEATS

Good meat is of a uniform color and is neither pale nor purplish. The feel is firm and elastic with an absence of pitting and crackling. The odor should be very slight, and meat that has the slightest odor of decomposition must be condemned. The cut section should barely moisten the finger. Meat that is decomposing becomes moist upon exposure to the air. Bull beef is darker and has a stronger flavor than that from cows or steers.

Beef and mutton are more readily digested than is pork. The fancy cuts of beef appeal to the palate, but when expense is considered they are far inferior to the round and other despised portions. Tough meat has the advantage that it must be thoroughly masticated, which is good for the digestion and also for the teeth. It is said by some dental surgeons that one of the causes of the decay of our teeth is lack of use. It is said that tough beef can be rendered tender by being placed in equal portions of olive oil and vinegar and kept on the ice for several hours.

Flesh from diseased animals has been eaten in many instances, especially that of those dead from tuberculosis and anthrax, yet in most cases the result has been disastrous and it is in the long run best to condemn all such carcasses. The Federal meat inspectors are allowed under certain circumstances, to pass meat from diseased animals, and those who desire to know the conditions under which this is done are advised to consult the latest instructions of the Department on the subject.

When meat or fish has undergone decomposition, poisons are developed which no amount

of cooking can destroy. These are the result of germ growth and are very dangerous. Not infrequently flesh which appears to be fresh contains these poisons and it is wise to refrain from using any meat or fish about which there is any suspicion.

Tape-worms, trichinæ, and other parasites are transmitted to man through the flesh of animals. They may be killed by thorough cooking but no amount of smoking or pickling will destroy them. It is wise to refrain from eating raw or underdone meat unless it is known to be free from these parasites. This subject will be considered more in detail under the subject of parasites.

FISH

As regards digestibility fish occupies about the same place as beef, but there is great difference in this respect between the several kinds of fish. Those which contain a considerable quantity of fat, such as the salmon, are less readily digested than are those with white meat. There are many prejudices against fish, most of which are without foundation. In common with other foods they are only fit for consumption when perfectly fresh. When

taken from polluted waters they are liable to cause disease. This is especially true of the shell-fish. Many epidemics of typhoid fever have been traced to the use of oysters or clams which had been fattened at the mouths of sewers. Ordinary cooking, especially steaming or making into soup, will not kill the germs contained in shell-fish.

As long as the fish is firm and free from odor of decomposition it is fit for food, but should it crush under gentle pressure or have the slightest suspicion of the odor of decomposition it must be rejected at once. Fish that are killed as soon as taken from the water keep better than those which are allowed to slowly die.

CANNED FOODS

Canned foods enter largely into the dietary of our people, especially during the winter months. When properly preserved they are excellent substitutes for the fresh articles, but a steady diet of such food not infrequently leads to indigestion and loss of appetite. It is said by some that foods that have been canned for a long time undergo some chemical change which renders them unfit for consumption,

and that their use may cause symptoms of poisoning. Such cases are generally reported from labor camps and tramp steamers the supplies of which are purchased in remote parts of the globe and from the cheapest sources. Well-prepared canned foods have been eaten in the Arctic regions after many years, and it is believed that the products of reliable houses will keep indefinitely.

Cans that are battered or that bulge at the ends are to be rejected, as the contents have generally undergone fermentation.

Poisonous chemicals are rarely used in the process of preserving foods. The recent Federal food laws, supplemented by those of the several States, seem to be a safeguard against adulteration and improper method of preserving.

There are occasional cases of metallic poisoning from the action upon the can of the acids in the foods; this rarely occurs except with the products of inferior factories. The author has never seen a case of such poisoning.

Smoked and salted foods are much used and are wholesome when properly cured. It is to be remembered that no process will make a bad article good and that salting and smoking

will not kill the parasites of trichina or of tapeworms when they are in the beef or pork.

PREPARED FOODS

Many of our people are purchasing the breakfast foods so widely advertised under the impression that they contain a larger amount of nutriment than do similar articles sold in the market without the fancy names. This is not the fact, for they are all predigested cereals, and, while such foods may be of service in cases of sickness, a healthy person does not require to have his food predigested. When such diet is used it eventually results in weakening of the secretions of the stomach and so causes ill health. The oatmeal, hominy, and rice sold in the stores as such are as good as the more expensive articles made from the same ingredients but sold under high-sounding names.

Beef extract is another article about which there is a popular misconception. Some years ago the papers contained the statement that the nutriment from an entire beef had been condensed in a small can. These advertisements have disappeared, but many persons believe that beef extract is a particularly strong prepa-

ration of beef. The fact is that, like all such fluids, it contains only the extractives from the meat and is in no sense nourishing. It is a stimulant and is of value as such but not as food.

CEREALS

In our modern dietary, cereals are represented by oatmeal, cracked wheat, hominy, and rice, and are largely used by those in moderate circumstances. They belong to the class of energy- and heat-producers, and when used in excess produce fat, but, being lacking in the tissue-producing elements, the body is badly nourished.

LEGUMENS

These are represented by the beans and peas and are rich in the tissue-producing elements. They should be more generally used, especially as meat has become so expensive that many cannot afford to buy it.

ROOT CROPS

The root crops consist largely of starch and sugar, especially the potato and beet, which are the most used. Some of them, such as the carrot, parsnip, and radish, contain large

amounts of extractives and very little nourishment, but they are useful as relishes.

GREEN VEGETABLES

The green vegetables contain acids and salts which are of value as relishes and also prevent scurvy. They deserve to be more generally used.

FRUITS

Fruits are very palatable and consist largely of acids and sugar. They stimulate the appetite and are laxatives.

NUTS

Nuts contain some fat and some of the tissue-producing elements, and, although not so readily digested as are the other fats, are, nevertheless, valuable articles of food, and the American people should make more use of these natural products. Almonds, chestnuts, peanuts, and cocoanuts are the ones most commonly found in our markets.

STIMULANTS

Coffee and tea are stimulants that are probably used in excess by many of our people, and

there is little doubt that they contribute to the nervous disease from which our race suffers. Used in excess they also cause disorders of digestion, yet compared with other stimulants their harm is insignificant.

Cocoa, as made in this country, is both nourishing and stimulating, but there are persons with whom it does not agree. Probably in many such cases, by diminishing the quantity of sugar and milk used, the difficulty can be overcome.

The question of alcohol has been considered in another section; it is sufficient here to say that it is a drug which may in a slight degree contribute to the nutrition of the body, but that its bad effects are so much greater than its good ones that it should be considered only as a drug and used as such. It is more dangerous to the community than morphine and cocaine and its sale should be restricted in the same way. This can only be accomplished by education of the public. The recent movements in the south and west certainly appear to indicate that this may be accomplished in the near future.

GARBAGE, SLOPS, AND OTHER REFUSE

The garbage from the kitchen is usually fed to the chickens or hogs. If properly done this practice results in no nuisance, nor it is unsanitary; but when it is thrown on the ground, and the uneaten portions are allowed to accumulate, it becomes a breeding place for flies and is unsanitary in other ways. Probably the most satisfactory method of caring for this class of refuse is to bury it in the garden, covering it with not more than ten inches of soil. A very small plot of ground will care for that from a large family, and by turning up one or two spades of earth it can be covered each day. If promptly covered it will neither cause an odor nor will it become the breeding place for flies. Burning the garbage is rarely satisfactory because of the odor; it is also an unnecessary waste of fertilizer.

Slops may be emptied into the drains of the Waring system, or where this has not been installed they may be strained through some straw and the liquid allowed to run through a perforated gutter into the garden. On either side of the gutter should be planted shrubs or vegetables. The ground on which the water

runs should be raked over each day. The straw through which the slops have passed should be burned or buried as soon as it begins to accumulate filth.

In some localities the slops are run through a pipe into a trench that has been partially filled with broken stone and covered with a few inches of earth.

Around a country house there is always a considerable quantity of solid refuse, such as tin cans, paper, old shoes, broken crockery, and bottles. Those for which there is a sale should be saved for the junk dealer. The others must be disposed of in such a manner that they will not become a nuisance. Those portions which are combustible should be burned. Ashes may be used for walks or for filling low ground. Cans must never be thrown about, as they collect water and become the breeding places for mosquitoes. They are best burned and then used with the ashes for filling.

It is well to provide receptacles for the different classes of rubbish so that there will be no difficulty in sorting it. This may be accomplished by hanging sacks on hoops or iron supports.

VII.

WINES, WHISKEY, AND OTHER ALCOHOLIC DRINKS

THE temperance question has been before the country for a long time and until the last few years seemed to be making no headway, but the elections of 1907 in the south showed that in that section at least, a majority of the voters favored sobriety.

All persons will agree that the abuse of alcohol, whether in the form of whiskey, beer, or other drinks, causes more misery than all the other evils combined. The burden of this generally falls upon the women and children or upon those least able to bear it. Whether we believe in total abstinence or not, most persons are agreed that moderation is desirable. Few persons desire to have a saloon located next to their residences or places of business.

The real status of alcohol is that it is a drug, and should be so considered both by the public and before the law. When first taken into the body it exalts the nervous system and stimu-

lates the circulation. This is soon followed by a depressed condition, and if the dose be sufficiently large there are loss of coördination and self-control, reduced ability to withstand cold, and lessened capacity for hard work.

The use of alcohol as a drug is diminishing every year. There are undoubtedly times when moderate stimulation by alcohol may be desirable, but this is a question for the physician who is confronted by the condition. As a rule our people are better off without the use of alcohol even in the shape of wines taken at meals.

As our American society is constituted, we have a large number of persons who drink alcohol in some form or other; many use it in moderation, but the number who indulge to excess is very large and is constantly being recruited from the moderate drinkers. This we cannot stop at once, so it becomes necessary to study the matter, hoping thereby to be able to remove some of the causes which lead so many of our people to poison themselves with alcohol.

My observations, based upon association with all classes of persons in all parts of the

country, have caused me to believe that the following are some of the reasons why men drink:

1. Most men are socially inclined, and a glass of liquor taken with friends promotes good fellowship and stimulates the flow of conversation for a time. Later it often causes quarrelling.

2. Many of our people are undernourished and drink because they feel the need of a stimulant to carry them through their day's labor. This lack of nourishment is due to the cost of food, bad cooking, and the lack of knowledge of domestic economy.

3. Many young men have no place to spend their evenings. If poor, they live in partly furnished rooms that are cold and cheerless, and the only warm and cheerful place where they are welcome is the saloon. Here they find company and their welcome lasts as long as they make an occasional purchase.

4. Many a hard worker is unable to throw off the cares of business when the office closes and takes home with him the troubles of the day. This man finds that indulgence in alcoholic drinks cheers him up and allows him the

relaxation he desires. These are the hardest cases to manage.

5. Many men are social outcasts, not because of any offence they have committed, but because of diffidence and lack of training they are afraid to mingle with the society of the locality in which they live. These men gradually become hard drinkers, for when their loneliness oppresses them they resort to drink to relieve themselves.

If you can find the cause for a man's drinking you can generally help him. It has been my good fortune to have done so in a number of cases.

It is said that the amount of drinking in the rural districts is increasing. In those localities where this is true it would be well for the better citizens to consider the question along the lines given above, see what the cause is, and determine what can be done to relieve the condition. Many of the country lads who go to the cities fail because they take to drink; not that they are inferior to their city competitors, but because they lack the company and home surroundings to which they are accustomed. This I have observed many times in the large cities of our country.

The country store where the men congregate is too often a saloon, and to counteract its influence there should be provided a better place to gather. This has been done in some localities by starting a club where both men and women can congregate. Move the post office from the store and you make a reason for going there every day. Whether there should be any drinking there must be determined by the members. This matter has been considered under work and recreation.

When one of your neighbors becomes addicted to the use of alcohol do not look upon him as a criminal but as one who is sick. Endeavor to help him in every way.

VIII.

MILK

NEXT to bread, milk is probably the most important article in the diet of the American people. The returns of the census for 1900 showed that, excluding the quantity used in the rural districts, our people consumed on an average 23 gallons per person per year.

How to obtain this quantity of milk in a pure state and transport it to the consumer without deterioration and at the same time sell it at a price which will remunerate the producer for his labor and not place the cost beyond the means of the average citizen, is one of the greatest problems before the country. At present the farmer does not receive a proper compensation for his portion of the work, and the consumer has to pay too much for his milk.

A number of years ago laws were enacted in most of the States requiring that milk offered for sale should conform to a fixed chemical standard. In most of the States these laws

required that the total solids should not fall below a certain percentage, but more importance was attached to the percentage of fat, which in most cases was required to be between 2.4 per cent. and 3.4 per cent. With the growth of the science of bacteriology it was learned that the number of bacteria in the milk was of far greater importance than the chemical composition. Application of this knowledge to the handling of milk has resulted in increased purity of that supplied to our people.

