THE PEOPLE'S HEALTH

WALTER MOORE COLEMAN

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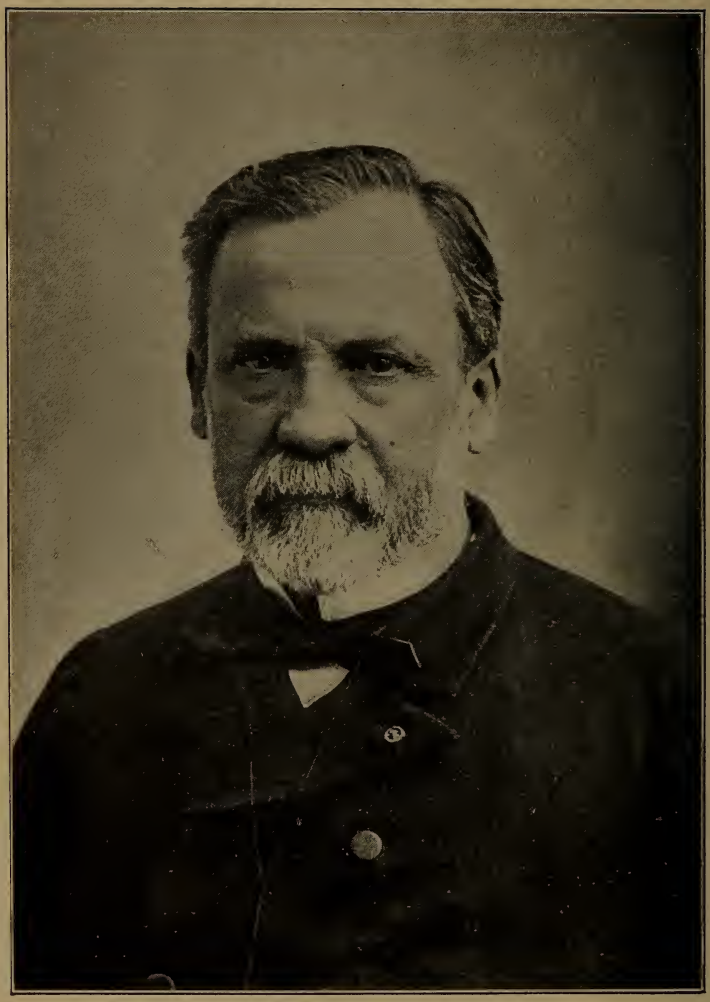
THE PEOPLE'S HEALTH



LOUIS PASTEUR.

The founder of modern sanitation. Born 1822, died 1895. (Director of École Normale, Paris, 1857–1889.)

THE PRACTICAL SERIES

THE PEOPLE'S HEALTH

BY

WALTER MOORE COLEMAN

ILLUSTRATED BY RETTA CARROLL, ALFRED SEILER AND WITH PHOTOGRAPHS

New York
THE MACMILLAN COMPANY
1915

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THE PRACTICAL SERIES

BY

WALTER MOORE COLEMAN

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1. PHYSIOLOGY FOR BEGINNERS.
2. THE PEOPLE'S HEALTH.
3. A HYGIENIC PHYSIOLOGY.

A Health Primer for supplementary reading in third and fourth grades belongs to the same series.

"A First Course in Biology" for high schools by Dean L. H. Bailey and Walter Moore Coleman devotes Part III to the biology of man.

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PREFACE

THIS volume is a *one-book* (*half-year*) *course in personal, household, and industrial hygiene, public health, and human physiology.* This plan permits the study of the several phases of the subject in their close logical relations. This is impossible when the branches of health study named above are scattered into four or six disconnected books. Such books are usually written in a chatty style, mix the important and the unimportant, and are wasteful of time, effort, and money. Especial care has been taken in reducing our recently established sanitary knowledge to a brief, clear code. Merely technical and impractical topics have been shunned. For example, the details of sewer and water systems have been omitted, but every boy should know how to make a slope of clay or cement to protect springs and wells (Chap. III).

The author deeply appreciates the kind reception the school world has given his other health books, over half a million copies of which in a few years have been used in the United States, Canada, and England.

It is believed the untechnical treatment, simple terms, and completeness of scope make this book useful in the two upper grammar grades and (with shortened time) in the high school. The book includes the usual topics in teachers' examinations. The illustrations fill 100 pages yet they shorten the time for mastering the text and enable the pupils to make inspiring stay-at-home trips to inspect health activities under many conditions.

There is a loss of plasticity and lessening of resourcefulness brought by mere book study, by memorizing and

cramming. On the other hand, to *sugar-coat* a subject by using books written in the diffuse style of popular magazines and by giving rambling talks, brings an equally unfortunate result, for it encourages pupils to be scatterbrained and superficial. Such study unconsciously degenerates into a disconnected lesson once a month; and the pupils leave school without a knowledge of how to protect their own health or the health of others. The writer believes that as useful and important a subject as this should not be taught in a loose manner, but that the pupils should be held to hard and faithful work. Hence the essentials should be brought together in a closely knit, orderly way, and studied each day in definite lessons.

Thorough teachers know that they must not only have texts which do not confuse the pupil by drowning essentials in a flood of talk about non-essentials, but that they must have books the pupil can understand. Numerous qualifications of statements which are true in general, discourage young students who are trying to get a grasp on the elements of a subject. No statement can be made to which the captious cannot take exception. Hence the author has not troubled the pupil with unnecessary hedging of statements.

Since the blazoning of topics and subtopics tends to disjoint the subject and to encourage mechanical study, italics have been used for the most important statements and key words as they occur in their natural places in the text. The italics will serve to guide the teacher's eye during the recitation to the most essential ideas, and save time in the framing of questions.

In an age when individualism has become rampant, the discoveries in sanitation have shown that selfishness and

indifference to others in matters of health is suicidal. The school prepares a pupil for his place in a social community. It must not only show him how to attain happiness and efficiency, but also help the people of which he is a part to become efficient and happy. The author believes in the building of character by the school, and that the study and the practice of public hygiene will contribute to that end. Before the pupil is aware of it he becomes a more social being. While studying the needs and rights of others, he becomes moved with a desire to help others and to respect their rights.

It is not enough to give knowledge which can be applied in daily life; we must cultivate the habit of independent thinking necessary in applying it. As long as many schoolrooms are dusty and ill-ventilated, and the death rate of teachers from consumption is near the head of the list, the school will be handicapped in doing its part in the war on tuberculosis and in other sanitary reforms. The teacher's clothing, food, gait, posture, exercise, simplicity of living, and love of fresh air can aid in hygienic instruction as nothing else can.

An effort has been made to show clearly the relations between public and private hygiene; also the relations between rural and urban sanitation. It is hoped the needs of neither the city, the town, nor the country have been neglected.

The teachers in the country and in small towns will receive little help from medical inspectors and health officers. They must themselves be the leaders for improved sanitation. The teacher need not wait for the appointment of a medical officer or school nurse before commencing effective health work with school children.

An outline for a brief health census and health survey is

NUMBER OF CHILDREN, Oct. 1 . .

HEALTH CENSUS OF SCHOOL

Teacher asks questions; counts hands raised.

	First Week in Oct.	First Week in April	Gains +, Loss −
1. Appetite good, do not miss meals?			
2. Seldom take cold ?			
3. Never drink tea or coffee ?			
4. Bathe weekly in winter, daily in summer ?			
5. Out of doors, several hours daily ?			
6. Sleep with windows open ?			
7. Headache very rare ?			
8. Pain in eyes very rare ?			
9. Read writing on blackboard easily ?			
10. Brush teeth at least once a day ?			
11. Wash hands before meals ?			
12. Toothache very rare ?			
13. Have no corns ? (See Chap. XVII.)			
14. Do not use tobacco ?			
15. Sleep eight hours or more daily ?			

NUMBER OF CHILDREN, Apr. 1. .

HEALTH SURVEY

Actual observations by teacher

1. How many have fresh-looking skins ?			
2. How many sit without cramping the chest ?			
3. How many write without bending spine to side ?			
4. How many walk with straight body and full chest ?			
5. How many breathe with mouth closed ?			
6. How many are without offensive breath ?			
7. How many are without "nasal" voice ?			
8. How many are without coughs, colds, sore throats ?			
9. How many have loose clothing at waist ?			
10. How many have no unfilled decayed teeth ? (Use a dentist's mouth mirror with handle.)			

Total points gained by all pupil in six months. . . . . .

placed in this preface with blank columns for the teacher's use. It is urged that the first of these columns be filled at the beginning of the term and that the ambition of the school be awakened to make the second census and survey show great progress in health. By such work the teacher's powers of observation for the physical state of the pupils will be greatly increased; a new sympathy for the weak will arise. Most important of all, the pupils will be convinced that health is not an academic question, but that study of it belongs to real life.

The teacher will doubtless be surprised at the number of children that raise their hands during the first health census taken. An observer in Minnesota finds that eighty per cent of the children drink tea or coffee; twenty per cent have frequent headaches; and forty per cent suffer from almost constant toothache.

After the general survey is made, individual pupils should be carefully studied. In the absence of blank forms supplied by the department of education or the board of health, the teacher should have a notebook with one page devoted to each pupil; defects may be noted according to the outline in this book (page 210). When conditions are discovered which in the opinion of the teacher need the attention of the family physician, specialist, or dentist, the parent should be so advised.

The author wishes to thank the following executive officers of the several states for important aid while writing this book: Eugene R. Kelley, M.D. (State of Washington), J. N. Hurty, M.D. (Indiana), Eugene H. Porter, M.D. (New York), William F. Snow, M.D. (California), Ralph Folk, M.D. (South Dakota), E. F. McCampbell, M.D. (Ohio), L. W. Hitchcroft (Statistician, Wisconsin), Morgan Smith, M.D. (Arkansas), Warren H. Booker, C. E. (North

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The author has received much courtesy and assistance in illustrating the book. This he has acknowledged beneath the pictures, and wishes gratefully to acknowledge here. He will be glad to receive suggestions for use in future editions that every line of the book may be kept as clear and accurate as the importance of the subject demands and the state of science permits.

American University Park,
Washington, D.C.

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Courtesy of Indiana Board of Health.

Having followed the jack-o'-lantern of CURE, and fallen into the pit of darkness, they now see the bright stars of PREVENTION, and resolve to be guided by them.

THE PEOPLE'S HEALTH

CHAPTER I

INTRODUCTION

The Athenian's Vow. — "We will never bring disgrace on this our city by any act of dishonesty or cowardice, nor ever desert our suffering comrades; we will uphold the ideals and sacred things of the city, both alone and with many; we will revere and obey the city's laws and do our best to arouse like reverence in those who are prone to set them at naught. We will strive to quicken in all the sense of public duty. All this will we do that our country may become not weaker, but greater, better, and more beautiful than when we received it."

Such was the vow made in the olden time by every young citizen of Athens, the most beautiful city of *Greece*. So long as they kept this oath, their country was free and great. The children grew up with the most beautiful bodies of any people in the world, and those beautiful bodies supported the minds of the greatest thinkers, poets, philosophers, and artists the world has known. We, as they, are free; and although *our country* is larger than Greece measured by miles, it is really more of a unit than was the small land of Greece, for now by means of railways and motor cars, newspapers and post offices, telegraphs and telephones, its citizens communicate with each other easily and constantly.

This *ease of communication* spreads diseases from one place to another; it enables selfish men to send and sell to others impure foods and medicines, clothing made in

THE RACE WITH THE SUN.

The railway is one of the inventions which spreads disease and also enables us to work together to prevent disease. It makes the whole country almost as one neighborhood.

the homes of diseased workers, and otherwise to endanger the public health. But it also enables us, if we will, to coöperate in preventing these evils, in helping each other to achieve the best things, in keeping off dangers to the public health, and in making the people healthy and happy.

Miss Jane Addams, who is striving for the right of working women to have sanitary conditions for their work.

This book is written to show what many noble men and women, as noble as those of Athens, are trying to do *for the health and life of all*, to suggest how each of you may help, and to explain the part that you may have in your own city or neighborhood.

During a recent session of Congress, a count of the Senate at Washington by one of its members showed that about half of the senators were under the care of physicians.

This shows how far our ideals have departed from the Greek ideal of perfect living. Such a condition, even of elderly men bearing public burdens, could not be imagined in Athens among the sane and healthy Greeks. Modern people have realized that the number of unsound bodies and minds has increased to an alarming extent, and they have set about remedying this great evil. This is our patriotic duty. A sickly nation is a weak nation. In the war with Spain 40 per cent of the recruits at several recruiting stations were rejected because of weakness unfitting them to be soldiers.

The large amount of weakness and disease at this time should not discourage us, for we are only beginning to *work at the problem in the right way.* To hope to *overcome disease by cure* is simply absurd. It has proven as hopeless a task as it would be to sweep back the ocean with a broom. Attempting to keep a nation healthy by curing disease after it begins will always be a hopeless failure. *Prevention is better* than cure. This is practical, reasonable, businesslike, and scientific. Even the Chinese, centuries ago, learned this and started the custom of paying the physician to keep them well and stopping his pay when sickness came. *Most diseases are preventable;* few are entirely curable; at least the effect of the disease remains in a weakened body. We need as many health officers and doctors of public health as we need doctors of medicine.

Although we now pay our physician for helping us to get well instead of to keep well, there are numberless men in the medical profession who, without pay, are doing all that lies in their power to set before the people true preventive measures. Perhaps before long the doctor will make regular visits when the family is well, oftener in families with very

young or very old, and therefore delicate members. He will foresee and warn against threatened breakdown from wrong living. He will notify them of infection in the

By courtesy New York City Schools.

EMPLOYING A PHYSICIAN TO KEEP US WELL.

A school doctor testing each nostril of a boy for adenoids. He will look out for any other weakness that might lead to illness.

neighborhood. He will know the family history and know what weaknesses to look out for and guard against, and a regular salary will be paid him.

The people of all civilized countries are slowly coming to realize what a costly thing illness is, and what *a paying investment* is money spent for *sanitary measures*. This is only common sense. Just as a boy who takes care of his health has lots more fun, so a nation is the happiest when the conditions of living are most healthful.

A sickly nation will not only be a *weak nation*, but also a *poor one*. The *working man* must guard his health well, for it is his only capital. The *business man* must guard his well, because capital is of little avail without health.

Hygiene is the study of health. *Health* is harmony between the body and its surroundings. *Personal hygiene* explains how to *fit the body to the conditions of life. Public hygiene* shows how to *fit the conditions of life to the body.*

THE DIRTY HOME of a woman who goes daily to cook for a clean household, perhaps taking the virus of disease. The best way to protect the health of one is to protect the health of all.

In studying personal hygiene, and especially in studying public hygiene, we are learning how to become better citizens. The ignorance of many people on health subjects is appalling, and the school is the best means of reaching future citizens. With careful instruction children will grow up with the knowledge of how to take

care of themselves and how "to fight both alone and with many," for higher ideals of public health. It will be a part of their sense of public duty to do this that they may make "their country greater, better, and more beautiful than they found it."