This movement for the improvement of the milk supply should receive the support of all classes of the community. The producer and vendor are benefited because their losses are less and the price obtained is better. The consumer receives a better article for his money and the health of his family is not endangered. Generally the public is benefited because the death-rate, especially among children under one year, is greatly reduced by the use of pure milk.

The sanitary requirements of milk are: that it come from healthy cows, which have not been fed on unwholesome food or food that will impart an unpleasant odor to the milk; that it be drawn and handled with the most minute

regard to cleanliness; that it be cooled as soon as drawn to 45° and kept at or below that temperature until used.

To obtain the best results from cows they must be well cared for. In summer they may be allowed the liberty of a clean pasture, provision being made for their protection from the direct rays of the sun during the heat of the day, and from the rain and wind during bad weather. An abundance of pure water is to be provided, running water if possible, otherwise in troughs. They must never be allowed to drink from polluted streams or stagnant pools. During the heat of the day cows will wade in the water to cool themselves, and if it be polluted they will become foul and it will be difficult to obtain pure milk from them.

If cows become excited or are driven hard, the quality as well as the quantity of the milk is changed. In districts where flies are troublesome it is often necessary to smear the cows with some preparation of soap in order to afford protection from the insects; a better way is to darken the stable and allow the animals to stand in the stall all day, using the pasture after dark.

In winter and during bad weather it is best to keep the milk cows in a well-ventilated stable, at least 1200 cubic feet of air-space being provided for each animal. The ceilings of the barn are to be from nine to twelve feet high, and there should be one window of from four to six square feet in area for each animal. Cement or brick walls are the best, but these are only possible in a very few cases and just as satisfactory results can be obtained by using matched boards covered with building paper or other insulating material. Cracks should not be left in the wall, as they not only harbor insects but admit draughts which interfere with ventilation and cause the cows to suffer from colds. In the model stable the floors of the stalls and the feed-boxes are made of cement, but rammed clay is often used for the floor, and matched boards for the feed-boxes. In width the stall should allow room for the animal to lie comfortably. The floor should slope to the rear and end in a gutter of cement or rammed clay, from sixteen to twenty-four inches deep, to catch the excreta. If moldy bedding be used it will contaminate the milk and cause a loss to the farmer. The importance

of dryness in the stable is not appreciated by many farmers. Each cow excretes about seven pounds of moisture daily in its breath, and when arranging for the ventilation this must be considered. The ventilation in many stables is far from what it should be. A physician once stated that some farmers found it to their apparent interest to keep their animals warm at the expense of proper ventilation and loss of health. Animals which are kept in moist, warm, badly-ventilated stables are prone to have tuberculosis and it is to the interest of the farmer to keep his herd free from that disease if possible.

The stable should be so faced that it will receive the maximum amount of sunshine.

MILKING

The milker should be dressed in clean white clothing that can be laundried. Under no circumstances should ordinary working clothing be worn. Such garments are usually filthy, from the standpoint of the bacteriologist, and are perfumed with all the odors from that of the manure pile to the pig-pen. Before beginning operations the milker must clean his

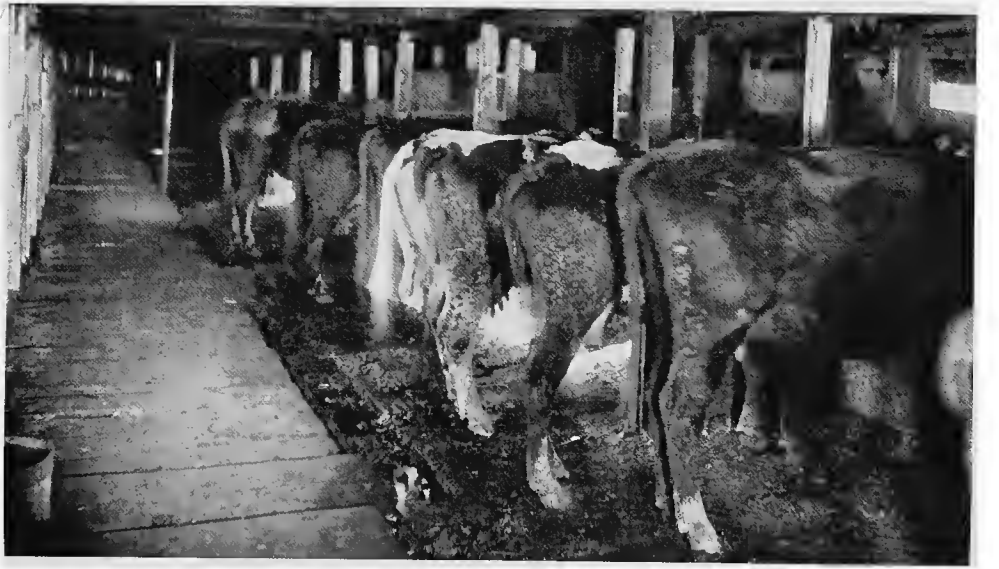

FIG. 12—Filthy cow stable. Milk from this dairy was being sold in one of the largest cities in the country.


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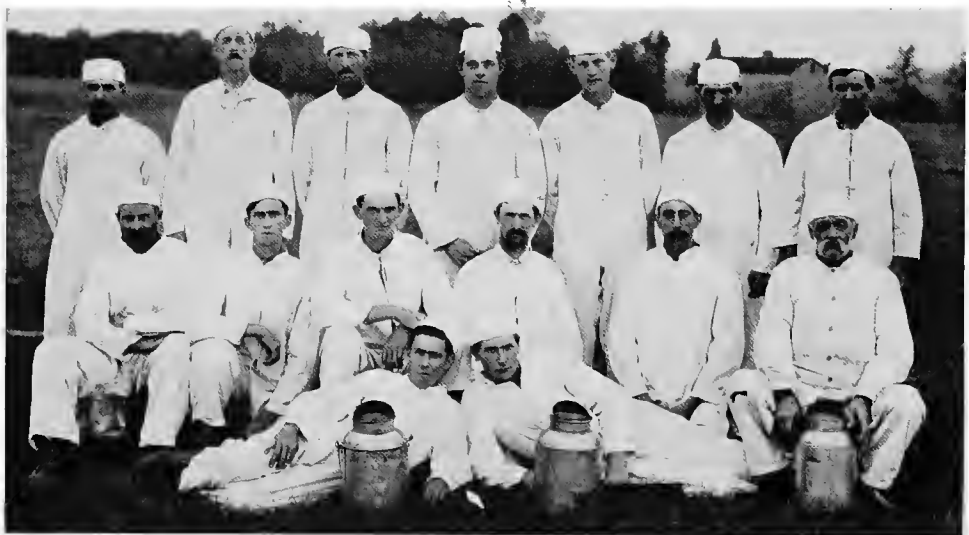

FIG. 13.—Milkers with modern pails, Walker-Gordon dairy.

nails and wash his hands with soap and brush, rinsing them in boiled water. At least half an hour before milking the cow should be groomed and the udders and teats wiped with a cloth that has been wrung out in sterile water.

Observance of these rules will greatly reduce the number of bacteria in the milk. In one instance the reduction amounted to six thousand per cubic centimetre (one-fourth of a teaspoonful). The purity of milk is greatly increased if the milking be done in a room that is used for no other purpose, but where this is impossible, the cleaning of the stable and the grooming must be completed at least half an hour before the milking is begun. The milker should not moisten his fingers in the milk, as is often done, but should have a cup of boiled water for that purpose. The first milk drawn contains many bacteria and should be discarded.

The wide-mouthed pails so commonly used serve no good purpose and are great collectors of dust and dirt. Tall narrow pails with the openings covered with sterile gauze, as shown in the illustration, are in use in all modern dairies. It has been found that by their use

the number of bacteria and the amount of dirt in the milk are greatly reduced.

Cows give more and better milk if milked at regular hours and by the same person. If the calf is to have a share he must be kept away from the cow until all the milk that is required has been drawn. If the calf be allowed to suck at the time of milking there will be an increase in the number of bacteria in the milk. The best plan is to feed the calf from the first from a bucket.

The time is not far off when a practical and sanitary milking machine will be invented. It should be able to obtain the maximum quantity of milk from the cow, without annoying her, and at the same time be so constructed that it can be kept sterile. Some of the machines now on the market fulfil the mechanical requirements, and with great care can be kept in good sanitary condition, furnishing better milk then than can be obtained by hand milking. It is believed, however, that the difficulty of keeping them clean is such that they cannot be used by the ordinary dairyman.

As soon as drawn the milk is to be taken to the cooling room and the temperature rapidly

reduced to 45° by placing the containers in running water or in iced vats. The value of this procedure is well illustrated by the experiment carried on by the Chicago milk inspectors during the summer of 1907. They took eight gallons of fresh milk at the dairy and placed it in two four-gallon cans, marking them "A" and "B" respectively. At the time the cans were sealed there were 11,500 bacteria in each cubic centimetre of the milk. Can "A" was handled by the farmer in the usual way while "B" was treated in the same way excepting that it was immediately cooled to 45° and shipped on ice. After twelve hours, when the milk was examined at the retailers, can "A" showed 114,000 bacteria while in can "B" the number was only 7800. At the end of twenty-four hours, when the milk was being delivered to customers, the number of bacteria in "A" was 1,300,000, while in "B" but 62,000 were present.

THE WAY MILK BECOMES CONTAMINATED

Milk may become infected with bacteria in many ways. Not infrequently the milker's hands are contaminated by handling articles

that have come in contact with those sick with, or convalescent from, contagious diseases. Even with the greatest care more or less dust and dirt from the stable will get in during the milking and these nearly always contain germs. Milk pails that are washed by those in attendance on the sick are always infected. An impure water supply may contaminate the cans that are washed in it or the milk that is kept therein to cool. Flies which get into the cans or the milk are one of the greatest sources from which germs of disease are communicated to the milk. Cans and bottles that are not sterilized are always a source of danger. In some houses the empty bottles are used for many purposes which are uncleanly to say the least. At the retailer's counter the dipper is a source of contamination.

The importance of excluding as many germs as possible is shown by the following experiment, in which the germs of typhoid fever were placed in the milk at the time it was drawn from the cow, subsequent examination giving the following results:

Number of hours.....	0	2	6	8	12	24
Number of bacteria.....	78	50	42	46	460	6000

FIG. 14.—(*b*) Gurler covered pail equipped with absorbent cotton strainer ready for use. (From Bulletin 48. of the Storrs Agricultural Experiment Station, by permission of L. A. Clinton, director.)

This table also shows the property which clean fresh milk has of preventing the growth of germs. This property appears to be exhausted in about eight hours when the milk is kept at 45°, but is lost much more rapidly when the temperature is above that point. At best this power is feeble and cannot be depended upon to render the milk safe. Some persons deny that it exists at all. It is destroyed by boiling or pasteurizing. Milk that is treated by either of these methods deteriorates rapidly if bacteria are introduced.

The utensils used at the dairy should be of the best tin, and made of but one piece, or, if of several pieces, the joints are to be well soldered and made as smooth as possible. The pails and cans should have small mouths but without abrupt corners. They should be washed in cold water as soon as empty and then in hot suds, being then rinsed in cold water and afterwards sterilized. If hot water be used first, the remnants of the milk will coagulate on the vessel and will then be removed with difficulty. Bottles should be treated in the same way.

Milk absorbs odors very rapidly, especially

that of the male goat, tobacco, carbolic acid, and creosote; therefore the presence of these in and around the room in which the milk is handled must be prohibited. Disinfectants are costly and are not needed when the stable and dairy are kept clean.

MILK ADULTERATIONS

The recent Federal and State laws have practically prevented the adulteration of milk. The principal frauds now practiced in its sale are:

1. Skimming off the cream.
2. Watering.
3. Adding thickening agents.
4. Adding coloring matter.
5. Adding substances to alter the taste or to increase the amount of solids.
6. Adding preservatives.

Skimmed milk is common, and where it is sold as such there is no objection, since the purchaser knows what he is getting. The color of skimmed milk is a dead white or a bluish white, while normal milk is a yellowish white.

Water is sometimes added to milk to increase the quantity. This is a distinct fraud. It is

also a matter of sanitary import, as the water used is frequently impure. Epidemics of typhoid fever have been started in this manner.

Substances added to milk to change the taste are in themselves generally harmless, being mostly soda or sugar which are used to prevent the sour taste; but milk to which these substances have been added is usually unfit for use and should not be sold.

Coloring matter is added to conceal imperfections and to cover up the rascality of those who skim it and sell it as whole milk. The dyes used are in some cases poisonous, while in others they only interfere with the digestion. The man who adds coloring matter to his milk should be severely punished.