The *shocking ignorance* of a part of the public is shown in many ways. They spend millions of dollars every year

From Jacob Riis' "The Battle with the Slums."

An East Side block, New York City. Babies, 500; bath tubs, 0.

for harmful patent medicines. They go to "magnetic healers" and other humbugs, passing the doors of honest physicians who would give them sound advice. If you do not believe in magic, why believe the "boasts" of a newspaper quack? The only magic about it will be the way he gets the money out of his victim's pocket. Sick people would not so eagerly accept the rankest absurdities if they did not believe in getting something for nothing. They

will be less persistent in doing the things that they know will undermine the health when they cease to expect a magic cure of disease. *Ill health is usually proof of some weakness of mind or character.* Preserving the health is perhaps more a matter of character than of intelligence. If the ignorant will not allow the beds of free hospitals to remain empty, intelligent citizens are no less inclined to

The baby in this home will not need a public inspector to make the dairy safe. Most babies are not so fortunate.

line up on sanitorium settees with a lot of invalids. No more rich men than paupers reach a ripe old age. If one expects to accomplish anything in the world, he must learn the proper handling of body as well as mind and have the strength of will to use the knowledge; otherwise when he seeks health, the character will show its lack of balance by the taking up of some health fad.

Personal hygiene is the first duty of every citizen, but a civilized community cannot continue to exist without

public hygiene. If every family milked its own cow, kept its own fowls, canned its own fruit and vegetables, taught its children at home, caught drinking water from its own roof, and neither traveled nor received travelers, there would be no need of public hygiene. But no one wants to lead so dull and selfish a life. As we now live, an individual as an individual cannot protect himself from many dangers to health, such as infected milk, foul sewage, impure water and air.

The Structure of the Body. — The structure of the body is not as simple as it looks, for it is made of *millions of tiny parts called cells.* Just as the walls of a brick house may not show at a distance that it is made of bricks, so unless we use the microscope, the millions of tiny cells of which the body is made are not visible. We can see with our own eyes that the body is made of useful parts, such as hands, feet, eyes, teeth, and tongue. These useful parts are called *organs*, and each has a duty to do, called its *function.*

A house seen at a distance and close at hand.

A boy seen with and without a microscope.

The microscope shows us that each organ is made up of millions of tiny cells that grow and enlarge by absorbing nourishment from the blood. Each cell has a tiny core or dot called a *nucleus* (nu′-clē-us). The organs grow and are repaired only by the growth of these cells. When *new cells* are needed for growth or repair, the cell enlarges, the *nucleus divides into two parts*, and *the cell divides with it* into two cells. Each cell is a bit of *living substance.*

Even the blood is composed largely of cells. In its *plasma*, or watery portion, are floating millions of *cells of two kinds*. Most of them are red and round, but there are also many of another kind called the white cells, which are colorless and of irregular shape. They are larger than the red cells, and when magnified look like bits of raw white of an egg.

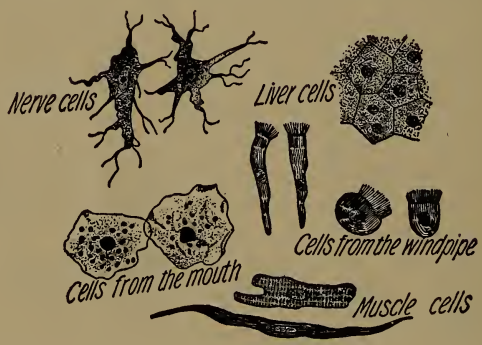
The white blood cells are the only cells in the body that can move about of themselves. By keeping close to the walls of a blood tube, they can even crawl along against the blood stream. There are many tiny one-celled animals that live in water; and the cell structure of the body, and especially the habits of the white blood cells, have suggested to some people the theory that the bodies of all large ani-

Five drawings of the same white blood cell. There are about 600,000 white cells in each drop of blood.

mals like ourselves are descended from tiny one-celled animals that lived in the sea millions of years ago; and that the one-celled animals, by living together in colonies and helping each other, formed larger and more powerful animals. For this reason our body likes salt; tears and sweat are salty, and our blood is salty, as you may have noticed when you popped your cut finger into your mouth. The blood is not as salty as sea water, for the ocean, now that much salt has been washed out of the rocks, is much saltier than the ocean of that early time. Be that as it may, the cells of our bodies do seem like little water animals, for they die if dried out. Hence the cells in the outer skin, hair,

and nails are dead, and we have no feeling when we cut those dry parts.

The cells are like the citizens living together in a city. They arrange themselves in *tissues* and form the organs. Since they cannot go to market for food nor to open spaces for fresh air, *the blood*, which is the circulating market of the body, *brings food and drink and air* to them through the pipe lines called *blood vessels*, and takes away used-up

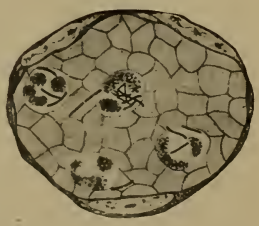


Some of the cells, or little fairy people that keep us alive. You notice the cells in the windpipe have brooms like little chimney sweeps; the nerve cells have branches for carrying messages.

rubbish. For these body cells of ours need food, and the liquid plasma of the blood soaks out into the lymph spaces between the cells to deliver the food. When the watery part of the blood gets into these spaces, it is called *lymph*. *The food we eat and the oxygen of the air we breathe are carried by the blood to the cells; there the oxygen burns the food, and this burning keeps the body warm and makes it strong.* The cells work even when we sleep; the blood continually carries used-up material to the skin and lungs to be given off in breath and perspiration. If you were to weigh yourself before going to bed, and again the next morning, you would find that the body had lost about half a pound.

Disease Germs. — Health and disease are not mere matters of chance. *Health depends most of all upon following good habits* and avoiding bad habits. We may weaken the eyes by using them in glaring light or by looking too much at very small things; we may poison the blood with alcohol; we may stunt the growth of the body by overwork, or starve it by not giving it the kind of food it needs.

Health also depends upon preventing certain kinds of tiny one-celled plants and animals called *disease germs*, from growing and multiplying in the body. It was long noticed that certain diseases passed from one person to another, but until the discovery of disease germs with the microscope we did not know they were conveyed by germs. The white blood cells are the tiny citizens of the bodily community whose especial duty it is to destroy disease germs, and most valiant little warriors they are. Diseases caused by germs are usually acute; that is, they come suddenly and are quickly over. Diseases caused by bad habits are chronic; that is, they last a long time. Acute, or germ, diseases are usually *infectious;* that is, they are passed on by means of germs from one person to another. Such diseases as indigestion and kidney disease are not infectious.



Four WHITE BLOOD CELLS devouring germs.

Experiments. — Collect specimens of mold, mildew, yeast, mushrooms, and other plants without green color, and study their manner of growth and multiplication. A magnifying glass will be useful.

Disease germs belong either to a class of *one-celled vege-*

tables called *bacte'ria*, or to a class of *one-celled animals* called *protozo'a*. The animal germs have various shapes; some have no definite shape at all, but are like specks of formless jelly. The tiny plant germs called bacteria are shaped like balls, rods, and corkscrews (or spirals); the germ of pneumonia is a ball, or *coc'cus;* that of consumption is a rod, or *bacil'lus;* that of cholera is a spiral, or *spirillum*. You no doubt are wondering what these bacteria are like. They are not like our common plants, since they have neither stem, leaf, nor flower, and are not green. They are more like the mold which grows on cheese or old bread.

Yeast plants.

Green plants flourish in the sunlight; colorless plants flourish in darkness. Bacteria are colorless plants; sunlight kills them. They resemble mold, but are far smaller. The limit of man's vision is about one five hundredth part of an inch. We can see a speck so small that 500 like it in a row would only reach one inch. But it would take 8000 of the larger kinds of bacteria to reach an inch, and some are so small that probably no microscope will ever enable us to see them, although we see their effects in causing certain diseases. Smallpox is probably a germ disease, but its germ

Courtesy Dr. Thos. S. Carrington.

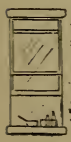
Bacilli of consumption in sputum.

has never been seen. Most germs are not disease germs, but are perfectly harmless.

Germs ride on particles of dust and droplets of water vapor, but left without support they fall freely to the ground; disease germs are seldom found except in places where they have been carried by men or animals.

The size of the largest bacteria compared to the finest cambric needle.

Most bacteria cannot move, though some propel themselves in water by means of fine threads. *When conditions are favorable, they increase rapidly in number.* For example, a bacillus, or rodlike bacterium, grows in length until it is about twice as long as at first, then a partition appears in the middle, and two bacilli are formed. When food is lacking, some kinds form *spores*, which may be compared to the seeds of ordinary plants. Spores are harder to destroy than bacteria. Boiling water kills some disease germs in one minute, but does not kill their spores. Fortunately, most disease germs never form spores.



A Calculation for the Blackboard: If one germ becomes two in half an hour, and these two become four in the next half hour, and so on, how many germs will be formed in 8 hours? In 12 hours?

If disease germs multiply so rapidly, how is it possible that any of us survive? Do not get a wrong idea. *Very few disease germs are harmful to a sound, healthy body*, and most germs are not disease germs, but are helpful to us. If bacteria did not live and work, no dough would ever rise, no cheese would ripen, butter would not have a good

Flies.

flavor, the earth would be encumbered with dead plants and carcasses, soil would lose its fertility, and the earth become a barren desert. The greatest of the many services that bacteria perform is to convert dead plants and animals into rich soil to support new life.

WHAT A CELLAR GAVE UP in San Francisco during the campaign against rats to stop the plague.

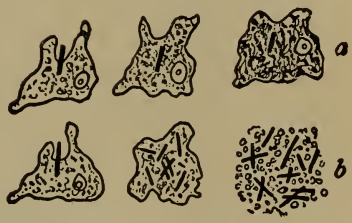
The *best way to prevent* the growth of harmful germs is by fresh air, sunlight, and old-fashioned cleanliness; by soap, water, and "elbow grease." The food required by man and other animals is just the kind suited for germ growth. Wild yeast germs do not attack pure sugar, but they may attack diluted sugar in jelly, stewed fruits and preserves; another kind of germ may cause meat to taint, another kind makes butter rancid. Germ growth is fostered by *moisture, warmth, and darkness.* Hence food should be dry and stored in a dry, cool place, though it may well be sunned occasionally. The skin of vegetables and fruit should not be bruised or broken, as the skin protects them from germs.

An animal cell devouring a plant cell.

Man is the highest animal in the world. Germs are the lowest, simplest, and weakest forms of life. Man's body can triumph over germs. The sounder the body is, the quicker the plasma and white cells of the blood kill germs. The most important factor in health is *the resistance*

of the individual. But the little white warriors of the body may sometimes be overcome by a very large number of germs. Hence cleanliness is necessary.

The body can kill germs to which it is accustomed, but sometimes *a germ that the body is not used to* gains entrance. This is usually because the person travels to a new place, or because a traveler brings in a new kind of disease germ. If new germs reach the body gradually, — only a few at first, — the defenders may learn how to destroy them. Often the struggle between the body and the new germ is so quickly over that it is not noticed. Sometimes the body is prostrated by the poisons, or *toxins, formed by the germs* while the body is struggling to acquire mastery over them or to kill them. It has long been known that an infectious disease seldom attacks the same person twice. You will now learn why.



A WHITE CELL devouring a germ (above) and a white cell destroyed by germs (below).

Courtesy U. S. Dept. of Agriculture.

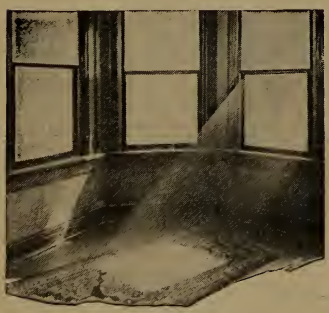
A FOWL WITH RHEUMATISM.

This illustrates that when man forces indoor inactive life upon domestic animals, such a life is as great a curse to them as it is to man. (Notice the feet.)

Pasteur, a Frenchman, when studying chicken cholera, noticed that if *old germs from a broth* or culture of the cholera germs, were used to infect chick-

ens, the disease would be much *less severe than if fresh germs were used*, and the mild disease protected them from having the disease in its dangerous form. Such weakened germs are called a *weakened virus*. *Jenner*, who lived in England long before Pasteur was born, had found that cowpox could be used as a *weakened virus* to vaccinate the skin of people. The vaccination produced a small sore which protected them from smallpox. This method of producing a mild attack which protects the animal from catching the disease in its dangerous form is only a way of *stimulating the body to form a medicine* in the blood, called an *antitoxin*, or *antibody*, which destroys the toxin or poison formed by the germs. Perhaps the mild attack also trains the white corpuscles to kill that kind of disease germ. Hence we seldom have a germ disease a second time.

We say that vaccination makes the body *immune* to smallpox. Although there are a few enemies of the public health who oppose it, this is no vague theory. It has been proved in numberless cases. Freedom from liability to a disease is called immunity. Immunity is either natural or acquired. We have natural immunity to most diseases of other animals, and they are immune to most of our diseases. Our pets do not catch scarlet fever or the measles when one of the family has it. But this is not true of all germ diseases. Rats have plague, and cattle have a form of consumption.



Sunshine, Nature's disinfectant, the best and cheapest.

To *disinfect* is to apply chemicals or other means to any

thing or place for the purpose of killing disease germs. Sunshine is the best and cheapest disinfectant. To *sterilize* anything, as water or butter, is to kill *all* germs and spores in it. This is usually done with boiling water or steam or by heating.

Steam and boiling water are used in sterilizing.

The body not only has the white blood cells with which to kill germs, and the tissues to form antibodies that render harmless the toxins formed by germs, but the saliva and mucus of the mouth and the acid of the stomach kill germs, while the unbroken skin and mucous membrane are germ proof.

Hygienic Laboratory, Washington, D.C.

There are both *direct and indirect causes of germ diseases*. The indirect causes are bad habits which make the body weak, so that it cannot resist the germs when they attack it. Thus the body becomes *predisposed* to disease by wrong living. The germs are the direct cause, but they alone can hardly cause disease. The germs of pneumonia and diphtheria are found in the throats

of many healthy people and do them no harm. But these people may carry the germs to weak people, who take the disease at once.

TEST QUESTIONS. — What vow did young Athenians make? What kind of people were the Greeks? Compare our country and Greece. What dangers come from ease of communication? What is the purpose of your present study? Give facts which show that our ideal of life is narrower than the Greek ideal.

What change are we making in attacking the problems of health? Why was the old way a failure? What will probably be the chief duties of future physicians? How is health related to wealth? What is health? What is the difference between personal and public hygiene? What can the school do for public hygiene? Give an instance of public ignorance. What is ill health often a sign of? Under what conditions of life would public hygiene not be needed?

LEPER COLONY at Molokai, Sandwich Islands.

What is the body built of? What is a cell? Organ? Function? Nucleus? How does the body grow and repair itself? What is plasma? Describe the two kinds of cells in the blood. Where is life supposed to have first existed? Why are the cells in the hair and nails dead? How do the cells in the body obtain food, drink, and air? What is lymph? What is the source of the body's warmth and strength? What burns in the cells? Upon what does health depend most of all? Upon what else besides this does it depend? What is infection? What is the duty of the white blood cells? What kinds of diseases are usually acute and soon over?

What are bacteria? Protozoa? A coccus? A bacillus? A spirillum? Tell the differences between bacteria and common plants. What are spores? Give some idea of the rate at which germs multiply. Name things done by helpful germs. How is the growth of germs prevented?

What is the most important thing in preserving the health? Which are more easily vanquished by the cells, strange germs or familiar germs? What is a toxin? What did Pasteur find out in studying the chicken cholera? What was Jenner's discovery? What is an antitoxin or antibody? Why do we usually not have the same germ disease twice? What is immunity? Give an instance of natural immunity; acquired immunity. What is disinfection? Sterilization? What other protection from germs do we have besides the blood and antitoxins? What two kinds of causes must work together to bring about disease?

CHAPTER II

FRESH AIR

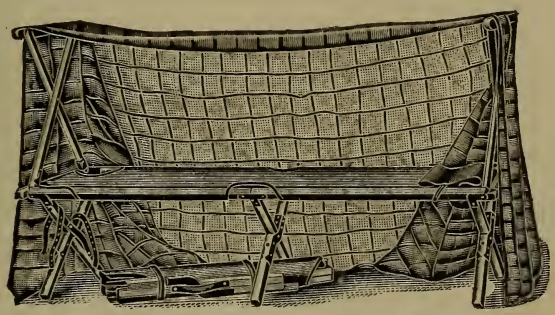
It is feeling that keeps us alive and active and all our organs doing their appointed work. The feelings from the skin are highly important. *The changing play upon the skin of wind, of light, of cold and warmth, keep the body active and healthy.* On a sultry summer day when the air is not only still, but almost as warm as the body, we feel oppressed and languid, and may even have a smothered feeling.

From the experiments of Leonard Hill and others, it is probable that the *bad effects of living in unventilated rooms* come as much from the warmth and moisture of the air as from impurities in it. Carbon dioxid is the gas that gives the sparkling bubbles to soda water; it is formed by the burning always going on in the living body, and comes off at every breath. This gas (as is taught in the two other books of the series) is not, in itself, an actively poisonous gas. Carbon dioxid does not poison, but it may replace needed oxygen, and so the body will suffer for want of oxygen. But in unventilated rooms there is usually enough oxygen. The harm of such rooms comes partly from the *abundance of germs* and odors from the body, but partly *from the warmth, moisture, and stillness,* — the very conditions that

A simple method of getting fresh air.

we find unbearable on a sultry summer day. Even the purest air is unhealthful if it is warm, moist, and still. The prisoners in the Black Hole of Calcutta (described in Book One) died as much from *heat stroke* as from smothering.

The *sameness* of sitting still at work in overwarm, motionless air for long hours, day after day, destroys vigor of body and brightness of mind. Most work in factory and office is of this kind. The degeneration due to city life will be mentioned several times in this book; but in cities



Courtesy of Gold Medal Furniture Co.

Demountable cot with mosquito bar used in camp hospitals of U. S. Army.

draymen, ditch diggers, and policemen are vigorous and healthy because of open-air life. For the same reason city horses are almost as sound as country horses; the air they breathe is not like the stagnant air of overheated houses. The city clerk, merchant, lawyer, or teacher may take the hint, and keep themselves in condition by plenty of outdoor or open-window exercise.

The deepening of basements and subways, the raising of skyscrapers which darken the streets, have brought it about that many people are "cave dwellers, confined during sleeping and waking hours in windless places, with artificial light and unchanging warmth." Dwellers in city and town

no longer have the benefit of struggling with severe weather. Only the warm air afforded by tight houses and warm clothes reaches their lungs and skin. This is particularly true in winter, and it is then that the health becomes bad most rapidly. In summer, when the windows are raised, scarlet fever, diphtheria, and measles almost disappear.

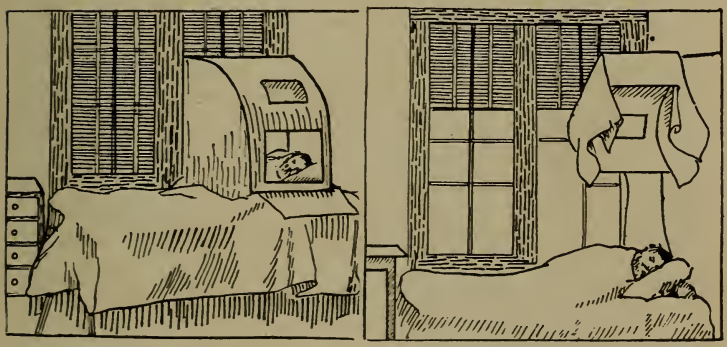
Any one who never has to endure cold and hunger becomes soft and flabby and unable to resist disease. It is

Sunshine and fresh air will keep you young.

not the cold of winter that brings weakness. The weakness comes from overeating and overheating. It is caused by the overheated and stale air of factory, school, office, public halls, homes, and trains. When the warm house and inactive life cause loss of appetite, more seasoning is added to the food. What is *needed is ventilation by moving air, cooler rooms, a part of each day spent out of doors.* It is worth while to keep a horse healthy and sound; it is more important to keep a man so. Tight, well-built houses and warm fires are dangerous comforts. With the poorest

people conditions are somewhat different, but hardly better. *Cool rooms require more food and more clothing.* The *poor* find that the best way to save food and clothing is to live in warm rooms, and that the cheapest way of warming a room is by their own breath. In order to warm it in this hurtful way, they must keep out the fresh air, which is their life, by stopping up every chink and crevice.

Ventilation is most difficult where people assemble. From bad ventilation, people are often sleepy in church. They



INSIDE WINDOW TENT, used and not in use. Thus one may sleep in a warm room with the head in the open air. For a home-made window tent use two sheets, overlapping and tacked to top and sides of window frame and lower ends tucked under the mattress.

feel faint in crowded halls, listless or fidgety in school, dull and heavy in the morning after sleeping in closed bedrooms. In crowds, it is the number of germs as well as the sultriness that makes people restless. Besides being unhealthful, close rooms are uncleanly and unrefined; they soon have a fetid odor caused by particles that are constantly coming from the clothes, skin, breath, teeth, and digestive organs of human bodies. This odor is depressing and hence unhealthful.

Most people *in England* are rosy cheeked, partly because

they use open chimneys for warming. Rosy cheeks are not so frequent *in Germany*, where stoves are used, and, to save coal, the windows are closed with double sash all winter.

Cold air, cold baths, and cold winds arouse the heart, deepen the breathing, increase the heat and energy. With

OPEN-AIR SCHOOLROOMS, Bryn Mawr School, Baltimore. The lungs, the color, and the health of these young ladies will be better instead of worse from having gone to school.

exercise, they make the difference between the "soft, rotund, overfed city man, and the hard, wiry, active farmer or frontiersman."

Not only the muscles, but the skin and the surface blood vessels, the radiators of the body, become weakened by constant heat; the heat regulating power of the body is weakened.

The air of closed rooms heated by hot water and steam

pipes becomes too dry. A little steam should be allowed to escape from a radiator in each room. The air of rooms heated by air which has passed over a furnace becomes too dry, unless it also passes over water pans or through a spray of water. A large water pan holding several gallons may be placed in the air chamber over the fire box. This will be enough for the usual-size dwelling, if it is used up and the pan refilled daily. A pan of water may be placed in each register. Dry air dries out the mucous membrane of the lungs and air passages, prevents the flow of blood through it, and leaves it undefended from the germs of colds, grip, and consumption.

Courtesy of Fla. Board of Health.

PIPELESS STOVE. If this man has no lung disease, he will soon get one.

Red-hot iron and loose-jointed stoves, furnaces and pipes, may leak a poisonous gas called carbon monoxid that destroys the red blood cells. To prevent this gas the smoke pipe of the furnace should never be closed with the damper, and the fresh-air pipe should always be open. It should lead, not from the cellar, but from outdoors.

One of the most vicious things ever invented is a pipeless gas or oil stove for heating. To burn one for a few minutes in a small room, as a bathroom, makes some people dizzy. Such stoves give headaches, but kill no one outright, so they are used. Gas escapes unburnt from many of the tiny

holes in a fancy "gas log." Open fireplaces are perfect ventilators, but much of the heat goes up the chimney.

It is better to spend money for warm clothing than for large fires. Since it is more convenient to add and leave off outer clothing with changes of weather or of houses, the inner clothing should not be heavy. Cotton is best. A perspiring skin under a mass of thick clothing may cause a cold. Mufflers cause many sore throats.

Courtesy of N. Y. Ass'n for Improving Condition of Poor.

WHERE GERMS DO NOT LINGER. Notice this sash; two thirds of window open, no curtains. No rugs or carpets.

Frequent colds prepare for consumption. There is no surer way to weaken the body and invite a cold than to shun all drafts. The stuffy germ-laden air of closed houses is the chief cause of colds. Overheating causes more colds than cold air. Colds are caused by germs; germs multiply in stuffy rooms; drafts take them away.

It is certain that in close, unventilated houses many

disease germs adhering to particles of dust in the air are carried from one human being to another.

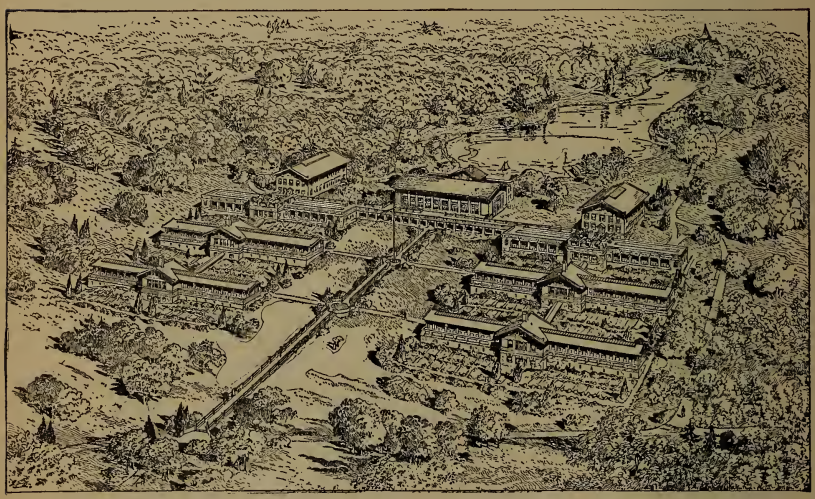
Tuberculosis. — The germ disease called *tuberculosis* is largely due to living in stale, house air. It has been called the scourge of nations, and it is scourging them to return to more natural ways of living. Stale air weakens the body and may take away the appetite. *Indigestion* follows, and the weak body is unable to resist the bacteria of the disease. This germ is called the bacillus tuberculosis; since it is a bacillus, what is its shape? It may grow and multiply in the skin and cause lupus; in the knee joint it causes white swelling; in the glands of the neck, scrofula; in the hip joint, hip-joint disease; in the spine, hunchback. *In the lungs occurs the commonest of all forms of tuberculosis; it is there called consumption.*

Tuberculosis is a house disease, for *the germ is quickly killed by a direct sunlight*, and more slowly by ordinary daylight. A house in which many consumptives die is usually a dark house with few windows. The *signs of tuberculosis of the lungs*, or consumption, are: a cough lasting a month or more, loss of weight, slight fever each afternoon, bleeding from lungs, and tired feeling. Habits which weaken the body make it unable to resist the germs. Such habits are overwork, worry, loss of sleep, drunkenness, constant indoor life. Grip, measles, whooping cough, and pneumonia predispose to consumption.

About 20 bacilli are necessary to infect a guinea pig; probably 1600 are necessary to infect a calf. It doubtless takes as many to infect a man. Thus you see that *infection is largely a question of cleanliness* and of the number of germs, not merely a question of contact with one tubercle bacillus. Most people are infected without knowing it,

one or more times during life. Most of them recover, as not more than one death in seven is from tuberculosis. The healed scars of the disease are seen on the lung of nearly every one examined after death.

No disease improves so rapidly as this if given half a chance. This may prove *a pitfall;* for, after a victim has lived right for a time, he gets so much better he thinks he



Courtesy of Dr. Lee K. Frankel.

TUBERCULOSIS SANITARIUM at Mount Macgregor, N. Y., for employees of Metropolitan Life Insurance Company. Thus the company prevents exposure of sound employees to infected employees. Notice the sleeping porches.

is cured, and goes to living in the old way again and the disease becomes as bad as before.

The victim first caught tuberculosis because he did not understand the art of right living. Since it is a house disease, the patient must *live outdoors* or in a shed or tent. It comes from undernourishment, so the patient *must eat plain food and plenty of it;* the fresh air brings back the appetite.

Drugs are useless. Beware of patent medicines. The time lost while using them may be fatal. Perhaps the digestion had already been injured by such drugs, or the disease would not have begun at all.

Plenty of sleep and rest for the body and mind will aid much. Food, fresh air, and rest enable the cells of the body to become strong and win the battle with the germs. The surest way is to increase the strength of the body so that it will resist and gradually destroy the germs. Consumption is a disease of filth, carelessness, and intemperance, especially intemperance in alcohol and work which keeps one continually overtired.

With very poor people tuberculosis is a difficult disease to cure. Plenty of food and rest and fresh air are the very things they cannot afford. If they had not been deprived of these, the disease probably would not have attacked them. Poverty causes the disease, and the disease increases poverty by cutting down the earning power. It is a disease of bad housing and lack of nourishing food. The pale, weary factory worker should move with his family to the suburbs before the disease attacks him. One half the means spent for cure would prevent having it. Not one child in ten among the hard-driven poor of our cities is up to normal. Often whole families live in one room and rent a corner of it to a boarder so as to be able to pay the rent. In slavery times negroes so seldom died of consumption that the black race was thought to be immune. Now negroes in poverty die of it by tens of thousands. No wonder that tens of thousands die of consumption when millions set up a condition within their bodies which invites the disease.

Every one, and especially consumptives, should resolve

that they will not sleep where there is no fresh air, they will not work where there is no fresh air, they will not live where there is no fresh air.

There has been somewhat too great a fear of air as a germ carrier. Germs die quickly in light and dry air. They thrive in drinking cups and closed rooms.

Courtesy of John A. Kingsbury.

STERILIZING THE CONSUMPTIVE'S DISHES.

Nurse giving instructions.

A consumptive should eat plenty of plain food, bread, butter, meat, vegetables, eggs, and milk. He should never swallow what he coughs up. He should spit in a sputum flask or in paper cups, and burn them. He should wash his hands with soap and water quite frequently. He should use paper handkerchiefs and napkins and burn them; if of linen, they should be disinfected before drying by being placed in boiling water. His laundry should be boiled before it is washed with other clothing, and his bed clothes should be often exposed to the sun. His dishes should not be washed with other dishes. Consumptives would oftener get well if they did not repeatedly reinfect themselves. One way to do this is to swallow the sputum. The consumptive himself is almost harmless, and only becomes harmful through careless habits of himself or

associates. Only one consumptive in three is careful unless required to be so. The Brompton Hospital in London is for advanced cases of tuberculosis, but only two nurses in 90 years have taken the disease.