Preservatives are added to make dirty milk keep longer. These are harmful, not only because some of them are poisonous, but because they allow an inferior quality to be sold to the public. This practice is to be condemned from every point of view.

STERILIZATION AND PASTEURIZATION OF MILK

Some persons advocate destroying the germs in milk by pasteurization or by sterilization.

In the first instance it is heated to 176 degrees and in the second case to 212 degrees. Either method will destroy most of the germs, but it also changes the digestibility of the milk so that, in some cases, children fed on it develop scurvy. Another objection is that it is difficult to carry out the process on a large scale and that milk improperly treated is frequently worse than in the raw state.

Unless contaminated milk is treated as soon as it is taken from the cow, the germs which it contains will develop toxins and no amount of cooking will render it fit for food. If left in the raw state this milk would rapidly spoil and be thrown away. It is safest to handle the milk in such a way that the chances of becoming contaminated will be reduced to a minimum and then to keep it cold, thus preventing the growth of the germs as much as possible.

The milk is readily affected by the cow's diet, and especially by foods that have a strong odor, such as garlic and turnips. The milk from cows fed with slops and brewery refuse is not fit for food, because of the bad taste. When brewery grain is fed, the alcohol finds its way into the milk and makes it unfit.

DISEASES TRANSMITTED TO MAN THROUGH MILK

The following diseases are transmitted to man through the medium of milk: tuberculosis, typhoid fever, cholera, summer diarrhœa of children, diphtheria, scarlet fever, milk sickness, foot-and-mouth disease, anthrax, cowpox, rabies, actinomycosis (lumpy jaw). Garget, a disease of cows, produces symptoms of diarrhœa in man.

TUBERCULOSIS

Several years ago, Doctor Robert Koch raised the question as to whether man could contract tuberculosis from animals suffering from the disease. This caused the entire subject to be studied anew and the general opinion is that human beings can contract the disease from animals through milk, especially when this is used as food for young children. The International Congress on Tuberculosis, which was held at Washington in 1908, indorsed this opinion; practically the only dissenting opinion being that of Doctor Koch.

It has long been known that milk of cows which show no evidences of the disease, but which react to the tuberculin test, contains the germs. Not infrequently the udder is the seat

of the disease and in such cases the germs are always found in the milk.

An examination of the milk supply of the City of Washington showed that out of 223 samples offered for sale 6.7 per cent. contained tubercle bacilli. Of 102 dairies supplying the city, the milk from 10.2 per cent. was found to contain the germs of tuberculosis. Many cows which show no evidences of the disease, excepting the reaction to tuberculin, pass tubercle bacilli in their fæces. Such cattle are very dangerous, for, although there are none of the bacilli in the milk as it comes from the teats, their hindquarters are almost invariably infected and even with the greatest care some of the germs from that source will get into it. The bacilli are also found in the dust of the stable in which tuberculous cattle are kept and this is one of the sources from which the milk is contaminated. The tuberculous cow is therefore a menace to the health of the human race.

The disease is very prevalent among cattle in the United States. During the five years ending with 1905 the Federal meat inspectors examined 29,360,136 carcasses, condemning

14 per cent. as infected with tuberculosis. Tuberculin tests made in the State of New York from 1905 to 1907 showed that 36 per cent. of the animals tested had the disease. These figures are somewhat higher than is the infection among cattle in general.

Tubercle bacilli will live a long time in butter and cheese and it is therefore undesirable to use infected milk in the manufacture of these products. Hogs that are fed on milk from cattle with tuberculosis develop the disease.

The farmer is interested in the prevention of tuberculosis, not only because of the danger of members of his family contracting it, but also because of the loss it causes among his cattle. When the question of the prevention of the ravages of the disease among cattle was first agitated, it was suggested that all animals having it should be killed, and in a number of States such a policy was pursued. This soon met with disfavor from all classes, and it was demonstrated that no government could long stand the drain upon its treasury. Fortunately such a policy is no longer necessary. Professor Bang of the Copenhagen Veterinary College

has devised the following plan, which allows of the reëstablishing of a healthy herd from one that is infected with but slight loss to the farmer: All animals which show symptoms of the disease (cough, diarrhœa, or emaciation) are destroyed. Those with no symptoms but reacting to the tuberculin test are isolated and kept for breeding purposes. They are watched with great care, and any that develop symptoms of the disease are at once destroyed. The calves from the infected herd are taken from the mother as soon as born and suckled by healthy cows or fed with their own mothers' milk after it has been sterilized. Should any of the calves develop scours or appear sick they are at once tested with tuberculin. The stable in which the diseased animals have been kept must be thoroughly disinfected before being used for healthy cattle. The pasture on which tuberculous cattle have been kept should be used for some other purpose for a year before having healthy cattle put upon it.

Tuberculosis is spread to a great many herds by cattle that are imported, and it should be a rule not to make additions to the herd until the new-comers have been proven to be free from the disease.

TYPHOID FEVER

Typhoid fever is frequently caused by drinking milk that has been infected with the germs of this disease. Doctor Kober of Washington has collected 195 epidemics due wholly to infected milk, mostly from contamination at the farm. During the year 1906, 866 cases of the disease occurring in Washington were studied by the Public Health and Marine Hospital Service of the Federal Government. Of these 85 were traced to milk infection, occurring among the customers of three dairies.

Milk is one of the best culture media for growing the typhoid bacillus. The germ may get into it through the unclean hands of those who do the milking, or by being blown around in the dust, or through infected water with which pails or bottles are washed, or flies may bring the infection on their feet. Not every case of typhoid fever is of sufficient severity to cause the patient to stay in bed. Often persons well along in the disease are walking about and not infrequently such persons are found in the dairy, milking. Those in whose families the disease exists should not be allowed to work about the dairy. This applies also to such diseases as diphtheria and scarlet fever.

To keep milk from becoming contaminated with typhoid fever the following rules should be observed:

Locate the dairy in good surroundings.

Prevent persons who have just recovered from the disease or those in attendance on persons sick with it from handling the milk.

Exclude flies from the dairy.

Sterilize the bottles and cans before they are used.

Seal all bottles and cans as soon as filled and keep them cold.

There are persons who carry the germs of typhoid fever in their bodies for years after recovery. They are known as "typhoid carriers" and are very dangerous to the community. In some instances these persons are engaged in the dairy business and their influence is extended to a large community. Whenever there are cases of the disease that cannot be accounted for a search should be made for carriers.

DIPHTHERIA

Kober's statistics show 35 epidemics of diphtheria due wholly to milk. In Ashtabula, Ohio, 100 persons became sick with this

disease in December, 1894, and upon investigation it was shown that all the houses in which it was present obtained their milk from one source. At the dairy it was ascertained that one of the workmen had had a very sore throat but had continued working.

SCARLET FEVER

Kober collected 95 epidemics of scarlet fever wholly depending upon milk. There have been numerous epidemics in all parts of the world in which the source of infection was definitely traced to dairies where persons convalescing from the disease assisted in the operations of milking or handling the milk.

CHOLERA AND DYSENTERY

Cholera and dysentery are usually water-borne diseases but can also be transmitted by milk. The milk in most instances becomes infected through the water used to wash the utensils, but in some cases water added to it causes the trouble.

SUMMER DIARRHŒA IN CHILDREN

In this country the greatest amount of sickness directly traceable to bad milk is in the

summer diarrhœa of children (summer complaint). The prevention of this is largely a matter of clean milk, and the mortality from the disease is being reduced as the people are becoming more educated to the importance of such milk. In Rochester, New York, it is estimated that during the past ten years 2486 lives of young children have been saved by supplying clean milk during the summer months.

MILK SICKNESS

This disease is primarily one of cattle, but is occasionally transmitted to man. In one locality in New Mexico there were thirty-eight cases in human beings during the past ten years, the population of the town being about two thousand. The disease appears to be less prevalent than it was some years ago. It is sometimes limited to certain pastures, those which are separated therefrom by only a fence being apparently free. The cause is said to be a poisonous plant, but this is by no means certain.

Cattle affected with the disease mope and droop, walking with a faltering gait and staggering when caused to run. They are not

infrequently unable to avoid objects in their path.

Just how man becomes infected is not known, but it is generally believed that the flesh, as well as the milk of animals suffering from the disease, can cause the infection to be transmitted to man and other animals.

ROPINESS IN MILK

Ropiness in milk is caused by certain bacteria which get into it through water in which the utensils are washed, or through the hands of the milkers. Such milk is not always harmful, but in this country there is no sale for it and every precaution should be exercised to exclude the germs.

IX.

ICE

MANY disease germs are greatly weakened by freezing, yet this is not always the case. An epidemic of typhoid fever was traced to ice that had been in storage seven months and the germs were recovered from the ice. Ice from small streams and ponds is nearly always polluted, and the ice from the Hudson River is open to grave suspicion as the fields from which most of it is cut are in the immediate vicinity of the outlets of sewers. The upper Hudson River receives the sewage of 210,000 persons and there is one part of sewage to every three hundred parts of water.

In Vermont the examination of a few samples of ice from ponds showed them all to be unfit for use. Ice that is formed upon pure water may become contaminated in many ways. Not infrequently the harvesters flood it to increase thickness, and they are not always particular to see that pure water is

used for this purpose. The cutting and delivery of ice is fraught with many dangers. In the first place the workmen may be infected with typhoid fever or other diseases that are transmitted through water. The custom of placing ice on the curb or the back porch insures that it will be contaminated with any germs which may be deposited in such localities. The house servants who handle it may be suffering from disease. Ice wagons as now used are most dangerous affairs. They are open and collect all the dust and dirt which blows. In the winter they are occasionally used as ash carts or for other purposes equally as bad. In the city of Washington I have more than once seen filthy colored boys riding in such carts and it is not an unknown occurrence for tramps and other vagabonds to sleep in them at night.

An examination of the artificial ice in the large cities has shown that in many instances it is far from pure and in some instances it contains more germs than the water from which it is made. This is due to great carelessness on the part of the manufacturer.

Ice should be cut from the purest sources available. In general that manufactured is

better than the natural. It should be delivered in closed wagons that are kept clean. The householder should provide a covered bucket or box to receive the ice from the wagon, and the ice-man should be compelled by law to close the cover after depositing the ice.

In the country there are many localities where ice from infected sources is all that is available. The farmer should remember this and use it for refrigeration only; under no circumstances should he place it in his drinking water or place his food on it. The ice should be kept in a separate compartment from the articles that are to be refrigerated and the only communication should be through an air shaft so located that none of the water from the ice can get into the food compartment.

ICE-WATER

During the warmer months our people seem to require a cooling drink, and without doubt moderately cool water is the least harmful. A sufficient degree of cold can be obtained by placing the water on the ice for a few hours, and under no circumstances should ice be placed in the water. High degrees of cold are undesirable and probably harmful.

ICE-CREAM AND ICES

There has been a great deal of discussion as to the bad effects of ice-cream and ices. There seems to be little doubt that very cold substances taken into the stomach tend to temporarily diminish the flow of the gastric fluids, and in some instances the taking of large quantities of ices at meals may produce indigestion. The practice of finishing a meal with an ice is, to say the least, not beneficial. The proper time for taking such refreshments is between meals, and I firmly believe that they fill a place during the warm season that is not filled by anything else.

Studies of these products as sold in one of the larger cities has shown them to be far from the pure article that they are generally supposed to be. In many cases samples of ice-cream contained a large number of bacteria. Not infrequently the cream and ices are manufactured in insanitary basements or other places which are unfitted for the purpose.

Doctor Vaughan, of Ann Arbor, Michigan, has reported a number of cases of poisoning traced to bacterial poisons generated in ice-cream. In 1906 there were six cases of typhoid

fever in the city of Washington traced to the use of infected ice-cream.

Ices and ice-cream are best made at home of milk or cream that is above reproach, and it is to be remembered that after cooking, milk and cream are better culture media for bacteria than when fresh. For this reason greater care should be used to keep them from becoming contaminated. An improved freezer which would prevent the contents from ever coming in contact with the ice is very desirable.

Ice-cream should be eaten as soon after being frozen as possible, and under no circumstances should it be kept over until the next day and then refrozen. Most of the cases of poisoning have been from cream that has been kept for some time.

X.