Dr. Knopf's sputum flask. It can be boiled.

A new tenant should never move into a house where a consumptive has lived until it has been disinfected and aired. If there has been more than one case, cut new windows to increase light and ventilation. Clean sheets in sleeping cars should fold back two feet over the blanket, which may have been sprayed the night before by a coughing consumptive on his way to a hospital.

The *bacilli are scattered by droplets of saliva* which leave the mouth in fine, invisible spray or tiny floating bubbles when

Courtesy of N. Y. Ass'n for Improving the Condition of the Poor.

A fresh-air bedroom. Every city apartment should have a balcony. Notice the proper fire escapes on the next houses.

a consumptive *coughs, sneezes, sings, or talks forcibly.* Hence he should cough or sneeze with a handkerchief held in front of the mouth; he should never speak with force while his face is turned directly toward any one near him. There is much danger from *droplet contagion*, and less from dried germs floating in the air. A handkerchief held over the mouth while coughing is to be put at once into the "handkerchief pocket," which is waterproof and removable. Every one should be kind and helpful to the careful consumptive — there is no need to shun him. Like the Athenians, we should "never desert a suffering comrade."

A Sleeping Porch built by a poor workman at the cost of a few dollars. Any upstairs porch is a sleeping porch if desired.

One tenth of children's cases of consumption are believed to come from *cow's milk.* Cream to be used for butter and ice cream, and milk for babies, should be sterilized. Child labor in factory and study in unventilated schoolrooms prepare the body for tuberculosis.

Consumption cannot be inherited. Being *a preventable disease*, it should be prevented. The death rate from consumption has been reduced one third in a few years. Isn't that encouraging? But it isn't half as well as the people of our country are going to do. Let us "obey the laws and stop those who are prone to set them at naught";

report all cases to the health officer; disinfect every house where a case has been, and burn the rugs and carpets; give treatment and relief to poor consumptives; protect their families; provide trained nurses to instruct cases in the early stage when cure is so easy; and do what we can to educate the public in fresh-air doctrines.

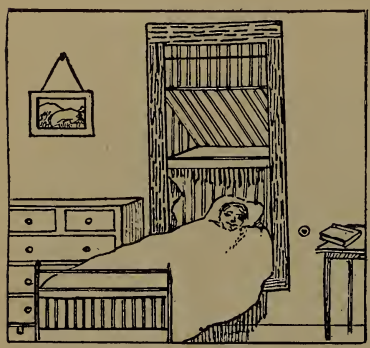
Camping in the woods and sleeping on porches have a value no one can explain. Color soon returns to the cheek

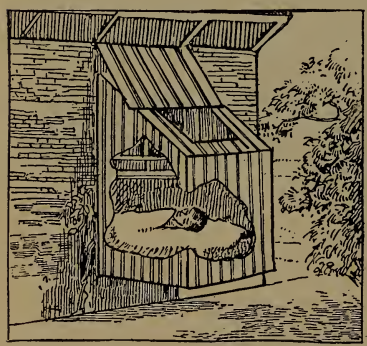
Sleeping on the porch, Raybrook Sanitarium.

and the sparkle to the eye. Living indoors practically the whole winter is a serious wrong to a growing child. A Frenchman has given three health rules for children: 1. Let them be in the open air. 2. Encourage them to go into the open air. 3. Make them go into the open air. Warmth is weakening, and cold is strengthening, yet moving to a warmer climate often restores a delicate child to sound health because of the open-air life. Not only the lungs, but the skin, suffers from indoor life. The delightful feeling when riding, walking, motoring, or coasting against the

wind is caused by the air reaching the skin through the clothing. Not only constantly changing air, but constantly changing temperature, is necessary for health.

Windows are the best ventilators, even though the clothes and fuel cost more when they are opened. The draft from the window may be broken by a board. Ventilating shafts and systems usually do not work, and none of them are "fool proof." Of course, no draft even of pure air which takes more heat from the body than the body is making, is good for long. "Coal is cheaper than colds." Even a tent can be made snug and warm enough for those who dress right.





OUTSIDE WINDOW TENT as seen from the inside and from the outside.

Colds are caused by overeating, indoor life, lack of exercise and cold air, wrong clothing. To prevent consumption, so live as to avoid colds, and so dress as to set free the lungs for perfectly natural breathing. A sunken chest or small waist means less breath, poorer blood, less resistance to strain or disease, and a shorter life.

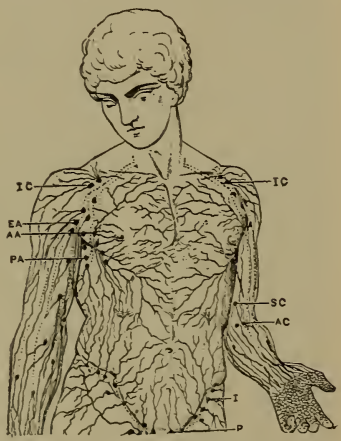
A person who breathes right will hardly have consumption. A large part of the wastes of the body must go out

A Health Resort in Front Yard (above) and Back Yard (below).

The lady is a policy holder of the Metropolitan Life Insurance Co. which lent the photo. Lower photo. lent by Emmanuel Church, Boston. The man is now well and at work. The "fly" sheet protects his tent from sun and rain.

through the lungs. We breathe 15 times a minute because we need to take in fresh air and send out impurities 15 times a minute. Oxygen keeps the fire of life burning. Fresh air costs nothing; that may be one reason people are so careless about having plenty of it. Another reason is that we used to think that malaria was in night air; now we know it is brought by mosquitoes. They used to close the bedroom windows at night to keep out damp air, but the dampest air of all is the breath we send from the lungs and confine in a closed bedroom. Perhaps another reason for closed rooms is fear of burglary.

The man who always sleeps in stagnant air is slowly killing himself.



LYMPH GLANDS in armpits and groins. These are little forts with garrisons of white cells to keep germs from entering the blood. Lymph glands are also in the neck, and they swell when there is a fight with germs from vile teeth, tonsils, or nose.

Note on White Blood Cells. — Tubercle bacilli protect themselves from the white blood cells by forming a waxy coating or tubercle. There are several kinds of white blood cells. Some of them have more than one nucleus; these cannot eat the wax. But the white blood cells with one nucleus eat the wax and then eat the helpless bacilli.

In other cases when the bacilli have entered the body the white cells surround them on all sides, imprison them, hinder their growth. The bacilli defend themselves by inclosing themselves in several skins. Then the white cells deposit lime in these protecting skins, and the bacilli, imprisoned in the tubercles, soon die.

Note on Natural Immunity. — The most advanced (but not necessarily more reliable) students of tuberculosis now hold that if human

bodies were examined minutely enough at death, one or more centers of living bacilli would be found in nine tenths of them; they hold that most babies become infected, perhaps from crawling on the floor and the habit of putting everything in their mouths. Probably by the age of six, nine out of ten are tubercular, and remain so through life. The tubercle bacilli which usually live in a lymph gland serve to vaccinate the body and immunize it, as the slight amount of poison they pour into the system stimulates the production of antibodies to protect it from further harm. Hence he who resists his own tuberculosis is incapable of being infected unless he should chance to receive large numbers of poisonous bacilli at one dose. Savage races are very susceptible to tuberculosis, because their pure manner of life has not exposed them in infancy to germs which might have rendered them immune.

On the porch in cold weather at the Raybrook Sanitarium. Collecting consumptives in sanitoria is the best way to prevent new cases.

Measles and whooping cough have bad records for breaking down the patient's resistance, but it is believed that typhoid fever is by far the commonest predisposing cause of consumption.

Even when immunity is at its lowest, the bacilli have to fight for every inch of ground. The body stubbornly resists and limits narrowly the area of disease. Months or years may pass before bacilli in the sputum and other symptoms of active consumption appear.

Sometimes tuberculosis appears so promptly after typhoid that the physician may think he should have called it tuberculosis from the

first; but probably he had made no mistake — one disease merely ran into the other. We can now explain Hazen's Law, that when a bad water supply increases typhoid fever, the tuberculosis death rate also rises. Pure water diminishes not only typhoid, but tuberculosis as well. Those who show signs of tuberculosis should probably not submit to vaccination against typhoid, as the efforts of the body in forming antibodies against the typhoid vaccine, may weaken its resistance to hidden tubercular germs.

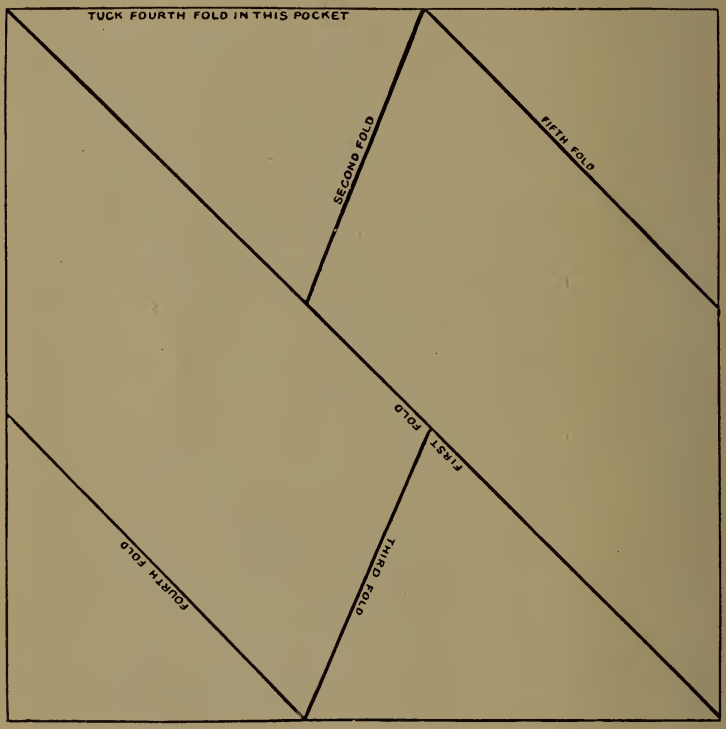
Sanitation has been the cause of the long-continued decrease in the tuberculosis death rate, for every epidemic of measles, typhoid, etc., which is prevented also prevents the tuberculosis which would have followed it. As people learn how to live, they avoid the things which destroy immunity. A real anti-tuberculosis crusade must be directed against everything which injures us. Hygienic living, by keeping the general health on the highest plane, not only strengthens our immunity to consumption directly, but helps us to resist other infections which might indirectly weaken our immunity to consumption.

BOTH ARE PREPARING THE WAY for consumption. Too much clothing and too little. The point of the lungs just under the collarbone is the chosen seat of consumption.

Jews, other Asiatics and brunettes in general, have stronger immunity than those of blonde European races; for the Baltic and blonde races are not used to confinement and hot air. Even Asiatics and Jews fade away with consumption if they crowd together too much. Hot sick rooms should become a thing of the past. Frontiersmen in their log cabins with many cracks in the walls escape consumption.

The telltale scars and nodules shown by nearly all post mortem examinations prove that, at some time, tuberculosis began to spread and was conquered. Probably at the beginning of the indoor life of the race, the consumptive bacillus first became poisonous, and at first

only infants died of consumption. Most deaths now are from the ages of 18 to 85. The race has become so immune that our bodies resist the ever present enemy for 70 years and only yield when exhausted by wear and tear. One fourth of all old people die of pneu-



A Sanitary Drinking Cup. Fold a clean square sheet of paper five times as shown by above guide. Tuck fourth fold as directed.

monia after having carried the germs of pneumonia around with them for 75 or 90 years.

Test Questions. — What is the effect upon the body of constant changes in air and warmth? Why is living in unventilated rooms harmful? What is the effect of motionless air and unchanging temperature upon the health? Describe the homes of the modern "cave dwellers." What is the effect upon the body of freedom from struggle and hardship? How must a city man live to preserve his health?

Why do the poor close their rooms tight in winter? Why are there more rosy cheeks in England than in Germany? How may dryness of air be prevented in steam-heated houses? In furnace-heated houses? How does dry air injure? What is the effect on the body of carbon monoxid? How may this gas be prevented? What is the effect of a pipeless gas or oil stove? What advice is given concerning clothing in cold weather? What is the chief cause of colds?

What are the causes of tuberculosis? Name several forms of it. What kind of a house breeds tuberculosis? What are the signs of consumption? What habits lessen the power to resist it? Why is cleanliness important in avoiding it? Give the clear proof that consumption is a very curable disease. Where should a consumptive spend most of his time? How should he live? Why is cure difficult for the consumptive poor? Show how consumption and poverty affect each other. What should a consumptive eat? What is said about a consumptive reinfecting himself? When is a consumptive not a danger to others? What precautions should be taken to protect others? What advice is given to a new tenant in a house where there has been consumption?

What is said of droplet contagion? What is a "handkerchief pocket"? Tell of childhood and consumption. Is consumption inherited? What are the facts about lowering the death rate from consumption? Discuss outdoor air and consumption. What suggestions are made concerning ventilation? How does the author attempt to explain the aversion to fresh air? Have you read the note on white cells, and on natural immunity?

CHAPTER III

PURE WATER

To be suited for drinking and use in the home, water must be without color, odor, or disease germs, and no deposit should form when its stands for a time.

Courtesy of Eugene R. Kelley, Board of Health, State of Washington.

A River that supplies Water to a City. These closets should have water-tight boxes, the contents should be disinfected, hauled away, and buried. Those who regard the public welfare will not pollute streams.

Impure water is the cause of three fourths of typhoid fever, and of much other preventable illness. The question of getting pure water is a question of being willing to spend the money or go to the trouble necessary to obtain it and protect it.

Since impure water is a chief source of disease, a community should take no chances with their drinking water. Yet throughout the land people are needlessly drinking impure water. If some one would guarantee to protect the whole family from water-borne diseases upon payment of $5, the father would jump at the offer and reckon it a bargain. Yet for $5 in taxes from each family, the water supply of any city can be rendered free from disease germs. For a few dollars, or by one or two days' labor, the spring or well on the farm may be made safe.

A Babbling Brook, yet human waste from an outbuilding washes into it with every rain.

It is wasteful for the nation to rear children to maturity only to have them stricken down with preventable diseases due to sewage. One city which had not done so for the sake of sanitation, purified its sewage because it was infecting oysters and ruining the oyster trade. This of course helped others besides those who ate the oysters, but meanwhile the health of many had suffered.

With growth of population, defilement of water is on the

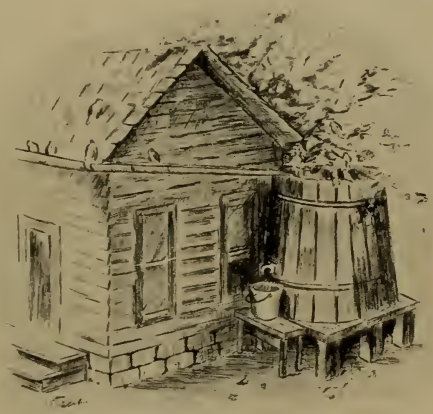
increase. New factories bring defilement to our rivers and lakes more and more, until many of them are too foul for household use, for bathing, or even for boating. The fish in them die. One can readily understand this who has ever stood on a river bank below a town or city and watched a sewer pouring in its corrupt mixture.