COUNTRY STORES, JAILS, AND GOOD ROADS

In many parts of the country the store is the general meeting place of the inhabitants. Here the men and boys congregate and await the mail in surroundings that are frequently far from sanitary. Especially is this true in the winter or during rainy weather, when the building is closed up. The author has a vivid recollection of a long winter afternoon spent in such a store. The building was low and but a few feet above the ground. The stock comprised a little of everything, from fresh meat and vegetables to dry goods and soft drinks. In the centre was a red-hot stove, around which sat the men of the community, some reeking with the odor of the stable and all wet and steaming from the drying of their clothing. Many were chewing tobacco and their expectoration was received into several large boxes of sawdust, which from appearances had not been emptied for many days. One man was plainly

a consumptive, but he enjoyed the privileges of the spittoon as did his neighbors. There were several windows and two doors opening into the room, but none of them were open, and the only fresh air received was that which entered when a new arrival passed through the door. In one corner was a bar at which soft drinks were sold, and it was well patronized. The glasses were never washed, but were rinsed off in a bucket of very questionable fluid kept beneath the counter.

There is nothing exaggerated about the above description, and I have seen the same condition in many parts of the country. The store in question I have known for over twenty years and it has always been as described.

All store-keepers feel that they must display their vegetables and fruits so as to attract trade. Not infrequently they place such things in open boxes on the sidewalk or on the floor of the store. Here they accumulate all the germ-laden dust possible, beside the spittle, from careless chewers. Besides which a dog occasionally voids his urine against the box. This is not a very pretty picture, but it is a true one and can be verified in the city or in the country. I see

such things almost daily in certain parts of Boston. Those who patronize the store can remedy this by refusing to purchase any food that is kept under such circumstances. Glass is not so expensive but that the store-keeper can afford to use a little of it to protect his wares from the dust and dirt. Insist on it and you will get it and it will not bankrupt him either.

JAILS

Unfortunately it will be a long time before we can do without jails, and until that time comes it will be necessary to provide a place of detention for those persons who are dangerous to their fellows. Many of our prisons are sadly lacking in sanitary appliances, and in not a few the ventilation is extremely bad. We should remember that, while detention is the first object, such institutions should be educational as well. We should endeavor to procure for those incarcerated, proper food, light, and ventilation, and provide them with the means of self-improvement, hoping they may become good citizens when released. The air space should not be less than 600 cubic feet per man, and proper methods of disposal of

excreta and other refuse must be provided. Personal cleanliness should be insisted upon, and the means of securing it should be within the reach of every prisoner. The number of persons who contract tuberculosis in our jails is a disgrace to the community.

The jail should be regularly inspected by the health officer and he should have power to compel the keeper to take proper precautions to safeguard the health of those confined in it.

GOOD ROADS

The dust from an ordinary road contains sharp particles of stone and sand, soil that has been reduced to a fine powder, and a considerable quantity of manure. In dry weather this mixture gets into our noses, lungs, and eyes, causing irritation of these organs. In wet weather the roads are filled with mud holes which contain all manner of decomposing materials. This is far from healthful. The farmer therefore should support the good road movement. Good roads directly benefit him by reducing the cost of hauling, and also enable him to get to town more often and thereby enjoy more of life. The roads are not local

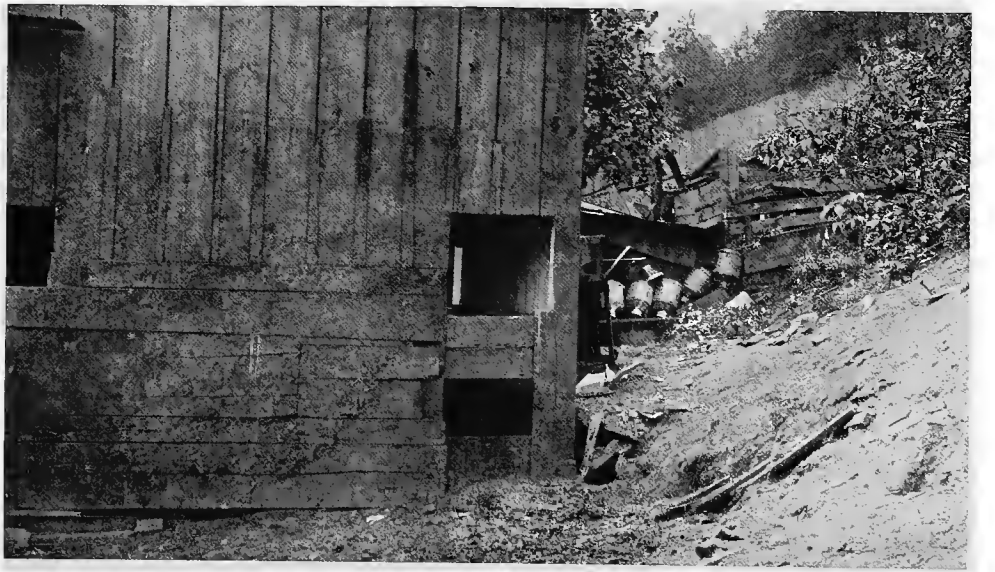

FIG. 15.—Insanitary dairy showing improper method of caring for milk cans, which are placed to drain in the vicinity of the pig pen.

matters, and it seems that their improvement should be charged in part to the general public. Especially is this true since the automobiles have come into general use. Fast moving autos raise great clouds of dust, and for that reason alone the speed should be regulated and the regulations rigidly enforced.

XI.

FLIES, MANURE, AND SLAUGHTER-HOUSES

FLIES are not only a nuisance but are one of the means of disseminating typhoid fever, cholera, and diarrhœa among human beings, and surra and anthrax among horses and cattle.

In this country we are most interested in the house-fly, which in reality should be called the stable-fly, for it breeds by preference in horse manure, although it will utilize any collection of animal or vegetable matter when manure is not accessible. During the winter months many of these insects hibernate in cellars, lofts, or other protected places, and with the first warm days of spring, frequently as early as March, they sally forth and soon begin to deposit their eggs. In the vicinity of Washington it has been demonstrated that each female deposits about one hundred and twenty eggs each time she lays. These will develop into flies in about ten days, depending upon

FIG. 16.—This is a plate of jelly over which a fly, taken from a butcher's stall in the Washington Market, walked. The dark spots are colonies of germs left on the plate by the fly's feet. The plate was incubated for 24 hours and then photographed by Dr. Wm. M. Gray. (Published by permission of Major F. F. Russell, U. S. Army, Curator Army Medical Museum.)

the temperature. In all about thirteen generations will develop in that region during an ordinary summer. The offspring of one fly during an ordinary summer may amount to several million.

The relation of the fly to the different diseases will be more fully considered under each one.

In certain portions of the country there are flies which deposit their eggs in animal tissues, where they hatch, the larvae causing great destruction of tissue. The nose and the ear are the most favorite localities for their activities in the human race, although they will infect any open wound that is available. From the nose they not infrequently invade the brain, and unless the condition is promptly treated death is the result.

The prevention consists in never sleeping in the open air during the day unless covered by a mosquito net. All open wounds should be covered with gauze.

There are occasionally cases of severe diarrhœa that are caused by the larvæ of flies (maggots) in the intestines. They gain access through food that has been left uncovered and often there are many hundreds of them in the

intestines. The condition is rarely dangerous and the larvæ are readily removed by purgatives, such as castor oil or salts. The prevention consists in keeping the flies from the food.

Intestinal infections appear to be more common in the eastern part of the country, while larvæ in the nose and in the open wounds are more commonly found in Arizona and other parts of the southwest.

In the Philippines many horses have been killed by surra which is transmitted by a fly abounding in that country but apparently unknown in the United States.

MANURE

Many of our people do not appreciate the value of the manure produced in this country. In our cities little effort is made to conserve this valuable product. Elaborate systems have been developed for the removal of the droppings of animals from the public streets, but none of them, as far as has come to the attention of the author, has endeavored to save the manure for the agriculturist. The general plan is to use the street sweepings for filling in low ground, but in some instances they are dumped

into the sea. All of this is a direct loss to the country. Manure represents the waste material of the food which has grown on the land, and true economy demands that it should be returned to the land to supply the elements used by the growing vegetation. Any other method of disposal tends to rob the soil of its fertility.

In the rural districts most of the manure is returned to the land, but very often it is handled in such a way that there is an unnecessary loss of fertilizer. Scientific agriculturists say that the sooner the manure is gotten on the land the better. There will also be less loss. Fortunately the best interests of the farmer are served by managing the manure in a sanitary manner. During a considerable portion of the year it is impossible to spread it on the land and some method of storage must be provided. While in storage it loses in value through the two following causes: (1) Fermentation, whereby a certain portion of the nitrogen is lost; (2) weathering and leaching, which cause a loss of soluble constituents, such as phosphate and potash. To prevent these losses the manure should be stored in sheds with

cement floors, or, better, in cement-lined pits. These pits or sheds must be fly proof. It has been found that if litter to the extent of one-third of the dry food consumed by the animal be used, the urine will be absorbed. Keeping the pile moist will delay the fermentation. The use of preservatives has not proven satisfactory, but the pile should be as compact as possible. It is open to question whether manure sheds pay for themselves, but when the sanitary side of the matter is considered there is no doubt as to their value.

The following general rules for the management of manure are recommended: 1. Place it on the land as soon as possible. 2. Spread it out uniformly. 3. Keep the air out as much as possible. 4. Keep it moist but not wet. 5. Protect it from extremes of heat or moisture.

In providing for the storage of manure it should be remembered that the average product of the various farm animals is as follows:

	Tons per year
Horse	6.5
Steer	20.9
Cow	15.0
Hog	1.8
Sheep	.8

These quantities vary according to the character of the food, green foods producing a greater quantity than dry foods.

Fowls produce a considerable quantity of manure which, if not properly attended to, will become the breeding place of flies. It is also to be remembered that a daily cleaning of the hen-house will insure better health among fowls.

SLAUGHTER-HOUSES

For many reasons the beef killed in the rural districts is not as good as the western refrigerator beef. There is a tendency on the part of the small butcher to kill only those cattle for which there is no sale in the large cities. In some instances animals that are diseased are killed, especially those with tuberculosis. This is more likely to occur in those States where there is no meat inspection by the State authorities.

The country slaughter-house is a nuisance in most cases. It is generally surrounded by dirty pens and stands upon ground that is reeking with untold filth. All the refuse is, as a rule thrown on the ground just outside the building, where it is devoured by hogs and stray

dogs. The building is the home of rats, and countless flies breed in the decaying refuse and walk at liberty over the carcasses of the animals which are hung up to cool.

The above is not a true picture of all country slaughter-houses, but it is a good description of a majority of them. The large packing houses are more sanitary at present, and their products are better because of the Federal and State supervision recently established over them. It has been suggested to consolidate the rural abattoirs and to employ inspectors to supervise their sanitation as well as inspect the animals slaughtered in them. This is in the interest of the health of the community and should have the support of all good citizens.

A modern slaughter-house should be as nearly fly proof as possible and well ventilated. The floors should be of cement sloping to a central gutter, and the sides, to a height of at least two feet above the floor, should be of the same material. Above this the walls should be of some smooth material, free from cracks and crevices in which particles of blood or other refuse can lodge. The gutter should empty into a movable vat protected from flies. After

each killing the floor and walls should be scrubbed or washed down with water and the table on which the carcass is cut up washed with hot water and lye. The vat should be removed as soon as possible and its contents either burned, buried, or converted into fertilizer. The ground must be kept as clean as possible, and under no circumstances should a hog-pen be maintained within a thousand yards of the slaughter-house.

There is no reason why the slaughter-house cannot be kept as clean as a kitchen or butcher shop. The butcher should wear clean clothing and cleanse his hands before cutting up the carcass. Beef should be transported in closed wagons, protected from dust and flies.

The rats which infest the slaughter-house are one of the means of spreading trichinosis to hogs. Stiles has found that about 50 per cent. of the slaughter-house rats are infected, while in Boston the percentage is somewhat greater.

Dogs that feed on the offal of abattoirs are often infected with the bladder worm which causes serious disease in man. It is therefore advisable to keep dogs away from the premises.

The following diseases may be transmitted

to animals from slaughter-houses: tuberculosis, anthrax, hog cholera, and swine plague. For this reason it has been advised that animals which enter the pens at the abattoirs should not be returned to the herd unless quarantined for sufficient time to insure that they are free from disease.

XII.

HOGS

Hogs are found on almost every farm, and with the increased cost of beef this hog raising will assume a greater importance each year. The flesh of hogs is highly nutritious and the cost of production is much less than of beef. Many of the animals sold in this country are raised amid the most unsanitary surroundings and fed upon the most improper food, the result being that they become the means of spreading disease to man, and are themselves subject to many diseases which cause a great loss to the farmer.

The hog in his native state inhabits a region where the climate is moderately severe and where there are extremes of heat and cold. He must, however, have protection in winter and shade and an abundance of water in summer. He feeds on grain and vegetation, but should be kept where his food and water can be procured with a minimum amount of labor.