Courtesy of Metropolitan Water and Sewerage Board.

WACHUSETT DAM AND POWER HOUSE. Water is running over the spillway. Water is here stored for the citizens of Boston and seventeen other towns. Do you waste water at your house? Have you ever visited or studied the source of your water supply?

People often dig a cesspool and a well in the same yard. The well is usually near the house for convenience, but the purity of the water is endangered by the household wastes, the pig pen, the cow stable, horse lot, hencoop, and slop ditch. The well drains the earth in every direction for at least ten times its own depth. Hence the importance of a drain pipe to carry off household wastes. If the water supply is doubtful, boil the drinking water.

Typhoid bacilli die in polluted water more quickly in summer than in winter, being killed by the strong sunlight. The typhoid rate per 100,000 in the 50 largest cities of the United States is 25. In 33 chief cities of northern Europe it is $6\frac{1}{2}$, or about one fourth as high.



Sunlight kills germs in water, but if there is a tree near, the cistern should be covered because of birds and leaves. It should be mosquito proof and have a faucet on level of window sill or porch. Rain is the purest water.

The sources of water supply are rain, springs, wells, rivers, and lakes. Rain water properly stored in cisterns is safer than well water. Gutters should be kept clean, and the water turned into the cistern only after the rain has washed the dust off the roof. Underground cisterns sometimes crack, and, when the water in the cistern is low, impure water seeps in from the soil.

Springs should be well protected from surface drainage. Stables, pigpens, and outhouses should be downhill from the well and not nearer than 150 feet, as the underground lines of seepage may not slope with the surface. Cement

should surround the mouth of the well for 5 feet, as shown on page 48. Otherwise impurities may wash in. A closed well with a pump is better than an open well, for, if there is a stable, manure from the feet may wash into it and dirt from the hands may fall into it. The well rope and well bucket should not be handled with unclean hands. Wells are usually forbidden in towns of over 10,000 people.

Courtesy of Va. Board of Health.

A SPRING unprotected and protected from surface washings.

Rivers and lakes receive dangerous germs from cities, but most of them die within a few hours or a few days. The Seine River contains no disease germs 43 miles from Paris. A lake is a natural *reservoir*. The water for cities, as Boston and New York, is usually stored in great reservoirs and purifies itself of germs by standing.

No one can have *typhoid fever* without taking into the body germs from the body of another person. These germs cannot enter the drinking water unless there has been carelessness in caring for the body wastes of others.

Lowell is 12 *miles above Lawrence* on the Merrimac River. Both towns drink river water. Lowell pumped wastes from the bedchambers of typhoid victims into the river and an epidemic of the fever broke out in Lawrence. Lawrence began to filter the water, and the death rate in general dropped 7 per 1000.

Change to *pure water decreases the deaths* from tuberculosis, pneumonia, diarrhea, and other diseases, especially diseases

of infancy. Drinking good water undoubtedly strengthens the body so that it can fight off disease germs. Professor Mason says that in Hawkinsville, Ga., chills and fever were common. But a change from surface water to artesian water for drinking and the household, almost freed the town of malaria. The white cells no longer had to fight water-borne germs, and were able to concentrate attacks on germs brought by mosquitoes.

Freezing may not kill typhoid germs. Place the ice beside the vessel of drinking water — not in it — to cool it. Besides danger of germs, ice in the water makes it so cold that it irritates the stomach instead of quenching thirst.

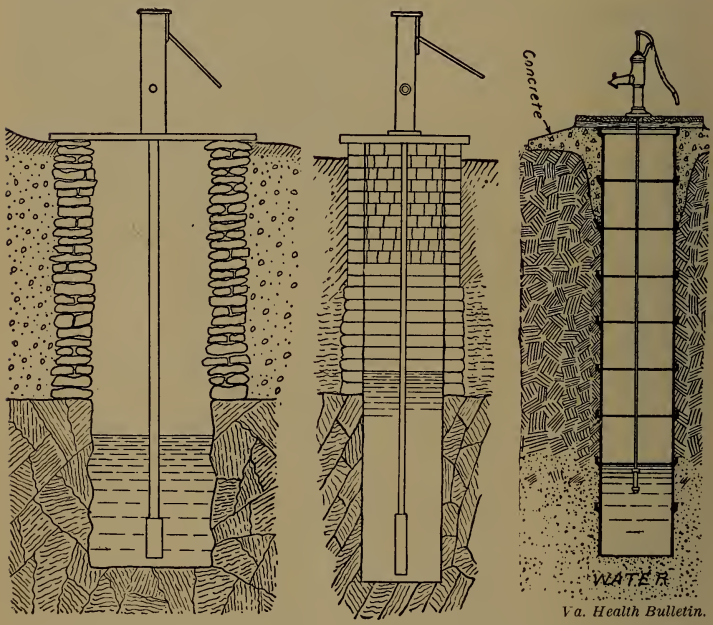
The common *house filter* is unreliable. It is usually no more than a strainer.

The earth is a great filter because near the surface it contains many useful bacteria that destroy disease germs and vegetable matter in the surface drainage. But if the cesspool is dug below the few feet of depth at which they live and work, disease germs may pass unhindered into the well. If the mouth of the well is protected by a proper slope and by cement around the curb to a depth of several feet, the soil will have filtered and purified the water that may leak through the curb lower down.

Before going into public bathing pools, bathers should take a shower bath. Hypochlorite of lime may be applied twice a week to kill all germs in the bathing tank.

Every wide-awake town that has no artesian wells is looking out for its future growth by acquiring areas necessary to protect the watershed surrounding its storage reservoir. Los Angeles has laid an immense pipe 130 miles and tunneled through two mountain ranges to reach a water supply. When a city uses river water, there are usually three parts to its

water reservoirs: 1. Settling basin. 2. Filter beds (usually covered). 3. Receivers for the filtered water. It would be useless to give the details of the great sand filters such as sanitary engineers have learned to construct; such filters are not mere strainers. When the water passes through at



Va. Health Bulletin.

An unsafe well; surface water will seep through the cracks between the upper stones before the good germs have a chance to destroy the disease germs.

A safe well with high platform and water-tight curbing, but the ground should slope away from the well.

The concrete prevents water from reaching the curb until it has filtered through several feet of earth.

a rate of not more than four inches in an hour, a gelatin-like growth containing helpful bacteria forms on the top of the bed of sand and by it all harmful bacteria are killed and the water purified.

The details of sewage disposal in cities must also be left to sanitary engineers. The drains from private houses lead to larger drain called sewers. If the sewers empty

into the river and the water supply is taken from the river there is as much disease as if there were no sewers. The sewage may be pumped to sewage farms; garbage may be burnt.

Typhoid Fever. — The bacilli of this disease attack the lining of the small intestine, but it is also a blood infection and may take the form of pneumonia. Though it is very

A WELL surrounded with concrete to prevent seepage, with a chain pump that stirs and aërates the water. (From Ogden's Rural Hygiene.)

A WELL that catches seepage from trash pile, an outdoor closet, and a stable.

common, *it is one of the most easily preventable of diseases.* Usually the first step in conveying it is pollution of the soil. Slops containing the spittle or the discharges from the bladder and bowel of a patient are thrown out without disinfection and the next rain may wash the germs into drinking water. The germs may seep into a well, or slops from the sick room thrown upon a hillside may wash into a river or lake from which the water supply of a city is drawn.

The danger of infection through the milk supply will be explained in the next chapter.

There are *walking cases* of typhoid which never take to the bed. There are many persons now perfectly healthy who once had the disease and have remained "*typhoid carriers.*" Many of them carry the germs in the gall-bladder and void

Teaching girls to swim, a part of the course in New York City schools.

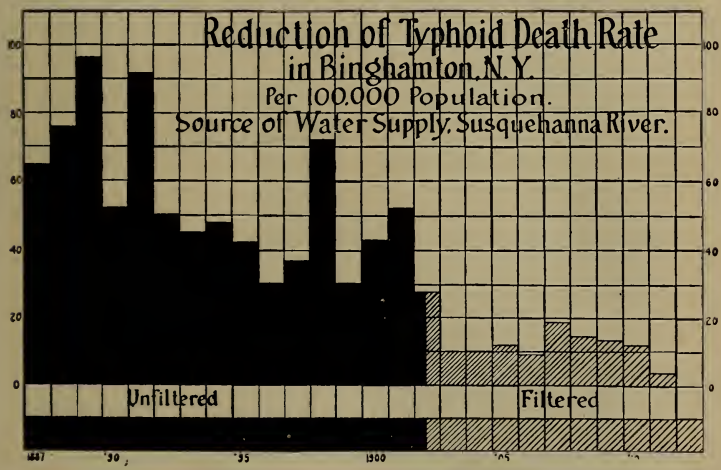
them through the intestine, thus spreading the infection for many years, or all through life. The problem of how to prevent infection by carriers has not been solved.

In Europe, where the sanitary code is stricter than with us, the death rate of the disease is only one third that of America. But one city in the United States (Asheville, N.C.) was without a single case of typhoid fever for six

months in 1912, and there was no death from the disease during the whole year.

The bacterium of this disease (the *bacil'lus typho'sis*) is shaped like a thick, short rod, and it possesses threads which, in a liquid, may wave and move it along.

The disease is *treated chiefly by careful nursing.* Only liquid food is given. If solid food is given, even after the



Courtesy of N. Y. State Health Board.

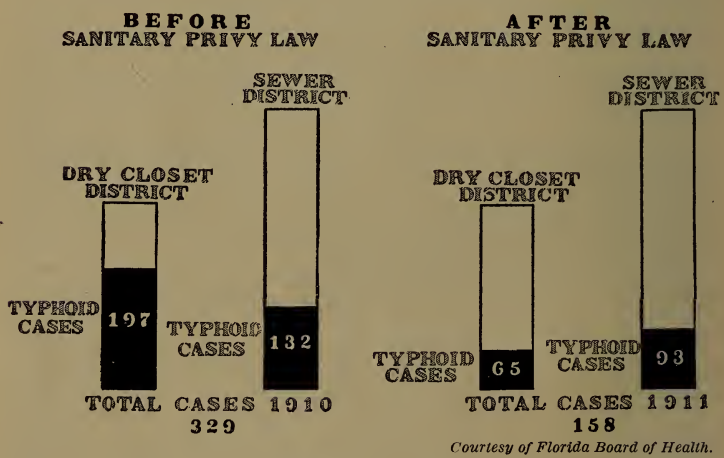
Filtering began in 1902. When was the death rate nearly 100 per 100,000? When was it less than 5?

patient is recovering, it is almost certain to cause a relapse which will probably be worse than the first attack.

It is largely a *country disease*, for it is easily spread in the country by *soil pollution*, which contaminates the water, milk, or uncooked food. The germs are then taken in through the mouth. In some cases the germs are carried by *flies* directly from the discharges of patients to food. Oysters grown in a body of water receiving the drainage of a city may contain the germs and infect those who eat *raw oysters.*

The *virus from a patient* may easily defile cooking utensils, drinking cups, and bed linen. The discharges from a patient should be *disinfected with chloride of lime* (6 ounces to 1 gallon of water). They should never be thrown out in the neighborhood of springs or wells. These precautions should be taken for some time after recovery, for the germs may continue in the discharges for a long time.

If, as sometimes happens, the *one who nurses* the patient *also cooks* for the household, the greatest care is necessary.



Courtesy of Florida Board of Health.

JACKSONVILLE, FLA., CHART, showing the effect on typhoid cases of a sanitary privy law. Was the effect more marked in the dry closet or sewer district?

The nurse and patient should frequently wash and disinfect the hands. All *dishes from the sick room* should be sterilized. The ordinary washing of cups and saucers has little effect in killing germs. They may be killed by allowing dishes to remain for a few minutes in boiling water, or by washing them in water at 120° to which soda has been added.

Even walking on ground polluted with human waste, as in the back yards of some dwellings, and then standing

upon or beside an insanitary well, has resulted in *polluting the water of the well.*

Vaccination to prevent typhoid fever has proved a great success in the armies of France, Great Britain, and the United States. Among 57,000 United States troops vaccinated, only twelve cases occurred. Before vaccination,

Courtesy of Maj. F. F. Russell, U. S. Army.

ARMY SURGEON VACCINATING A SOLDIER against typhoid. The vaccination is usually done three times.

there were several hundred cases a year in the army. In vaccination, 500,000,000 dead germs are used.

In the war with Spain in 1898, typhoid fever was very fatal. We lost four men from this or other diseases to one

from bullets. By the time of the war between Japan and Russia in 1904, sanitation had rapidly advanced, and Japan lost only one man from disease to fourteen from bullets.

In the time of a typhoid epidemic eat only thoroughly cooked food; boil drinking water and milk of uncertain origin; do not fail to wash the hands before eating; make all cesspools and closets fly-tight and perfectly sanitary.

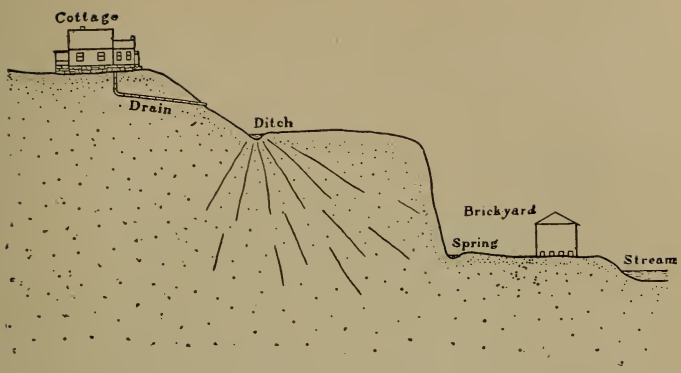
There are 175,000 cases and 16,000 deaths yearly in the United States from the disease. Most of these could be

Two Water Tables or surfaces of underground water. Where should a well be dug? Where would little water be found? No water?

prevented by thorough sanitation. Drying will quickly kill the germ, for it is a *very delicate* one, and unless it is in soil or in a liquid, its life outside of human bodies is short.

The *colon bacillus* resembles the typhoid bacillus. It is always found in the intestine of man and beasts, and is usually harmless. It may become hurtful and cause diarrhea when the intestine gets into a vile condition, or a more virulent race of the colon bacilli may gain access to it.

Experiment. **To make a Paper Drinking Cup.** — The teacher may distribute clean sheets of paper a foot square in size. The pupils may make cups, following the guide on page 40. The cups may be kept in envelopes in the desk for daily use.



A drain that pollutes a spring. (Ogden's Rural Hygiene.)

TEST QUESTIONS. — What qualities should drinking water have? What part of all typhoid fever cases is caused by impure water? What is the connection between money and a pure water supply? Why did a certain city purify its sewage? Is pollution of water decreasing or increasing? Why? Where should a well not be located? State precautions about water of springs; cisterns; wells. Does water in rivers and lakes purify itself? Give the experience of two cities on the Merrimac River. What diseases decrease when pure water is used? When is ice water dangerous? What is said of home filters? Of the earth as a filter? How are public bathing pools purified? What is done by wide-awake cities to guard the future water supply? How do large filter beds purify water?

Explain how typhoid germs may get into the water supply? What is meant by a "typhoid carrier"? Describe the typhoid bacillus. Why is it easily spread in the country? What insect may carry it? What precautions should be taken to prevent a case from infecting others? How may a well become infected? Has vaccination against typhoid been a success? Is the germ easily killed? What is said of the colon bacillus?

CHAPTER IV

CLEAN MILK

Experiment 1. **Dirt Test for Milk.** — Get samples of milk from several sources. Put absorbent cotton or filter paper in a funnel and pour a quart of milk through the funnel. Replace the used cotton with exactly the same amount of unused cotton, and pour in a quart of another sample. Grade the samples in cleanliness (good, fair, bad) according to the whiteness of the cotton.

Experiment 2. **To Test Pasteurized Milk.** — Pasteurize half of a quart of milk (see text) and let it and the unpasteurized pint set for 12 hours and compare their condition. The simplest and least accurate way to pasteurize milk is to place the bottle in a wooden rack, set this in a tin pail, pour into the pail enough boiling water to come to the level of the milk in the bottle, cover the pail with a lid and allow the pail to stand on a wooden table for 30 minutes. At once place the bottle in a cool place.

Experiment 3. **To make a Refrigerator** for the milk bottle (see pages 57 and 67).

Experiment 4. **Test for Preservatives in Milk.** — Set some of the suspected milk by the side of an equal quantity of reliable milk. Notice whether it is unusually slow in souring and spoiling. If so, it may have been treated with formaldehyde or other preservative.

It is easy to obtain clean *milk in the country*. People can look after their own cows or buy fresh milk from a clean neighbor; and the milk is used within a few hours before it turns sour. How to *obtain clean milk in cities is a hard problem*. It comes from sources unknown to the user, and may have been a long time on the journey.

Milk is made to curdle and *turn sour by bacteria* which change the *sugar of milk into lactic acid*. Fresh, clean milk

starts out with about 2500 bacteria in a cubic centimeter (about 15 drops). These will increase in a day to 500,000 or more if the milk is lukewarm.

Courtesy of Henry Phipps Inst., Phila.

THE BABY'S REFRIGERATOR.

At 40° F., bacteria in milk multiply very slowly.

At 50 to 60°, bacteria in milk multiply slowly.

At 75 to 100° bacteria in milk multiply very rapidly.

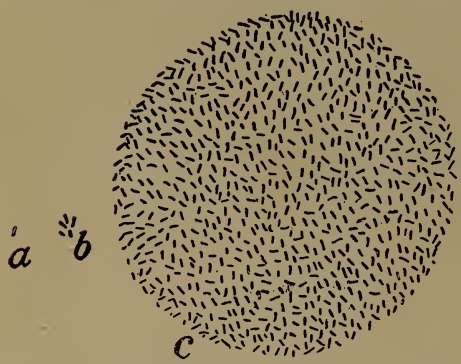
The lactic acid, or milk-souring, bacteria are not so objectionable, but a great number of them show there may likewise be many disease germs present. The sale of milk is usually not allowed if it has over 500,000 bacteria in a cubic centimeter. They are so unthinkably small that a half million is not a large amount. The highest grade milk should not contain over 30,000 bacteria in a cubic centimeter.

The milk-souring bacillus.

Some hygienists object to *boiling milk* as it kills all the milk-souring bacteria, turns some of the milk sugar into caramel, and as milk, boiled, may cause constipation. It

is the custom to use boiled milk for babies in Europe. Since it does not form as tough curds as unboiled milk, it is in that way more digestible. Boiled milk is distasteful at first. To prevent a tendency to produce constipation and scurvy, fresh vegetable juice (of orange or grape) is used when babies are fed on it.

Sour milk, or clabber, has been recommended as a health drink, since a moderate amount of lactic-acid bacteria is believed to be healthful and to kill injurious bacteria in the human food tube. Many people, seemingly determined not to be sensible on health subjects, immediately based a *sour-milk fad* upon this fact, and expected sour milk to make up for all the shortcomings of an unhealthy life. They could stop the breeding and feeding of hurtful bacteria in the intestine if they ceased to overeat. Then they would not need to set good bacteria to kill the evil ones.



EFFECT OF TEMPERATURE UPON GROWTH OF BACTERIA.

a, A single bacterium; *b*, its progeny in twenty-four hours in milk kept at 50° F. (5 bacteria); *c*, its progeny in twenty-four hours in milk kept at 70° F. (750 bacteria). (From Bulletin 26, Agricultural Exp. Station, Storrs, Conn.)

There are usually a few bacteria in the udder of the cow; but sour milk is old milk and there are other kinds of germs that may multiply in milk. These are *putrefactive bacteria* and *other germs of disease* which may get in the milk from the cans, from dust, and the hands of milkers.

One case of *typhoid fever* in every six is caused by unclean milk. *Other diseases* which may be brought by milk are scarlet fever, diphtheria, tuberculosis (perhaps 3 or 4 per cent), summer complaint, and other diarrheas of children.

The bacteria in dirty milk manufacture *toxins* while multiplying in the milk, and will continue to do so after they are swallowed. While older children and adults may

BAD CARE AT HOME causes much of the mischief from bad milk. (Bottles uncovered and near stove, crowded room.)

Courtesy of Bureau of Animal Industry.

GOOD CARE AT HOME; a glass over the mouth of each bottle. The refrigerator often aired and sunned.

recover from attacks of diarrhea caused by these poisons, they are often fatal to infants. The effect of dirty milk on babies is dreadful. In an epidemic of cholera in Liverpool, 300 bottle-fed babies died against 20 breast-fed — 15 times as many. Of 2000 fatal cases of diarrheal diseases in infancy, 1940 were bottle-fed. Bacteria grow slowly in cold weather, but in the summer the milk in the baby's bottle may be swarming with bacteria. Hence the great frequency of infant diarrhea in summer has given it the name of "summer complaint." Infant mortality due to bad milk is preventable and is a disgrace to civilization.

In Stamford, Conn., 526 persons had *typhoid fever* in two months. Nine tenths of these got their milk *from one*

milkman who supplied only one eleventh of all the milk used; two weeks after closing his dairy, new cases ceased. In 1908, in Georgetown, D.C., 55 persons contracted typhoid who drank the milk handled by a certain dairy maid. She was in perfect health but *had had typhoid fever eighteen years before*, and was still a carrier of typhoid

Courtesy of U. S. Bureau of Animal Industry.

DIRTY CANS AND BOTTLES. A closed bottle is better than a dip tank, but a clean tank is better than dirty bottles. Milk should be paid for according to cleanliness as well as richness of cream.

germs. Up to 1907, twenty-three outbreaks of typhoid were spread by milk in the United States and Great Britain in twelve years.

Some dairymen say: "Why this fuss about clean milk? My babies use the milk of my cows and thrive on it; why can't the city babies also?" But the farmer's baby has fresh milk. Such milk shipped to the city and examined 24 hours later may be quite different. It may be spoiled

and even moldy, and no housewife would buy such stuff, but the masses of *germs and mold are hidden* because milk, unlike water and glass, is opaque (that is, it stops the passage of light).

Water is sometimes added to milk and sometimes it has been taken from infected wells. *Cream is* sometimes *removed* and the milk still sold as whole milk. In St. Louis about 1600 gallons of cream were removed each day — $900,000 worth a year. The children of the poor were the chief victims.

Coins are found in milk bottles, put there by the unclean hands of a customer of yesterday, — proof that the bottle was used again unwashed. Some peddlers with dip tanks hold the measuring can with the thumb inside the can so that he not only sells the space occupied by his thumb each time, but a few germs besides. Some farmers have filthy barns or milk houses or use filthy methods.

Some dairymen need to study *cow hygiene* as well as human hygiene. To force them to give great amounts of milk, cows have been overfed and protected until they are abnormal. Few cows live long nowadays. Except in the South where the cattle are outdoors almost the whole year, cows are kept in close barns in winter and suffer for *want of fresh air and exercise.* Some cows have tuberculosis, which may be given to babies through the milk. Their udders may be inflamed inside or out, and *pus germs* thus reach the milk. Cows which are not in good flesh and condition should be examined by a surgeon. Tuberculin serum is used in testing cows for tuberculosis.

The cows must not only be healthy, but they must be clean when milked. Their tails should not grow so long as to reach the ground. With the use of a *brush* and of a

cloth and warm water, the flanks, sides, and udder should be thoroughly cleansed; and the cow, held by a throat latch or chain under the neck, should not lie down again until milked. The use of *small-mouthed milking pails* keeps out about half the germs which would have fallen in during the milking. Typhoid germs may get into milk before it leaves the dairy farm. Sometimes the person who milks the cows has a mild "walking case," and the *germs upon his hands* are washed by the milk into the pail. The milker may be in good health, but may have *just come from the sick room* where he has nursed his wife or child and failed to wash his hands. The *milk cans* may have been washed in contaminated water. Clean overalls and jumper should be put on at milking and removed just after and kept in a place protected from dust. The *milker's hands*, above all else, must be thoroughly clean.

Dirty farmers lower the average quality and keep down the price of milk and butter, and thus cause a loss to their clean neighbors who send milk to the same dairy or same market. They *injure the whole milk industry*, and cause many mothers to use canned infant foods and condensed milk.

The *cow stable* should be in a dry, well-drained place. It should be well lighted and ventilated with windows on the sides away from cold winds. Muslin may be stretched over window openings in cold regions in winter. If *openings are screened* in summer to protect from insects, the cows will give more milk. The *ceiling* should be of matched planks to prevent chaff and dust from sifting down from the loft. If the walls are unpainted, they should be whitewashed twice a year. The walls and ceiling should often be swept down and kept free from dust, manure, and

Courtesy of U. S. Bureau of Animal Industry, Washington.

Cows Wading through mire and muck. Such conditions prepare the way for tuberculosis.

From John Spargo's Commonsense of the Milk Question.

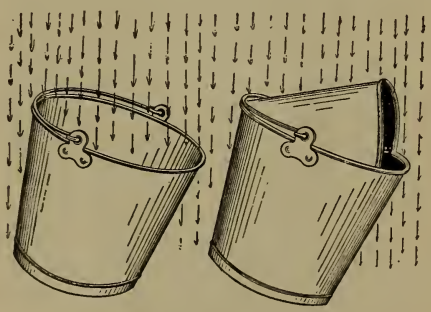
Cows that need washing. Notice the unclean flanks.

A dark, dirty stable which held 17 cows although there was only room for 6.

An Unclean Cow Barn, dark, dusty, and undrained.

cobwebs. There will always be some dust, and each pail should be removed as soon as filled. The floor should be water-tight. Cement is damp for the cow's feet, and it should be waterproofed while it is being made; or waterproof bricks or rammed clay may be used for the floor. An open drain should pass in front of the stall. Manure should be removed twice daily.

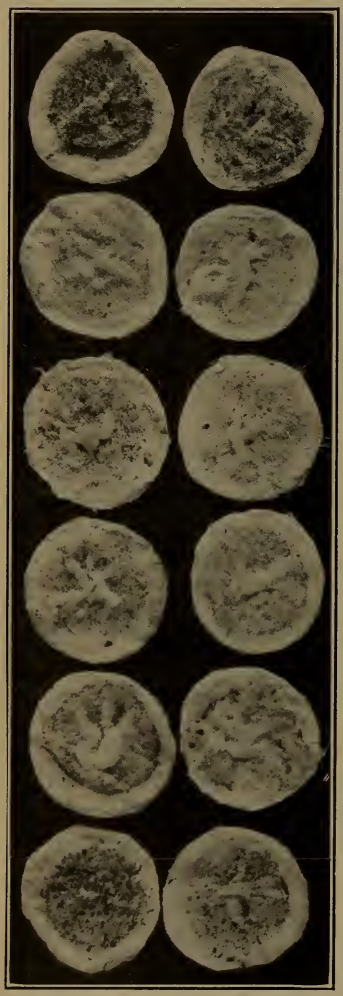
A clean dairy man will furnish clean milk under hard conditions; a slovenly dairy man will furnish unsanitary milk from the finest model dairy ever built. Cows should not wade in muck, but should spend most of the time in a clean pasture or a graveled yard.



How many times as much dust falls into the large-mouth as into the small-mouth pail?

The milk which is soon to be used by the farmer's own family can be kept cold in a spring or in an "iceless refrigerator" (see chapter on Food). Few springs are cool enough to preserve milk for a long time. Milk to be shipped should be cooled with ice *to* 50° F. *or less within an hour after it is milked.* Ice is needed as much for the milk as boiling water or steam is needed to *scald and sterilize the milk vessels* before using them. It is an advantage when the milk is delivered on a milk route by a wagon direct from the dairy farm. Milk becomes more unsafe every hour after it leaves the cow. When the distance is greater and it goes by rail, it waits for hours at stations and junctions and is from 16 to 60 hours old when it reaches the door.

Sealed packages are safer than a dip tank. Milk should be bottled at the dairy, not at the customer's door. Dipping spatters milk on the hands or bottles and it runs back into the tank. "*Typhoid carriers*" should not sell milk, nor follow any occupation which places them in contact with food products.



OPEN PAIL SMALL TOP PAIL.

Bacterial cultures from milking into two kinds of pails. Set of plates from open pails shows larger number of colonies, a proof of unclean milk.
Courtesy of Exp. Station, Univ. of Wisconsin.

When milk reaches the consumer's home it should not stand on the doorstep in the hot sun for an hour but it should be cooled at once. In the summer months heat weakens the babies and multiplies the germs. Cholera infantum and other diseases of the stomach and bowels are greatly multiplied. One fifth of the babies die before they are four years old.

Babies die (of summer complaint) because the mother or sister or servant does not clean the nursing bottle and milk vessels thoroughly. No rubber tube should be used in the bottle, but a wide-mouth bottle and nipple. After use these should be

washed thoroughly in cold water, then with hot water and soap. They should be scalded again just before use. If there is illness, the bottles from the dairy should never be taken into the sick room and should be disinfected after they leave the house. Milk is a fine food for bacteria and flies carry bacteria; keep the flies out of it.

Courtesy of Bureau of U. S. Animal Industry.

SANITARY MILKING. The milkers wear white suits that are kept in a clean place when not in use. Buy from the dairyman that takes the trouble to have things right. (Pail scalded, cow groomed, milk bag wiped, hands washed.)

To make the Baby's Refrigerator. — Place in the center of a box, a pail, or a strip of tin curved into a circle; fill in between the pail and box with sawdust. Place the ice and milk bottles in a smaller covered pail and set it inside the first pail. Pad the cover of the box with many thicknesses of newspapers to keep out the heat.

When it has been impossible to keep the milk cool from the time it was drawn from the cow, the souring may be delayed by *pasteurizing* it. This is done by heating the milk to 150° to 160° F. and keeping it at that temperature for 20 minutes,

stirring it meanwhile. It is then promptly cooled. A simple method is given in Experiment 2. Pasteurizing will not give it the cooked taste of boiled milk, nor make it less digestible, since not all the good bacteria are destroyed.