He requires a varied diet, but corn is probably the cheapest and most satisfactory food, and almost as good results can be obtained by feeding barley, oats, or wheat. Alfalfa is a favorite food in some parts of the west, and peas, beans, peanuts, and acorns are largely used in the south. In the dairy regions many are fed upon skimmed milk from the creameries. Where milk is used great care must be exercised lest it be contaminated with tubercle bacilli, and unless it is known to be free from such germs it should be sterilized. Root crops are much used for winter feeding, but if given in large quantities the animal will suffer from diarrhœa. The feeding of brewery refuse and offal from slaughter-houses should be prevented by law.

Although the flesh of hogs which are fed on kitchen slops is not as good as is corn-fed pork, it is believed that a moderate use of such food, combined with corn or other grain, will produce good meat. It is not advisable for the farmer to import large quantities of kitchen refuse for his hogs, as is done in the vicinity of some of the large cities.

The feeding troughs should be shallow, with as few crevices as possible and sufficiently

stout to resist the teeth of the animals. Those made of concrete and surrounded by a concrete floor are the most sanitary. Whatever the nature of the trough, it and its surroundings must be kept very clean. Hogs can be kept without causing the unpleasant odors so characteristic of most stys in this country.

In construction of piggeries four things are essential: light, ventilation, warmth, and cleanliness. Under cleanliness especial attention must be paid to dryness and ease of removal of refuse. The fewer cracks in the walls the better, as they harbor insects and other vermin. The manure, which is a valuable fertilizer, should be removed at frequent intervals and stored under the same conditions as is horse manure. The inside of the building is to be washed at least once a month with a 5 per cent. solution of carbolic acid.

Where the climate permits, hogs do better if kept in pastures where there is running water that is above reproach as to its purity. The field is to be fenced with woven wire that is from thirty to thirty-six inches high and above which may be stretched several strands of barbed wire.

The practice of placing pens over streams is

only mentioned to be condemned. It is far from uncommon, and some years ago the author came across a large pen located over a small stream which emptied into the reservoir from which the city of Washington drew its water. Hog cholera has been transmitted through water, and it is therefore advisable not to allow the animals to enter the stream, but to provide a trough for their bathing and drinking and to run the water from the trough through irrigation trenches.

The interests of the hog raiser are identical with those of the health officer and these should co-operate and endeavor to enforce cleanliness both in the pen and on the range. This will diminish the mortality among animals and improve the health of the dwellers in the rural districts.

The diseases which may be transmitted to man are trichinosis and tape-worm.

Trichinosis is transmitted to the hog through the fæces of animals or man that are infected, as well as through flesh, and especially through the refuse and rats from slaughter-houses. Man contracts the disease by eating undercooked meat, raw pork, or ham.

In some sections tape-worm is a very common infection. The disease is transmitted to the animals through the fæces of other animals infected with the disease or through the fæces of man. Man contracts the disease by eating raw or partially cooked pork and also by eating food that has been contaminated by being washed in infected water, or directly through his own hands, which have come in contact with the eggs of the parasite and have not been washed.

This is one of the most serious infections, as the parasite may find its way into the brain, the eye, or other organs and cause death. The worms in the intestines of men do not cause serious symptoms but there is reason to believe that they pave the way for more dangerous diseases of the body.

It is not impossible that the vermin on the bodies of hogs may be one of the ways of transmitting diseases to other animals, and it is therefore important that hogs should be kept as free from these pests as possible. This may be accomplished by keeping their pens clean and by *dipping* the animals from time to time as may be necessary.

XIII.

INTESTINAL PARASITES

THERE is a host of parasites living within the human body. Many of them apparently do no harm, while not a few are the cause of serious disease. Even when no symptoms are produced their presence is a source of considerable annoyance, and some physicians claim that they make the body susceptible to other diseases. Intestinal parasites are said to be three times as common in the rural districts as in the cities.

ROUND-WORMS

Probably the most common of these animals is the round-worm. Generally they cause no symptoms, and the first indication of their presence is the passage of one or more of them with the fæces. Occasionally they migrate to other parts of the body and cause serious symptoms.

The embryos enter the body through the medium of infected food or water, and children

not infrequently infect themselves by sucking their fingers.

If the food and water be kept pure and measures are taken to prevent children from sucking their fingers there is little danger of infection.

TAPE-WORMS

The tape-worms are far from uncommon. Four different worms infect the human body; the beef-worm, the fish-worm, the pork-worm, and the bladder-worm. The embryo of the latter is the only form in which it is found in the human body.

The eggs of the first three are passed from the body in the fæces, and after undergoing some development in the soil are swallowed by the animal in which they are found. Here they develop into embryos and lodge in the muscles, where they may remain for an indefinite time. Man becomes infected by eating the flesh which contains the embryos. The eggs of the pork-worm can develop in the human body. This worm at times causes serious disease of the brain or of the eyes. In general the only symptom of tape-worm infection is loss of flesh.

The embryos are destroyed by thorough

cooking, but smoking or pickling does not kill them. If kept in cold storage they are said to die in twenty-seven days.

The prevention consists in thoroughly cooking all meat or fish unless it is known to be free from the embryos. In addition all stools which contain the eggs should be destroyed by fire. No person with the disease should be allowed to defecate in a field used for pasture. As it is difficult to know whether persons have the disease or not, it should be a rule on the farm that no person be allowed to defecate in the fields.

The most serious of all the tape-worms is the bladder-worm. It is not very common in America but its prevalence is increasing. The mature worm is generally found in the dog, but other animals harbor it. In man the embryos are generally found in the liver or lungs and cause serious disease. The only treatment is surgical, but the results are not very satisfactory.

Dogs become infected by feeding on the offal from slaughter-houses, and Stiles, the leading American authority on these parasites, says that no dog which has entered the grounds

of a slaughter-house should be allowed to leave it alive. The eggs leave the dog's body in the fæces, and the hair of the animal's hindquarters is always soiled with its dejections. Persons who fondle dogs which have the disease are always in danger of contracting it.

The prevention consists in destroying as many of the stray dogs as possible and in refraining from fondling any unless they are known to be free from the disease. Dogs which are infected should be killed unless they are valuable, in which case they may be isolated until cured, care being taken to disinfect all of their excreta by fire.

ANKYLOSTOMIASIS (Miners' or Cotton Mill Anæmia)

This disease is more prevalent in hot than in cold climates. In Porto Rico it causes a large number of deaths, and the majority of the population at the time of the American occupation were found to be infected. Recent studies have shown that it is very prevalent in the southern part of our country. Often it is epidemic in mines, but those of the United States are apparently free from any serious infection.

The disease is caused by a minute worm which makes its home in the large intestines of human beings. It attaches itself to the mucous lining of the gut and is believed to draw blood from its victim. At times there are many hundreds of them in the intestines.

The eggs are passed with the fæces, and if deposited on warm moist ground develop into larvæ which gain access to the human body through the mouth, either with water or foods that have been handled by dirty hands. The most common portal of entry is through the skin of the legs of those who run bare-footed on ground that is infected. It has been proven by direct experiment that the larvæ can pass through the skin in a comparatively short time. In countries where the disease prevails there is a very common skin disease of the legs called ground itch, and in recent years it has been learned that this is but an inflammation caused by the passage of the larvæ through the skin.

The prevention consists in disinfecting the stools as is done in typhoid fever. Personally those who live in communities where the disease prevails should be very particular

about cleansing their hands and faces before eating, and should also see that their food and water supply is above reproach, or else take measures to render them so. Great care should be taken to disinfect lettuce and other vegetables that are eaten raw, as the larvæ often adhere to these, and no amount of ordinary washing will remove them. In order to sterilize green vegetables that are eaten raw they should be placed on ice until very cold and then passed rapidly through boiling water and immediately returned to the ice chest, but not placed upon the ice.

Persons residing in regions where the disease prevails should not go barefooted.

Regarding the disposal of the fæces in diseased communities, Doctor C. W. Stiles, who has devoted much time to the study of the parasite, says: "I would say that hook-worm eggs die very rapidly if subjected to fermentation, less rapidly if excluded from oxygen. Accordingly the septic tank seems a splendid method of getting rid of them. The earth closet appears theoretically at first a good method, but practically the fecal material is often not covered with sufficient earth to

exclude the oxygen. Personally I favor the pail system, the frequent emptying of the pail, and burial of the night soil in the case of farms or burning of night soil where feasible in communities."

TRICHINOSIS

This is caused by a parasite which is found in the hog and several other domestic animals. In man it is a serious disease and not infrequently results in death. Probably the primary host of the parasite is the rat. This animal keeps the infection alive by eating its comrades which have died of the disease, and by eating the offal of hogs that are slaughtered. In Boston, Billings found that from 75 to 100 per cent. of the rats captured in the slaughterhouses harbored the parasite. Of 2,227,740 hogs inspected in the United States during 1899, 41,659 were found infected. The parasite is not so common in this country as in Europe, yet it is more common than is generally supposed. Stiles collected 900 authentic cases which had been reported during the thirty-six years ending with 1905, and Williams, who examined 505 dead bodies in Buffalo, found the parasite in 5 per cent. The disease

was three times as prevalent among the Canadians and Italians as among the Americans.

It is transmitted from animal to animal through eating the flesh of those which have the disease or through foods that have been soiled with the excrement of animals which have it. Hogs become infected by being fed on slaughter-house refuse, man by eating the raw or partially cooked flesh of hogs. Smoking and salting do not, as a rule, kill the parasite, and the practice of eating raw ham and sausage, which is far from uncommon in certain sections, is very dangerous.

As a result of experiment we have learned that pork which harbors the parasite must be raised to a temperature of 160° before it can be considered safe. If the pork be boiled we must allow eighteen minutes for each pound plus half of the time required to bring the water to a boil. Roasting should be continued until the red color has disappeared. Cooking to such a degree does not make a very palatable dish for the average American, and it is therefore better to purchase only pork that is above suspicion.

XIV.

MALARIA, TETANUS, DIARRHOEA AND DYSENTERY

MALARIA is one of the diseases which is more prevalent in the rural than in the urban districts. It is caused by a minute organism that passes a portion of its life in the red blood-corpuscles of man. The rest of its life is passed in the body of a mosquito of the family Anopheles. The disease is transmitted from man to man through the agency of this mosquito. The malarial mosquitoes are usually brown or yellowish in color, with spotted wings and straight proboscis. They do not hum as much as other insects. When resting on the wall the body is nearly at right angles to the surface, and the head, body, and proboscis are in a straight line. Their larvæ (wigglers), which are generally found in pools of clean water or comparatively still water or of sluggish streams, have straight breathing tubes and rest parallel to the surface of the water. If disturbed they dart back and forth and sink

with difficulty. They are rarely found in rain barrels.

These mosquitoes do not fly far. Occasionally they have boarded vessels at a distance of a mile from the shore, but as a rule those found around the house are bred in its immediate vicinity, possibly in shallow pools in the grass,

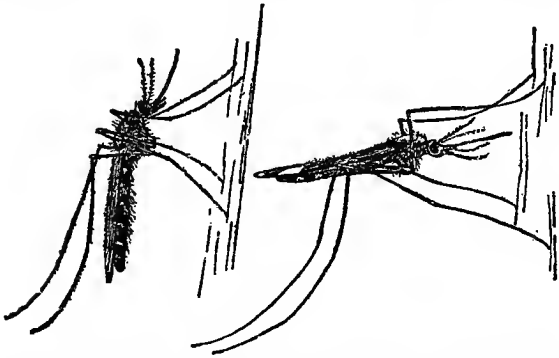

FIG. 17.—Resting position of Culex (at left) and Anopheles (at right). (From Howard, Bulletin No. 25 N. S., Division of Entomology, United States Department of Agriculture.)

in tree-hollows, or on the leaves of plants. Their time of greatest activity is from just before sunset until shortly after daylight, for they avoid draughts and during the day secrete themselves in the thick foliage of the garden or in the darker corners of the house. Not infrequently they hide beneath the bed.

In order to prevent malaria it is necessary to adopt measures against the mosquito. The householder should see that there is no uncov-

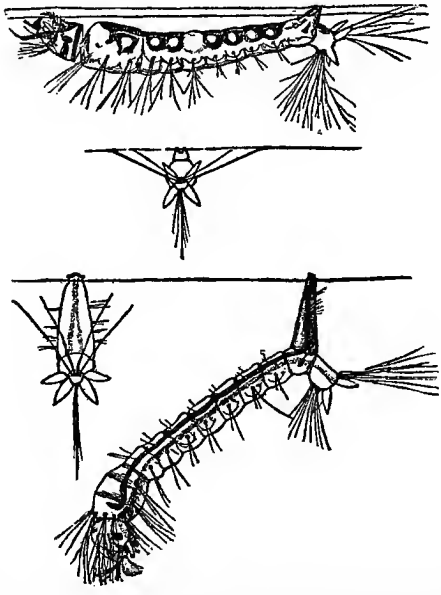

FIG. 18.—At top, half-grown larva of Anopheles (malarial mosquito) in feeding position, just beneath surface of water. At bottom, half-grown larva of Culex in breathing position. Greatly enlarged. (From Howard, Bulletin No. 25 N. S., Division of Entomology, United States Department of Agriculture.)

ered water about his premises in which they can breed. In this connection it is well to remember that mosquitoes breed in the water of privies, cesspools, and rain barrels, and that

where there is such water it should be oiled or protected by wire gauze. The oil will have to be renewed at least once in ten days. One ounce of oil to fifteen square feet is sufficient to prevent mosquitoes from breeding in water. Screen your houses, doors, windows, and ventilators, with wire gauze of eighteen strands to the inch. This will not only prevent mosquitoes from entering but will exclude flies.