To pasteurize milk use a tin pail containing water, and having a hole in the cover. Set the bottle of milk in the water, heat for 20 minutes, keeping it at 155° F., testing temperature with thermometer. Spores are not killed by the process and will multiply if the milk is allowed to get warm again. Pasteurizing does not destroy the toxins which may have already been formed by germs. The process kills as many good germs as harmful germs, and even more. If disease germs reach the milk again they will multiply more rapidly in pasteurized milk than in raw milk. Pasteurized milk must therefore be carefully protected from contamination in air-tight bottles and kept cool. Pasteurization must be used only until it becomes possible to get absolutely safe milk. It is better to keep down bacteria by cleanliness and cold than to destroy them by heat.

Courtesy of Amer. Mus. of Natural Hts.
Pasteurizing milk (thermometer, rack for bottles, a tin pail).

Condensed or evaporated milk will not rot in one day in hot summer weather as dairy milk will do if not kept

cool, but condensed milk is less nourishing. When properly diluted it contains less than half as much cream as cow's milk, and only two thirds as much solid food. It is sometimes weaker than the milk sold by the notorious dairyman whose favorite cow was the well pump. Some *manufacturers make extravagant claims* for infant foods sold in paper boxes. These foods may be little better than starvation diet. The remedy is to regulate the milk supply so as to have clean, fresh, whole milk.

Courtesy of U. S. Agri. Dept.

A Sanitary Cow House. Notice the feeding-trench, stanchions, windows that open, spots of light on the pavement from the ventilators above.

Inspection is necessary, both for dairies and salesmen, and both before and after permits are issued. Clean milk and healthy children cost less than cheap milk and doctors' bills. Milk that costs less per quart may cost much more before the summer is over. Clean milk is *worth more as a food* than dirty milk, for the sugar and casein, or cheesy part, have not already *served as food for bacteria*. The consumer should treat the producer fairly by paying more for good milk than for bad. Fair treatment of the

Clean Milk House, Pails, and Cans. The vessels are placed with mouth down to keep out flies and dust. The house is not near a pigpen.

consumer means prosperity for the producer. Inspection is necessary for cleanliness. In Berlin, one of the best inspected cities, it is estimated that 300 pounds of barnyard filth are consumed in milk each day. The mixing of one dirty quart with a thousand clean ones contaminates them all in the same way, but much more rapidly, than a few rotten apples will spread the germs of putrefaction and destroy the whole barrel of apples.

The *public will be fed* with butter, cheese, cream, and ice cream *made from dirty milk*, or the milk of diseased cows, as long as it does not object vigorously. The movement for pure milk is largely a crusade to help the helpless little folks, and preserve their ruddy cheeks, healthy bodies, and little lives.

In some cities, inspectors grade milk in *three classes: A*, certified; *B*, selected; *C*, ordinary inspection. *Grade A* is for use of infants. *Grade B* has been filtered, placed in bottles or cans, and sterilized by steam. It is safe milk. *Grade C*, used in restaurants, and hotels for cooking and for ice cream, should always be pasteurized before use, as otherwise it is unsafe. Cans containing it should be painted red (for danger) on the neck and shoulder.

TEST QUESTIONS. — Why is a supply of clean, fresh milk a harder problem in the city than in the country? At what temperatures do germs in milk multiply very slowly? Slowly? Very rapidly? What is the bacteria count allowed in some cities for the worst milk sold? The best milk?

Discuss the use of boiled milk; the sour milk fad. Name germs of disease that may get into milk. Why may milk be dangerous even after all germs have been killed? At what age of life, and at what season of the year, is milk most dangerous? Give the facts about the typhoid epidemic in Stamford, Conn.? Georgetown, D.C.? What is sometimes added to milk? Taken from it? In what ways may milk become contaminated?

By Courtesy of John Spargo.

Strauss Pasteurizing Station, New York City. The Pasteurizer is at the right.

How may cows be made unhealthy? Describe the management of cows and other methods in a clean dairy. Why are dirty dairy farmers a burden to other dairy farmers? Describe a sanitary dairy barn. Explain the care of milk after it leaves the barn.

What precautions with the baby's milk must be taken by the nurse? How is the baby's refrigerator made? How used? What is pasteurization? What are its advantages and disadvantages? How is it done? What is said of condensed milk? Artificial infant foods? Why does clean milk contain more nourishment than dirty milk? Why is good milk cheaper in the end? What is the most important reason for guarding the milk supply? How is milk graded?

Illustrated Studies. I. It will prove a welcome change of method to send pupils to the blackboard, each to draw and explain one of the following figures: pages 9, 10, 13, 15, 23, 25, 34, 37, 39, 40, 45, 46, 48, 51, 54, 55, 57, 58, 65, 81, 83, 84, 89.

II. *Chap. I.* Describe the face of Pasteur, discoverer of bacteria. If *Prevention* is a guiding star, what may *Cure* be likened to? How may railroads affect public health? Describe the face of a noted friend of workingwomen. How test whether a nostril is open? Test each of yours. How may dirt in a poor woman's home affect a clean home? Are all the rooms in the East Side block, N.Y. City, in reach of light and air? What is the shape of liver cells? Nerve cells? Muscle cells? Yeast plant? Tubercle bacilli? When is a cellar a menace? (One half the cellar air reaches the rooms above.) What may result from keeping fowls shut in? *Chap. II.* Describe two cots for outdoor sleeping. Describe two window tents: p. 23, 34. How may the sides of an open-air school be protected when it rains? Describe six ways of sleeping in the open air: p. 26, 28, 31, 32, 33, 35. How may a tent be protected from the heat of the sun? The damp ground? Where do lymph glands abound? Their function? Describe two imprudent ways of dressing. *Chap. III.* Describe Wachusett reservoir. Describe a fit and an unfit cistern. How is a spring protected? When has a well an unsafe curb? A safe curb? Protection from drainage? Seepage? Is your well so protected? (If you cannot obtain cement, use clay.) What was the typhoid deathrate in Binghamton, the year before and the year after filtration began? *Chap. IV.* How is a small ice box made? p. 57. Test your refrigerator; it should be 50° F. or less? How fast do bacteria in milk multiply at 50°? 75°? Describe good and bad care of milk at home. Describe unsanitary dairy conditions: p. 60, 63, 64, 65. Sanitary conditions: p. 65, 68, 69, 70.

CHAPTER V

PURE FOOD AND PURE FOOD LAWS

Experimental Tests for Food Adulterations. — The teacher should write for Bulletin No. 100 of the Bureau of Chemistry, Department of Agriculture. It is well to have samples of food known to be pure, to compare with the samples to be tested. Note the cleanliness and age of the wrapper or container, the look and feel of the food.

The following will be needed for these tests: Ferric alum, muriatic acid (caution: it will attack skin or clothes or metal, if contact is allowed), formalin (solution of formaldehyde), borax, alcohol, turmeric paper, and filter paper.

Experiment 1. **Formaldehyde.** — (Used to preserve milk, etc.) Place $1\frac{1}{2}$ ounces of milk in each of two china cups; to one add 5 drops of formaldehyde solution. Now proceed as follows: Add to each lot of milk $1\frac{1}{2}$ ounces of muriatic acid and a piece of ferric alum as large as a pinhead. Rotate the cup gently so as to mix the acid and the milk. Place the cups in boiling water and let stand away from the fire for five minutes. The one containing the formaldehyde will turn purplish. (See also Experiment 4, Chapter IV.)

Experiment 2. **Copper.** — (At times used to give peas or beans a bright green color.) Mash up a teaspoonful of the suspected peas or beans in a china cup with several teaspoonfuls of water; add about 25 drops of muriatic acid and set the cup in boiling water. Place a bright iron nail or piece of steel in the cup with the beans, and heat the water around the cup for half an hour. If copper is present in considerable amount, a red coating of that metal will appear on the nail. (Because of effective enforcement of pure food laws, bright green peas may not be purchasable; copper acetate may be added to show the test.)

Experiment 3. **Borax.** — (Used to preserve meat and fish.) Mix a tablespoonful of finely chopped meat with hot water, and rub up well; press through a cloth, and to three tablespoonfuls add about 50

drops of muriatic acid. Filter through paper, and dip a piece of turmeric paper in the clear solution. Pin the turmeric paper to a board to dry. If borax is present, the turmeric paper will turn cherry red. (The National Pure Food laws do not allow the use of borax on meat. If you have no suspected sample, a small amount of borax may be added to meat before making the test.)

Experiment 4. **Genuine Butter, Renovated Butter, and Oleomargarine.** — Melt the sample in a tablespoon over a lamp turned low, stirring it with a splinter or match. Increase the heat until it comes to a brisk boil, stirring it thoroughly. Oleomargarine and renovated butter make a noise and splutter when boiling, like grease boiling in water, and foam not at all, or very slightly. True butter (unless it contains much milk) boils more quietly and produces much foam. Dairy butter foams, but does not splutter; renovated butter and oleomargarine splutter, but do not foam.

Experiment 5. **Canned Goods.** — If the ends of a can are swelled out, or if gas escapes when a small hole is made, or if the can is leaking, the contents have spoiled. The contents should not be used. When a can is opened, notice whether it is rusted or corroded; this may mean that tin or lead has been dissolved in the food. Preservatives are rarely found in canned goods. If canned oysters or lobsters have the least suspicious taste or smell, a poisonous ptomaine may be present. Two solder marks are a sign of spoiled food. All cans should be emptied as soon as opened.

Experiment 6. **Vinegar.** — If a little grape or apple vinegar is nearly dried up by applying heat, an odor of grapes or of baked apples will be detected in the part remaining.

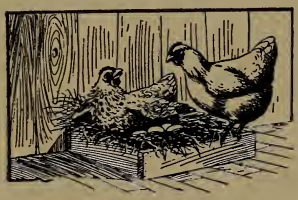
Experiment 7. **Vanilla Extract.** — This is sometimes adulterated with the cheap and poorly flavored tonka bean. By comparing sample to be tested with genuine vanilla extract, a difference in odor and taste is readily noticed.

Experiment 8. **Eggs.** — A "candler" may be made by rolling cardboard or stiff paper into a tube 12 inches long and $1\frac{1}{2}$ inches in diameter, with one end cut to fit the eye and the other to fit the egg. Look through the tube and the egg towards the sun. Study fresh eggs first, then examine decayed eggs. A fresh egg appears unclouded. If setting has begun, there will be a dark spot, larger as the setting is more advanced. A rotten egg appears dark. The white and yellow of eggs which have been long in cold storage have a tendency to run together when the egg is broken. An egg may be tested by odor and taste after it is opened.

Experiment 9. **General Test for Preservatives** in canned goods and other foods. (See Experiment 4, Chapter IV. These tests are made in the same way as the tests for a preservative in milk.)

The adulteration of food and drink had become such an alarming evil that in 1906 Congress passed a *pure food law.* Various states have also passed pure food laws.

Straw stack eggs are often musty.



A laying hen and a sitting hen; some eggs good and some bad.

From Egg Circular, Kansas B. of H.
Hidden nests may contain rots.

Passing a law is a very easy matter compared with its *enforcement*, especially when there is large profit in breaking it. Much bitter abuse has been vented upon those who stand for pure food, and strong opposition against an officer that does his duty is often aroused by those whose purses are growing large at the expense of the people's health. It is needful here, if anywhere, that "we try to arouse reverence for the laws in those who are prone to set them at naught" (page 1).

Poor people are more liable than the rich to be injured by adulterated or spoiled food, since they cannot pay high for extra care in maintaining purity. Food adulteration is stealing, and most often from the needy. *Each citizen must do his share* in watching for and reporting violations of law and upholding faithful officers. We are all links in a chain.

When avaricious manufacturers or dealers add *acids*

(sulphurous, salicylic, benzoic) and alum to stale food to prevent its spoiling; when they stain peas a bright green with a *copper* compound, or give sweetness to food with *saccharine made from coal tar* to create the impression that the food contains wholesome sugar, not only our pocket-books, but our health and lives, are attacked. What are we going to do about it? At present, because of the efforts of the government, such adulterations have greatly decreased. But there are rascals ever ready to take advantage if officers or people cease to be vigilant.

These enemies of the public good often lose a small part of their ill-gotten gains in fines. They deserve imprisonment in addition as a warning to others that the health of a people must not be sold for gain. Thus will honest merchants be protected against cheats, and civic righteousness not be a mockery. The first duty of citizens in this matter is to see that *food inspectors and other health officers are not selected because of politics, but for competence*, and that faithful ones are kept in office no matter what party carries the election.

There are three kinds of impure food sold: those which have begun to *decompose* or rot; those preserved with *chemicals;* those adulterated with *cheaper foodstuff.*

Here is a list of the *food unfit for use, condemned and destroyed* by food inspectors in Missouri during seven months in the year 1912: 20 pounds of candy, 135 packages of breakfast food, 741 pounds of meat and fish, 1200 pounds of hominy, 125 pounds of spoiled beans, 640 bottles of poisonous catchup, 80 cans of unwholesome milk, 134 bottles of olives, 316 cans of decaying canned meat, 1885 cans of bad fruits and vegetables, 581 bottles of impure patent medicines, and 225,000 eggs.

Sometimes *sulphur* is found in dried fruits, candy, molasses, wines. *Benzoate of soda* is sometimes used to preserve butter, catchups, jellies, mincemeat, preserves, and cider. In canneries it is sometimes used not only to preserve food, but to preserve green or partly rotted tomatoes and berries which are unfit for canning, but which are made into a pulp to be used as fillers for pies, preserves, and catchup.

Courtesy of Holland's Magazine.

TESTING FOR ADULTERATIONS.

The use of *chemicals enables men to stop the decay in unclean trash* and sell it as food. Their use is a danger for this reason, even if they do not injure digestion. But we should remember that whatever chemical protects food from decay makes it indigestible for the body. All are not agreed on the unhealthfulness of small amounts of benzoate of soda and several other preservatives, but it is well to give the body the benefit of the doubt, and buy foods to which they have not been added. Even if the chemical does not poison the body, their use to prevent the spoiling of food permits careless methods of handling and manu-

facture, and the use of unsound material. Preserves, jellies, and jams are sometimes chiefly made of pumpkin pulp or of glucose, colored with coal tar (aniline) dye, preserved with benzoate, and labeled with the name of a fruit of which they have hardly a trace. Crushed millet and timothy seed have been used to adulterate fruit jams.

Some "*apple vinegar*" has never been touched by apple juice, but is made of acetic acid and colored. Since the fruit flavor, not the acid, is the chief part of vinegar of benefit to us, such vinegar is a fraud.

Raisins, dried figs, apples, and currants are sometimes wormy or decomposed. *Raisins* on the bunch are usually cleaner, fresher, and better flavored than stemmed raisins. *Lemon and vanilla extracts* may be made of artificial flavors and colored with coal tar dyes, but artificial vanilla extract is more often colored with burnt sugar. Pure vanilla extract is colorless.