In the eastern and southern parts of the United States there are large tracts of land practically uninhabited because of the mosquitoes, which make it impossible for persons to work there with comfort. As a rule these are the salt marsh mosquitoes which breed in great numbers and fly a great distance, so that towns free from marshes or other breeding places are often alive with these insects.

Experiments made in New York and New Jersey show that it is possible to reclaim these marshes and do away with the mosquito pest. The work is really not a local affair and the State should undertake it, the owners of the land repaying the entire or a portion of the cost, as is being done in the irrigation projects in the west. In this connection attention is

called to the fact that the Federal Government is continually dredging from the rivers and harbors of the country material which could be well used in this work. In most instances this is dumped out at sea, when it could in many cases be used for filling the swamps at greatly reduced cost.

Marsh land that has been reclaimed is usually very fertile, and when placed under cultivation will repay the cost of the work put upon it. Especially is this true in the vicinity of large cities where such land can be turned into truck farms. These lands may be worked somewhat earlier in the spring than others and are less liable to be damaged by drought and frost. This subject is fully discussed in Farmer's Bulletin Number 187, which may be had from the Secretary of Agriculture and should be in the hands of those who have swamps on their premises.

Other diseases that are transmitted by mosquitoes are yellow fever and dengue, both of which are found in the United States and have prevailed as far north as Boston.

If you have occasion to sojourn in a community where there are mosquitoes, provide

yourself with a good square net of not less than eighteen strands to the inch and sleep under it all the time. Head nets can be obtained from dealers in sporting goods. They are small and so occupy little space in the baggage and will enable you to spend many a comfortable night that otherwise would be anything but pleasant; besides they will prevent you from contracting malaria. The author has carried one of these ever since 1899 and has never regretted it. Never put your trust in oils that are to be smeared on the body. They are of no value, for as soon as they begin to dry the pests will be at you again, and sometimes they even sting through the oil. I have frequently seen them do the latter.

Before entering the net be sure that there are no mosquitoes within it. Not infrequently the servants or those making the beds, fold or roll up the net in such a way that the insects get beneath it during the day. This is very common, and in the best hotel in New Orleans I have always found mosquitoes within it. Nets should not be hung on the outside of the bed posts, but suspended from the inside, and they must be tucked under the mattress.

They should be entered through as small an opening as possible and tucked under the mattress at once. Unless the bed is large the hands or other portions of the body are liable to come in contact with the netting and be bitten through it. To prevent this it is well to have a flounce about six inches wide placed around the net at such a distance from the bottom that it will just rest on the top of the mattress.

Occasionally mosquitoes will enter a house that is screened, and it may become necessary to fumigate to destroy them. This is accomplished by closing up all the cracks with paper and burning insect powder at the rate of one pound for each thousand cubic feet of air space in the room. After two hours the room is opened and the stupefied or dead insects are swept up and burned. This latter may be facilitated by darkening all the windows but one, where the mosquitoes will congregate in their endeavor to escape.

All persons should be actively interested in the extermination of mosquitoes. Excepting where there are marshes this can be accomplished at no great expense, but it requires the co-operation of all the families in the neighborhood.

TETANUS (Lockjaw)

There are not a few deaths from this disease in the rural districts. It is caused by a germ which lives in the soil, especially in that of gardens and stables. The dung of horses often teems with tetanus germs. They will not live in wounds that are exposed to the air, but grow rapidly in punctured wounds, especially those made by splinters or nails. The disease is most prevalent following Independence Day, due to the injuries made by toy pistols.

The prevention consists in keeping all wounds clean and free from infection. Punctured wounds should be opened and thoroughly cleansed with a solution of peroxide of hydrogen, and dressed with sterile gauze moistened in a solution of bichloride of mercury one part to one thousand parts of water.

DIARRHŒA AND DYSENTERY

Under these names are classed a number of diseases which are not fully understood. In fact diarrhœa and dysentery are really only symptoms. The following are some of the causes: eating overripe or green fruit, eating other spoiled foods, drinking water that con-

tains a large amount of animal or vegetable matter, exposure of the abdomen to cold. The prevention consists in avoiding the causes.

There are several kinds of dysentery. One is caused by a little organism which lives in water and is found on the leaves of growing plants. This form is commonly called tropical dysentery, but it is far from uncommon in this country. There is another variety which is caused by a germ found in all parts of the world. To this latter group belongs the summer diarrhœa of children (summer complaint).

The prevention of dysentery is one of the greatest problems before the nation. It is one of the greatest causes of "race suicide." Its importance may be appreciated when we consider that in the year 1905 there were in the registration area of the United States 545,533 deaths, 105,553 being among children under five years of age, and of these 39,399 died of diarrhœa or enteritis. In Germany, Behring, who is an authority on such subjects, has found that, of every 1000 children born 233 die during the first year of life, that only 510 out of every 1000 males born reach manhood and that not more than a third of those who

reach maturity are fit for military service. He attributes this sad state of affairs to milk infection during infancy.

For many years the great heat of summer was considered to be the cause of the disorder, but recently it has been demonstrated that it is a germ disease and that the heat is only a secondary cause. In other words dirty milk contains germs which cause disease and these germs grow better when the milk is kept warm.

Dr. George W. Goler, of Rochester, New York, has been attacking the problem, assuming that dirty milk is the cause, and his results have been most satisfactory. For the ten years from 1887 to 1896 there were 7451 deaths among children of five years and under. In 1897 the work of providing pure, clean milk to children during the summer months was begun and during the following ten years the number of deaths was only 4965, a saving of 2486. The cost of this was about $1000 per year, or about $4 for each child saved, a small amount to pay for a human life.

Similar work is being done in other parts of the country and we may hope for as good results in other places, but the real solution of

the problem is in the hands of the milk producers. It seems but just that we should expect them to take all reasonable precautions to insure the purity and cleanliness of the milk they offer for sale. That such precautions cost money cannot be denied, and the consumer should be willing to pay the increased cost, as he receives a much better article. That the increase in the price of milk is a serious matter to many is beyond dispute, and the practical men of the country can render the nation no better service than to devise some method whereby the cost of its production may be reduced without endangering its purity. The man who corners the milk market and advances the price simply to enrich himself should be dealt with as we deal with those who commit murder.

In another section the question of pure milk has been considered more fully. Those who desire to know more of its relation to disease should consult "Milk in its Relation to Public Health" Bulletin No. 41 of the Laboratory of Hygiene, the Public Health and Marine-Hospital Service, which will be found in almost any public library.

XV.

GENERAL RULES REGARDING CONTAGIOUS DISEASES

In the less populous portions of our country it often happens that many hours must pass before a physician can be secured. If the case be contagious this is valuable time lost, for during the interval many persons may come in contact with the patient and become infected. It therefore seems advisable to include here some description of the more common contagious diseases, hoping to enable the family to form a probable diagnosis or at least to determine whether the disease is contagious. It is better to err on the safe side and assume that any doubtful case is transmissible than to make light of one that is communicable.

Before considering the diseases severally it will not be out of place to give some general directions regarding the precautions necessary to prevent their spread.

The ideal way to treat these cases is to remove them to a hospital where constant attention

can be had and isolation carried out. Unfortunately this is rarely possible because of the lack of such hospitals, and where such facilities are to be had many persons, from superstition or other reasons, dread to send their friends or members of their families to such institutions.

The vast majority of diseases are treated in private homes, and it therefore becomes necessary to make the best provision possible to protect the other members of the household.

As soon as the disease appears a physician must be summoned, and during the interval before his arrival preparations for isolation should be made. If possible the sick-room should be in a detached portion of the building and all communication with the other portions of the house should be through the open air, but this is rarely possible. If the room opens into the common hall the door must be kept closed as much of the time as possible, and a sheet wrung out of a disinfecting solution hung before it. This must be tacked to the jamb on the hinged side and at the top of the frame, and in length it should reach the floor and allow sufficient for folding several times.

The furniture must be as scant as is consistent with the comfort of the patient. A screen is to be provided to ward off draughts. The carpet and all hangings excepting the window shades must be removed. Thoroughly clean the room, dusting with a damp cloth but never with a duster.

A spit cup, bed-pan, urinal, enamel ware buckets, and bottles or china containers for disinfectants are to be provided. A small wooden tub will be required in which to soak the towels and other linen. All dishes must be boiled or disinfected before leaving the room. Generally the physician gives minute orders regarding the disinfection of the urine, fæces, and sputa, but until he comes it is wise to mix these with an equal volume of a solution of bichloride of mercury one part to five hundred parts of water, and allow the mixture to stand for thirty minutes, occasionally stirring it. After this it may be thrown into the closet if there be water disposal of the excreta, otherwise it should be buried. Metals or silverware must not be placed in the mercury solution, but must be boiled.

Only the necessary attendants are to be

allowed in the room, and all visitors must be excluded. Flowers may be taken to the patient but when wilted they must be burned if there be a stove or open fire in the room, otherwise they should be placed in a disinfecting solution. It should be an unbreakable rule that nothing must leave the room unless it be disinfected. This means work, but it is the only safe way.

The attendant should take several hours exercise in the open air each day. Before leaving the room the hands and face are to be washed with soap and water and then with a disinfecting solution. This must also be done before meals and after handling the patient or any of the excreta. A loose over-garment, such as a kimona, and a cap should be worn by the attendant while in the room.

Many persons have an idea that all children must have the "diseases of childhood" and that the sooner they are through with them the better. With this in their minds many mothers purposely expose their children, a great mistake and one that the law should take cognizance of. Especially is it important to avoid measles, whooping-cough, and scarlet fever.

This will be more fully discussed under the diseases themselves.

The school authorities should make inquiry as to any malady from which the child has suffered before admission and make it a matter of record. This will be found invaluable in cases of epidemics.

The information here given is not intended to cause persons to dispense with the services of a physician, but rather to serve as a guide until he arrives and takes charge. His services are invaluable in cases of transmissible disease. He guards the household from it, watches the case, and is often able to turn the tide towards recovery, when if left alone, the result would be death or prolonged illness, and in some cases permanent deformity.

XVI.

MEASLES AND SCARLET FEVER

MEASLES is not so prevalent in the country as in the city, but nevertheless the death-rate in the rural districts is 7.7 per 100,000. In Michigan in 1903 it caused a sick rate of 356 per 100,000 and a death-rate of 5.6.

Of 2031 cases 1301 were among children under five, with a mortality of 8.5 per cent., while of 599 cases over five the mortality was 1.1 per cent. In other words the chances of recovery were 7.4 per cent. greater in children over five than in those under. Many mothers take no steps to shield their children from this disease, reasoning that the sooner they have it the sooner they will be through with it. This is a most dangerous practice and accounts for many deaths.

The after-results of measles are frequently very severe. Not a few children are rendered deaf from inflammation of the ears following measles, and many cases of tuberculosis follow it.

Measles

Measles is a disease of school children and most of the epidemics start in the schools.

For the first three days the symptoms are watering at the eyes, running at the nose, and cough, or the symptoms of a common cold. On the third or fourth day a rash of small red spots appears on the face and extends rapidly to the entire body. The case is infectious from the day the first symptoms appear until the skin has all peeled off and appears natural. The discharges from the nose, mouth, and ears are also infectious.

During the first days the child will in all probability have attended the school or mingled with its companions, all of whom will have been exposed. After exposure it is generally ten days before new cases appear. At times the infection is three weeks in developing.

Prevention consists in isolating the patient until the skin has peeled and all discharges from the nose, ears, and throat have ceased. None but the persons in attendance should be allowed to enter the sick-room. All bedding and whatever comes from the room should be disinfected.

The question of closing the school comes up

every time there is a case of infectious disease among the pupils. It seems the part of wisdom to take the long chances and close the school in every case, unless the sanitary authorities who investigate the matter should otherwise direct. This will surely reduce the number of cases and the time lost will about even up in the long run. All books and other things in the room from which the case came should be disinfected when the child is removed.

There is a popular belief that the disease is particularly severe among grown persons, but such has not been my experience. There is always more or less measles among soldiers, and the cases that have come under my care have been rather milder than usual.

SCARLET FEVER

Scarlet fever and scarlatina are one and the same disease, and there is no difference in the seriousness no matter which name is used. Scarlatina is one of the most serious of the "diseases of childhood." During the five years ending with 1904 the death-rate from this in the rural districts of the registration area of the United States was less than one-half the

rate for the cities in the same area. In an epidemic in one of the counties of Michigan in 1903 the sick-rate was 869 per 100,000. In the following table is shown the death-rate and the sick-rate from scarlet fever in two rural districts of Scotland.

Years	Death-rate per 100,000	Sick rate per 100,000
1891–1895	23.8	716
1896–1900	14.4	605
1901–1905	3.4	284

The table also shows the result of supervision, isolation, and disinfection as applied to this disease.

Scarlet fever begins suddenly, with vomiting and high fever, and in young children convulsions are quite common. The eruption, which appears first on the neck and chest, comes out in about thirty-six hours after the first symptoms, although in some cases five days elapse before it shows.

After exposure the disease generally appears in seven days, although not infrequently as early as the third day. The case is contagious as long as there is any scaling of the skin or discharge from the nose, mouth, or ears. It can be transmitted through the medium of

milk, clothing, furniture, toys, dishes, bedding, carpets, cats, and dogs. There is likewise evidence to show that it may be carried to a third person by an intermediate person, who does not contract it.

The acute symptoms last about ten days and are often followed by serious disorder of the kidneys.

Deafness is another of the after-effects, and when it develops before the child has learned to speak, the child remains a mute. This and the fact that the mortality is much less after the age of ten is passed, shows the importance of preventing the disease if possible. To expose a child purposely to scarlet fever is a crime and should be dealt with by law.

From a study of the ways in which the malady is transmitted, it will be seen that the room in which a case is treated should be as bare of hangings, furniture, and carpets as possible. No unauthorized person should be allowed admittance, and everything leaving the room must be disinfected. The writing of letters by those sick or convalescent must be prevented, as frequently the disease is transmitted in this way. Toys that have been used by the sick

child during its illness must be destroyed. Clothing that has been used during the sickness should be also destroyed unless it is of great value. In such a case it may be sterilized by steam. The woodwork and walls should be washed with bichloride of mercury solution.

XVII.

DIPHTHERIA AND SMALLPOX

DIPHTHERIA usually begins with a sore throat and fever. Examination of the throat will show a grayish or whitish membrane on it or the tonsils. There are other diseases in which there is a membrane in the throat, but, owing to the seriousness of diphtheria, it is best to consider all cases with membrane in the nose or throat as diphtheria and to isolate them and send for a doctor at once.

The malady is caused by a germ which is found in the throat and is given off from the body in the excretions from the mouth, nose, and throat. The disease also prevails in dogs, cats, and other animals, and is at times transmitted to man from such sources. Milk, as usual, is one of the most common carriers of the germs. There are cases of the disease which are so mild that the sick person is not confined to bed, but does the usual daily work. If such a person be employed about the dairy the milk

which passes through his or her hands will almost certainly be infected, and many epidemics have been traced to this source. The infection can also be transmitted by books, toys, dishes, and clothing.

After exposure the disease may develop in twenty-four hours, but more commonly it does not manifest itself until the third day.

When it develops in a school child the other children should be examined with care, as not a few cases are frequently found among them. The school should be closed, and the children kept under observation until the danger is passed.

The prevention consists in isolating those sick with the disease and the administration of antitoxin to the patient and also to those who have been exposed. The early use of antitoxin will save many lives and prevent many persons from having the malady.

From 1888 to 1894 there were treated in the Boston City Hospital and its South Department 3067 cases of diphtheria, with 1325 deaths, a mortality of 43.2 per cent. Since 1895 antitoxin has been used exclusively and the number of cases treated has been 18,198, with 2079 deaths, a mortality of 11.4 per cent.

Had the previous rate prevailed there would have been 5773 more deaths.

There is no danger in the use of antitoxin that is prepared by reliable houses and issued under the supervision of the National Government. Occasionally there have been cases of unfortunate results following the administration of the serum, but there have been none for some years and under the careful supervision now maintained there will be none in the future. Next to vaccine there is no other discovery that has conferred so much benefit upon the human race. Those who oppose its use should make a careful study of the statistics of hospitals where the disease is treated, comparing those for the period immediately preceding and after the use of the serum, and unless they are unable to be convinced by plain statistics their opposition will vanish.

We still hear of persons who maintain that sewer gas and the emanations from manure will cause the disease. This is not a fact, but such gases may have an indirect effect by so reducing the general health of those who breathe air so contaminated that they are rendered susceptible to any disease.

SMALLPOX

Smallpox is comparatively rare in this country, although there is, every now and then, an outbreak which shows that the disease is still to be reckoned with. In the Philippines and Porto Rico at the time of the American occupation it was very common. In the town of Mangataren in the Philippines 26 per cent. of the inhabitants were "pock marked," and as many more who showed no marks claimed to have had the disease.

Smallpox begins abruptly, frequently with a chill, intense pain in the back, severe headache, and great prostration. Soon small red spots appear on the arms, neck, or at the roots of the hair. These increase in number and extend all over the body. They become larger and fill with serum, which changes to pus; then they dry up.

The exact method of transmission is unknown, but it appears that the infection is given off from the body and transmitted through the air. It can also be carried by domestic animals, clothing, furniture, or carpets.

The sick should be isolated in a building remote from the public road or dwellings. A

distance of four thousand yards is recommended, but it is not always possible to obtain such a situation. The quarantine should be continued for sixteen days after the last symptoms have disappeared. All persons who have been exposed to it should be vaccinated and held under observation for sixteen days.

Vaccination, if properly done and repeated at intervals of five years, will practically prevent contraction of smallpox. The following table, prepared by Doctor Barry of Sheffield, England, should convince any fair-minded person of the value of vaccination.

INDIVIDUALS LIVING IN HOUSES INVADED BY SMALLPOX.

		Over ten years of age	Under ten years of age
Vaccinated	Attacked	28.1 per cent.	7.8 per cent.
	Died	1.4 per cent.	0.1 per cent.
Unvaccinated	Attacked	68.0 per cent.	89.9 per cent.
	Died	37.1 per cent.	38.1 per cent.

In the vaccinated the difference between the rates for children under ten and those older is due to the fact that nearly all children are vaccinated when they enter school, but comparatively few after completing their education. The table speaks loudly for revaccination.

The British Royal Vaccine Commission reports the following statistics:

	Cases	Died	Per cent. died
Vaccinated.....	8744	461	5.0
Unvaccinated...	2321	822	35.1

There are in this country a few misguided persons who have developed a most violent prejudice against the use of vaccine. They are prepared to paint the rare accidents, which have followed the careless use of the virus, in the most vivid colors. They tell their hearers that all manner of dreadful diseases have been contracted from its use. As a matter of fact there have been accidents, which are not to be defended, but very few if any will now occur. During the past few years the National and State Governments have taken precautions which will preclude accidents. The author has vaccinated more than ten thousand persons, and has never met with a case of lockjaw, or other disease which could even remotely be charged to the vaccine. There will always be some soreness of the arm when the operation has been successful, but if the physician uses proper aseptic precautions in doing the operation, and the patient keeps the arm clean and

refrains from scratching it, very sore arms will not be encountered.

According to the Interstate Commerce Commission there were, during the year 1906, 10618 persons killed and 97,706 persons injured by the railroads in the country, yet we hear of no persons who tour the country endeavoring to persuade the people to stop using the railroads. It would seem if the persons who are now preaching against vaccination are really anxious to save their fellow countrymen from suffering they would devote their energy to endeavoring to find some preventive for the terrible slaughter dealt out by the railroads.

Vaccination is without doubt one of the greatest blessings which has ever come to the human race, and every man, woman, and child should honor Edward Jenner and his teacher, John Hunter, who made it possible for the former to discover vaccine. For the sake of humanity do not oppose the vaccination, but endeavor to make it compulsory in your schools on admission, and revaccination a prerequisite before the child can enter the grammar or high school.

XVIII.

WHOOPING-COUGH AND TYPHOID FEVER

WHOOPING-COUGH is a highly contagious disease of the respiratory tract, characterized by periods of spasmodic coughing followed by a prolonged inspiration which is the cause of the whoop. This is one of the most fatal diseases of young children and is not infrequently followed by pneumonia or tuberculosis of the lungs.

At first it appears to be only an ordinary bronchitis (cold), but sooner or later the characteristic symptoms develop. The disease lasts a long time and is infectious from the beginning of the bronchial symptoms until some time after the child is entirely well. It requires careful nursing, and those sick must be isolated and all articles with which they have come in contact disinfected. Cloths used to receive the discharges from the nose or mouth must be burnt at once. A cloth must be held in front of the mouth when coughing to intercept the

small drops which are then expelled from the throat. The sputum must be disinfected.

TYPHOID FEVER

This is one of the preventable diseases which causes no end of misery and many deaths in this country.

For the five years ending with 1904, in the portion of the United States where accurate statistics of deaths are kept, 28 persons out of every 100,000 in the rural districts and 26 in the cities died from it. In one county in Michigan in the year 1903 the sick-rate from typhoid fever was 495 per hundred thousand, while for the rest of the State it was 128. Many of the cases that are credited to the cities are, in reality, contracted in the country.

The duration of the disease is about five weeks, during which time those afflicted are unable to earn anything and are a source of expense to themselves and to their families. Considering the time lost and the deaths, it is estimated that the loss to New York State amounts to $7,000,000 per year. As typhoid fever is distinctly preventable, most of this loss is unnecessary.

The germs are given off from the body in the fæces, the urine, and the excretions from the skin.

The disease is transmitted to man through water, milk, and other foods, and by direct contact with infected clothing or other articles.

Water becomes contaminated by receiving the excreta from those sick with the disease. This may occur through the medium of the sewer, the privy, the cesspool, or through the washings from the ground upon which the infected fæces have been thrown. Not infrequently the fæces are thrown into a stream. In the summer and fall of 1905 the little town of Nanticoke, Pennsylvania, with a population of 1500 persons, was visited by an epidemic of 437 cases with 50 deaths. Upon investigation the State Board of Health ascertained that some weeks before the appearance of the disease in the town, a man who lived on the watershed from which the town derives its supply, was taken sick with typhoid fever and that the fæces, which were apparently not properly disinfected, and the other refuse from the house were thrown into a small stream running beneath it. This emptied into a swamp

drained by the stream from which the town took its water supply.

Had proper precautions been taken in that case the town would have been spared the epidemic. For similar illustrations see the section on water.

Milk becomes contaminated by being placed in containers that have been washed with water in which are the germs. In some cases the infection comes through the hands of milkers who have been in attendance on the sick or who have just recovered from the disease.

The fly is the great distributor of the germs. He delights to feed on infected fæces and then without "wiping his feet" adjourns to the milk-house or kitchen for dessert, and, alighting on the milk or other food left exposed for his benefit, promptly transfers the infection thereto. This was the way the disease was disseminated throughout our military camps during the war with Spain.

Blankets soiled by typhoid patients were also one of the means of spreading it in 1898, and an epidemic in London was traced to blankets which had been used in the hospitals in South Africa during the Boer War.

Shell-fish that have been fattened near the outfalls of sewers have been found to be infected, and I know of a case of a lady who was infected by eating raw clams taken from a beach some distance from the mouth of one of the sewers which pollute the waters of Boston Harbor.

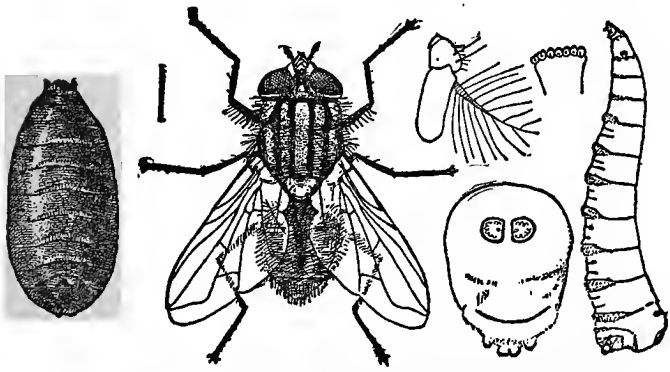

FIG. 19. The house fly, *Musca domestica:* larva with details at right, puparium at left. "The fly which does not wipe his feet." (From Howard, Bulletin 35 N. S., Division of Entomology, United States Department of Agriculture.)

In New York City it has been found that around the mouths of the city sewers there are belts in which typhoid fever is very prevalent. Further investigation has shown that much of the fecal matter floats on the surface and finally lodges on the piles of the docks. Flies caught in such localities are teeming with germs,

many of which come from the human intestines.

Travelling mendicants and, in fact, other travellers not infrequently infect the water supply of the region through which they pass. A case is recited of a man who was taken sick at a tavern where he had stopped for the night. His excreta were thrown on the ground without being disinfected, and in a short time the disease attacked the family of the tavern keeper and later half of the population of the neighborhood, resulting in ten deaths. All the houses in which it appeared used the water from the tavern well.

The prevention consists in destroying the germs as soon as they leave the body. If this were done in every case the disease would soon die out, but this seems to be impossible at present. Under the headings of food, water, and milk, have been given directions for keeping these pure. Every effort should be made to keep flies from the milk or other food, and as far as possible all breeding places should be abolished.

To destroy the germs of typhoid fever the fæces, sputa, and urine must be mixed with equal parts of a solution of the bichloride of a

strength of 1 part to 500. A 5 per cent. solution of carbolic acid may be used, but it is not so good. These mixtures must be stirred from time to time so that the disinfectant shall penetrate to all parts, and after standing for at least two hours they may be thrown into the closet or buried. No solution containing a disinfectant must be thrown into a dry earth closet.

All dishes and linen that have been in contact with the patient should be soaked in a similar solution. Silverware must not be placed in the bichloride, but should be boiled.

The attendant's hands should be washed in a solution of bichloride of mercury 1 part to 1000 every time the patient is handled, and especially after handling the bed-pan or urinal. Before eating, the hands and face must be washed in soap and water and then in the solution just mentioned.

Where these measures have been carried out there has been a great reduction in the number of cases. In one county in England these precautions have resulted in a reduction in the sick-rate from 315 per 100,000, in 1893, to 93.2, in 1905.

XIX.

TUBERCULOSIS

THIS has been called the "universal disease," and there are few families in this country who have not had some experience with it. It causes more deaths and more suffering than any other. In 1900 there were 111,059 from this disease in the United States. In New York State, from 1884 to 1907, it caused 11 per cent. of the deaths, and the Commissioner of Public Health estimates that it costs the State $70,000,000 each year in sickness and death.

Being no respecter of persons, it attacks the rich as well as the poor, but prevails more in the crowded tenements of the large cities. It is found in all parts of the globe, even among people who live largely in the open air. On our Indian reservations it prevails to such an extent that the tribes are rapidly being exterminated by it. Among cattle it causes a great mortality. Professor V. A. Moore, of

Cornell University, states that of 8649 cattle tested with tuberculin in New York State 36 per cent. were found to be infected, and of 364 herds tested 72.8 per cent. responded. In Prussia 12.7 per cent. of the cattle killed in 1905 were found to be tuberculous. In Saxony in the same year 2.7 per cent. of the swine killed showed evidences of the disease. In the large packing houses of this country less than 1 per cent. of the animals killed are infected, but in the small establishments where "home killed beef" is slaughtered the percentage is much larger. This is mainly because the large houses receive their cattle from the plains where the animals live in the open air, while the small butcher obtains his from the infected pastures of the local community.

Tuberculosis is a preventable disease and with proper precautions can be stamped out. It is transmissible to persons through the medium of germs which are given off in the expectoration and in the minute drops of mucus which are expelled during the act of coughing. It is not transmitted through the breath, as has been conclusively proven by experiments with animals, which are far more susceptible than

human beings. There is no reason for the dread which has taken hold of some of our people and which causes them to shun those who have the disease. Persons with tuberculosis are not dangerous to the community as long as they exercise care regarding coughing and in disposal of their expectoration.

In cattle it is transmitted in the same way and in addition the germs are found in the milk and the fæces.

The conditions that predispose to the disease are bad food, alcohol, bad ventilation, and excesses of any kind. Against these we must contend if the disease is to be eradicated.

The prevention consists in enforcing regulations against expectorating in public places, both by law and by public sentiment, which is stronger than the law. Cuspidors of proper construction, filled with a disinfecting solution, must be provided for public places, and those who are known to be suffering from the disease must be required to provide themselves with proper spit cups or other receptacles for their expectoration. They must also hold a cloth or absorbent paper before the face while coughing. Milk from tuberculous cows must be excluded

from the market, and the dairy cattle must be tested with tuberculin at frequent intervals.

Many cattle which are apparently healthy give off millions of germs in their milk. The illustration (Fig. 21) is of a cow which was furnishing part of the milk supply for the city of Washington, and upon examination was found to be badly infected with tuberculosis.

Some years ago, in their anxiety to rid the community of cattle infected with tuberculosis, some of the States passed laws requiring that all such animals should be killed, the State paying the owner a part of or the entire value of the animal. It was soon demonstrated that such a policy would bankrupt any State. Professor B. Bang, of Copenhagen, Denmark, has devised a better and more economical method of accomplishing the desired result. He causes all the cattle of the herd to be inspected, and those which show symptoms of the disease, cough or emaciation, are killed. All others are tested with tuberculin and those which react are separated and kept in distant pastures and stables which do not communicate with those in which the healthy animals are kept. All calves born of the infected cows are

at once taken from the mothers and fed on milk from healthy cows or upon their mothers' milk after it has been pasteurized. The well herd is watched with care and tested at least once a year. Any cattle which become sick or react are dealt with as the case demands. In this way it is possible to restock a herd from cattle which have tuberculosis, and at the same time get rid of the disease. This method is being successfully tried in many places in this country.

No animal should be added to the herd until it has been tested and found free from tuberculosis.

The housing of cattle has not received the attention it demands. Good ventilation usually means a cold stable, and a cold stable means reduction in the output of milk. As has been aptly said, some of our milk producers find it cheaper to keep their cows in badly ventilated but warm barns than to properly house them at an expense which reduces the profit on the milk. Few barns provide more than 600 cubic feet of air per animal, but the amount should not fall below 1200 cubic feet. The question of feeding and housing has been considered under the subject of milk.

FIG. 20.—The fæces of this animal contained large numbers of tubercle bacilli. (From Schroeder, "The Unsuspected but Dangerously Tuberculous Cow." Circular 118, Bureau of Animal Industry, United States Department of Agriculture.)

FIG. 21.—An apparently healthy cow recently in a herd supplying milk to Washington, D. C. Tubercle bacilli were found in her milk and fæces. When killed her udder and intestines were found to contain small tubercular nodules. (From a photograph taken by the Bureau of Animal Industry, published by permission of Dr. E. C. Schroeder.)

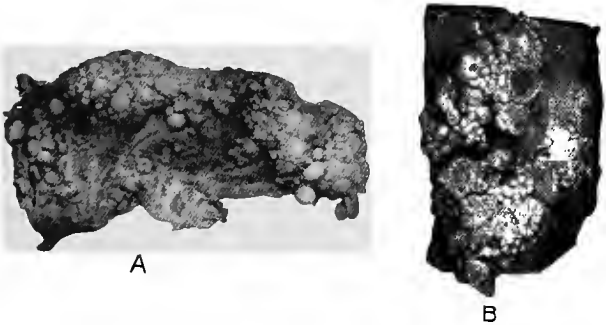

FIG. 22.—A. Mesentery of the preceding cow showing tubercular nodules. B. Part of chest wall of the same cow showing tubercular nodules. (From a photograph taken by the Bureau of Animal Industry, published by permission of Dr. E. C. Schroeder.)

There are persons who claim that the milk from tuberculous cows is safe unless the udder is the seat of the disease, yet it has been proven that cows apparently in the best of health may pass the germs in their fæces. Nearly all milk contains a small amount of cowdung, and where the cow passes the bacilli of tuberculosis in her fæces they will always be found in the milk.

Personally we can do much to protect ourselves from tuberculosis. Our greatest asset in this warfare is a strong body that has not been undermined by excesses. Next comes fresh air and exercise in the fresh air. Sleeping with the windows open is no hardship, even in the coldest of weather. Our ancestors lived in rooms without fires, and the numerous cracks allowed the snow to filter in, yet they were healthy. If the room becomes very cold with the windows open, another room that is heated should be used for dressing. Many persons with tuberculosis are sleeping out of doors all the year round, even in the severe climate of our northern States.

Do not be afraid of sunlight. The draperies which we hang about the windows no doubt look very pretty and make the room more

exclusive and save the carpets, but in shutting out the light we are shutting in the germs of disease. There is no better disinfectant than strong sunlight.

When you have a "cold" go to a physician and have him treat it before it becomes serious. A "cold" that hangs on or is slow in leaving is probably something else, more likely tuberculosis. This is true of "cases of *la grippe*," from which the recovery is slow. If you have a cold or a cough that persists, do not trifle with home remedies, but consult a physician at once and be prepared to be thoroughly examined and to do what he says. If taken early tuberculosis is almost always curable, but if allowed to run on the chances of recovery are greatly reduced. Do not spend your money for the consumption cures which are advertised so widely. They never cure, but do harm by causing delay in beginning proper treatment at a time when a few weeks may mean life or death. Above all avoid alcohol in any of its forms; it will not give you strength, but will add fuel to the fires of the disease which is consuming your body.

XX.

RABIES (Hydrophobia) AND RATS

RABIES is a disease of animals and of man. The dog seems to be most subject to it. For many years it was maintained that it was comparatively rare in this country, but recent studies have shown that it is anything but rare. In the registration area, which comprises the States of Connecticut, Indiana, Maine, Massachusetts, Michigan, New Hampshire, New York, New Jersey, Rhode Island, and Vermont, there were, during the five years from 1900 to 1904, two hundred authenticated cases of hydrophobia. In the District of Columbia during the six months ending July 1, 1908, sixty-eight animals were attacked by it, and for the seven years from 1893 to 1900 twenty-eight persons suffered from this disease. This seems a large tax to which we willingly submit in order that the dog may enjoy privileges not allowed to other animals.

Rabies prevails at all seasons and is about as frequent in winter as in summer.

Not every dog infected runs wild on the streets foaming at the mouth, for in not a few instances the animal seems but slightly sick and is only a little restless. These cases are very dangerous, as their owners are liable to caress the animal at such times and become infected.

The most important step in the prevention of this disease is to have all dogs muzzled whenever they are on the public streets, no matter whether they are in the leash or not. This is quite common in Europe, and in every case where it has been done the disease has practically disappeared. Some of our people will object, on sentimental grounds, to the use of muzzles, but if properly fitted the dog is not injured in the least and will be saved from many a bite from his fellows.

A dog the least bit sick should be watched with great care lest he be suffering from this disease. If there is the slightest suspicion about a dog which has bitten a person it should be killed at once and its head sent to a laboratory where it can be examined. Persons who have

been bitten should receive the Pasteur treatment immediately. The expense should be charged against the person owning the dog, and, should he be unable to pay, the public should furnish the funds. This is sound teaching from an economical as well as from a sanitary standpoint, and will tend to reduce the number of unmuzzled dogs to the minimum. A community which does not properly protect its citizens should pay for any damages they sustain from the lack of such protection.

RATS

Rats are not desirable inhabitants of the home or of the barn. They destroy an immense quantity of grain and other valuable produce, besides eggs and young chickens. Rats which live at the slaughter-house feed on the refuse and become infected with parasitic diseases, especially trichinosis. These are in turn transmitted to hogs which devour the dead rats about the slaughter-house.

Rats suffer extensively from plague, and the infected fleas which are found on their bodies are the means of transferring the disease to man. Plague is practically unknown in the

United States, but it has had a footing in San Francisco for over nine years, and has gradually extended its territory, resisting the efforts of the sanitary authorities of the city and State. It is epidemic in many of the ports of South America. Once it is established in a country it is eradicated with difficulty, and its ravages are something appalling, especially where there is an extensive population that is ignorant and careless of sanitary precautions. In India the mortality from plague during the year 1905 was 878,602. It is not at all improbable that it may gain a footing in some of our eastern or southern cities. Should such a thing happen the man would be indeed well off whose premises are free from rats.

Rats may be excluded from the house by closing up all holes, especially those around the sewer and water pipes, and by blocking up the space between the plastering and the walls. The cellar floor should be laid in cement, and a good cat kept on the place. Corn cribs and similar buildings may be made rat proof by covering the walls and floor with stout wire netting, which is strong enough to resist the teeth of the animal. The usual method of plac-

ing an inverted tin pan upon the top of each post upon which the building rests frequently fails, because the rat can jump from the pole to some hole in the floor of the building.

Rats may be destroyed by trapping, fumigation, poisoning, and by the use of certain germs which are deadly to rodents but harmless to man. Ferrets are also useful. In India it has been learned that where there are many cats plague is very rare, because these keep away the rats and apparently do not suffer from the disease.