Saccharine, a costly coal tar drug, is said to be 500 times sweeter than cane sugar, and hence is cheap to use when imitating foods made partly of sugar. It is injurious and is not a food, but passes from the body unchanged. Its taste is sweet, but it leaves an unpleasant after-taste.

Cane sugar, or *sucrose*, costs twice as much as *glucose*, hence glucose is often substituted for it. The glucose of commerce is made by treating corn starch or potato *starch with sulphuric acid*. If it is carelessly manufactured, it contains sulphuric acid. It is much used to adulterate honey, sirup, and preserves.

Ginger ale often contains pepper instead of ginger, as a little pepper takes the place of much ginger and is far cheaper. Bottled soft drinks may have an injurious preservative added to them. Many *summer drinks* have

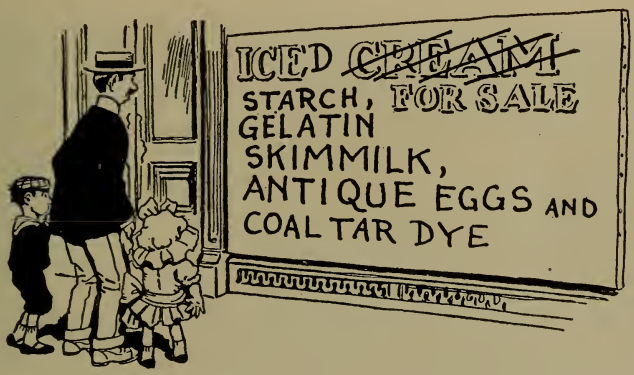
caffeine or extract of cocoa leaf added to them so as to produce a craving and increase the sale. They may thus lead to *a drug habit* and break the health. There could be no more fiendish scheme to destroy health for the sake of gain than to offer a beautifully colored, sweet-flavored, foaming summer drink to the thirsty, with a habit-forming drug in it to fasten its use upon the victim.

By Courtesy of Good Housekeeping, 381 *Fourth Ave., N.Y.*

Cool Drinks are refreshing in summer, but be careful not to choose a drink that contains caffeine or other "dope." At some fountains drinking glasses used by dozens of people are washed in the same water. (Too much soda water causes gas on the stomach.) The cartoon on the next page was also loaned by "Good Housekeeping."

Ice cream and *cold drinks* are pleasant in hot weather. They should not be gulped down, but eaten or sipped slowly. Cases of poisoning from ice cream may be due to milk that had putrefied before it was frozen, or the ice cream may have thawed and spoiled and was then frozen again. Ice cream cones may be stale or freshened with borax. Some people will eat any frozen stuff that happens to look

like ice cream, though it may have the flavor of stale condensed milk or no flavor at all. *Dextrin, starch, gelatin*, and other things are used for thickening, as their cost is a small fraction of the cost of cream, and they require less ice in freezing the stuff and keeping it. Dextrin costs about three cents a pound. You may have wondered why blocks of "hokey-pokey" ice cream do not melt on the peddler's cart, even when exposed to the summer sun.



They probably contain no cream and precious little even of skimmed milk. The legal standard in most cities requires 14 per cent of pure cream in ice cream.

Soda pop and soda water sometimes contain lead from the pipes which dissolves very readily; if so, such drinks may cause diarrhea.

The *cold storage* of meat and eggs is a practice readily open to abuse. Undrawn *fowls* keep better frozen than fowls from which the entrails have been drawn, because there are no cut or raw surfaces. They are sometimes kept fresh for six months, and are perhaps preferable to live fowls so handled in coops as to become thin and feverish. If *fowls* and *fish* are not sold solidly frozen, poultry

should be sold alive in coops, and fish alive in tanks. This is the custom in most countries of Europe. If kept in cold storage only a few degrees below freezing, they slowly spoil. Those yellow, soft, wet, soggy chickens so often sold in city markets do not taste like chickens nor look like chickens to a farmer or a dweller in the suburbs who raises chickens at home. They may have been soaked in water to increase their weight. To save expense of ice,

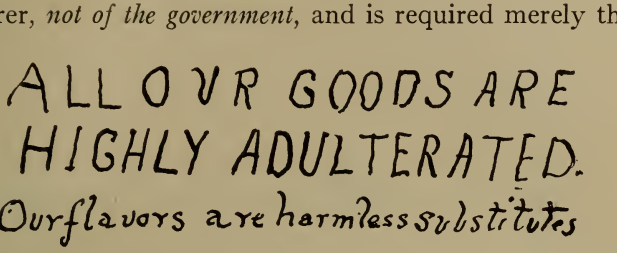
Courtesy of Indiana Board of Health, Dr. J. N. Hurty, Sec'y.

A Sanitary Meat Market, Kokomo, Ind.

poultry and meat are too often kept on the market till the last minute without freezing and then put in cold storage after decomposition is beginning. It continues slowly during storage and becomes very rapid after removal and thawing. *Eggs* kept in cold storage longer than a month or six weeks change their taste and aroma. Such eggs are useful only for baking. Hamburger steak and sausage, if of a bright red color, have probably been treated with sulphite.

You see the inscription on foods and drugs: "*Guaranteed* under the U. S. Food and Drug Act, June 30, 1906,

serial no. —." This is merely the guarantee of the manufacturer, *not of the government*, and is required merely that



COPY OF A SIGN on a soda-water stand in Philadelphia. The pure food law requires truthful labels but does not prohibit non-poisonous substitution if notice is given. *To avoid impure food read the labels.* Watch for the words: — coal tar, saccharine, salicylic, sulphite, benzoate.

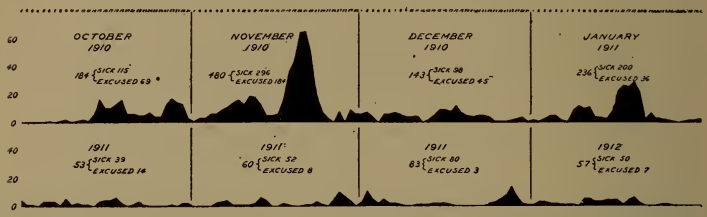
an *innocent retail merchant may have the guarantee of the original packer or manufacturer if sued for selling impure food.* But most people fall into the error of thinking that it is a government guarantee of the truthfulness of the label or the purity of the goods. The requirement will probably soon be changed so that labels will read "guaranteed *by the maker* under, etc."

TRICHINA (enlarged) in Pork. Half-cooked pork or sausage is unsafe.

Cleanliness. — Pure food must be kept clean and cool, or it will soon become as dangerous as impure or adulterated foods. *Places of manufacture* should be watched by officers and customers to see that they are clean and that clean, fresh materials are used.

Ice cream may be made of pure cream and sugar, yet it will not be safe if it is made in *a dirty cellar* which is dark and unventilated, has a ceiling black and dropping with filth and cobwebs and is used, perhaps, as a storeroom for old clothing and waste. Yet such places are sometimes used for *bakeries* and for making *ice cream.* *Boiling*

water is as necessary for washing ice cream *saucers* and *drinking glasses at the drug store*, soda fountain, and refreshment parlor, as in the kitchen at home, yet this is seldom



Courtesy of U. S. Bureau of Animal Industry.

HEALTH CURVES AT ANNAPOLIS NAVAL ACADEMY. Upper curve for 4 mos. in 1910–1911 while the school was without its own dairy. These curves show that the greatest number ill at one time (more than 60) was in Nov., 1910, and that average illness decreased to about one fourth after school dairy was established in 1911.

done. They are hurriedly rinsed in a trough under the counter; hundreds of glasses and saucers used by clean and unclean, sound and diseased, are rinsed in this trough or vat before the water is changed. Food tastes better from perfectly clean dishes. A telltale odor or taste of soap and grease is the chief difference between a clean restaurant or home and one that is unclean. Dishes should be rinsed after they are washed with soap.

Have you ever looked behind the counter in your grocery store?

Food and dishes should not be left exposed in *pantry or kitchen* during sweeping, nor uncovered soon after. Molds, yeast, and bacteria are much more abundant in the air during *sweeping*, and do not settle from the air for several hours; hence it is better to sweep the kitchen less often, lightly brush up bits of trash, and wash the floor every few days.

Dusting with a cloth to which dust will stick is even more necessary in the kitchen than in other rooms. The fur of *dogs and cats* touches many things which we would not like to have touch our food. It is more uncleanly to let a dog come into a kitchen than into a parlor. They leave loose hair and dirt in the house.

Diseased cooks, diseased dairymen, grocers, or peddlers may contaminate food. Notice your baker as well as his shop; does he cough and spit?

Honest Measures.—To protect honest dealers and buyers a law should require that the *weight or quantity be marked* on every package, can, bucket, bottle, or measure. A good present to a bride who expects to be a home maker would be a correct pair of scales. The buyer may be cheated by the use of short-weight scales and short measures. Some correct scales will weigh incorrectly if the meat is put toward one edge, or if the butcher touches it with his hand to steady it. Of a hundred *bushel baskets* tested in a certain city market, only five held a bushel. A *quart berry box* may be made to hold much less by pressing slightly on the sides. *Quart bottles*, especially those with rounded-up bottoms, rarely hold more than six gills.

One who *steals by the use of false weights* and measures is liable to arrest and a heavy fine. When a housekeeper finds she is being cheated, she may merely transfer her trade and hope that others will do the same, and the cheat have to stop business. If so, she misses *doing a real public service.* Because of her cowardice in not having him arrested when sure that he was cheating, other housekeepers will be cheated and honest merchants have to compete with a rascal. The housekeeper should also beware of merchants who, when reliable goods of known quality

are called for, always offer another kind "just as good."

Marketing; buying for freshness and flavor. — If the health department has done its duty and allowed only safe foods to be sold, it still depends upon the citizen whether the food bought shall also be *well flavored and palatable.* Even if the acid of the canned tomatoes or fruit has not dissolved the tin or lead from the solder, canned fruit is not so palatable as fresh fruit. Of two foods equally safe, it pays to buy, at a higher price, the more palatable one, for it will be better digested and give more nourishment.

Sometimes the flavor of the best food is spoiled in the cooking. The writer who suggested that vegetables be avoided because most of them have no flavor and have to be highly seasoned with salt, pepper, and vinegar, had a bad cook or was a stupid buyer. Fresh vegetables eaten raw, or properly cooked, have fine flavors.

Skill in marketing is soon learned. Pods inclosing *peas* should be crisp and plump. *String beans* should not look faded and limp, nor be tough or stringy when snapped. *Cabbage* heads with the dark green outer leaves somewhat wilted may be fresher than bright white heads which may have had the outer leaves taken off every day or two to restore a fresh look until sold. *Cucumbers*, *carrots*, and *turnips* should be firm to the touch. *Head lettuce* should have firm, white hearts without the rusty look which tells of long keeping. It will keep fresh longer if the root is left on. When *cabbage is eaten raw*, one head will keep fresh several days if the outer leaves are not removed, but merely turned back while slices are being cut. *Green corn* should have fresh, bright husks, or shucks. If wilted, the ears will have little flavor. It loses some of its sweet-

ness within two hours after being pulled from the stalk. This is because its sugar begins at once to turn to starch.

There are *tricks of the trade* to give old vegetables a fresh look: the *wilted outside leaves* of celery, cabbage, and lettuce are pulled off and the ends of the *stems* of these

Courtesy of Nat'l Cash Reg. Co.

GOING TO MARKET. The food is fresh. Stale food has little flavor. Unappetizing food causes dyspepsia. This gardening kept the boys off the street.

vegetables and of melons are cut to show a fresh surface; or their leaves are given a fresh look by being *sprinkled with water* which is not always clean. The tops of beets are removed, leaf by leaf, as they wilt.

In general, *when a vegetable is cheapest, then it is also best,* for this will be its natural season of ripening. Half-grown new potatoes are costly and unhealthful. At the time when potatoes are very old, they are highest in price; rice and hominy may be used instead.

The farmer with his wagon, the gardener with his cart

or little booth, usually have the freshest fruits and vegetables. The farmers came to market with their wagons at Georgetown, D.C., for a hundred years, and there was a fine, cheap market. But local dealers wanted to add to their profits and keep out competition, and charges to be paid by the farmers were increased. The market place is

Courtesy of Nat'l Cash Reg. Co.

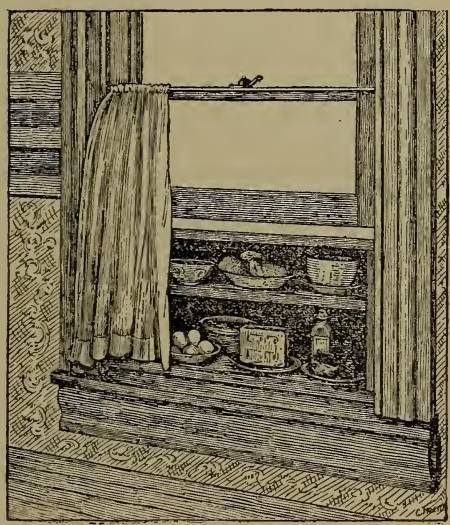
Young gardeners balancing accounts. Their garden is on a vacant lot.

now nearly deserted, and more profits must be paid by citizens. This has happened in many towns.

A *standing order* may be given a neighboring farmer, and *delivery made daily by parcel post.* A dozen eggs or *2 pounds* of butter or other foods will *go by a rural route to town* for *6 cents*, 50 miles for 8 cents, 150 miles for 10 cents. Eleven pounds, say a hamper basket, with assorted vegetables or fruits or dressed fowls, will go by rural route to

town and be delivered for 15 cents; the *producer* and *consumer* can thus retain and divide the profits of middlemen and peddlers equally, and the food supplied will be fresher. This is a general custom in England. The telephone makes direct dealing easy.

The freshness of fruits and vegetables is highly important, for if fresh they may be eaten without seasoning and will purify the blood, skin, and complexion. Highly seasoned, they have the opposite effect. The acids in fruits purify the food tube. People who eat well-flavored food will not often feel depressed, and their appetites will not need other than this natural stimulus.



A Window Box for keeping food in contact with outside air. Protected outside by wire screen, inside by window, or by curtain when window is raised. (Mary Hinton Abel.)

The freshness of meat may be judged by its color, that of fish by the color of the gills. "Fish, flesh, and fowl" are kept fresh with greater difficulty than vegetables, grain, and fruit. How is the freshness of eggs tested? (Experiment 8.)

Methods of storing food are worthy of thought. In cool weather, *fish and meat* may be wiped with a damp cloth and placed outside in fresh air in a box on the wall closed with a wire screen. *Bread and cake* will keep fresh

if well wrapped or kept in a tin box with a tight lid. The box will become musty if never sunned and crumbs are left in it. *Beans and peas* may be kept in earthenware crocks or tin lard buckets with tight lids. People with their own gardens will be able to *store their vegetables for winter* by the following rules: *Potatoes* are best kept in a cool, dry, *dark* place. *Carrots, parsnips, and turnips* remain plump and fresh in earth or sand-filled boxes on the cellar floor. *Sweet potatoes* may be kept until January if cleaned without bruising their skins, dried, and packed in chaff, and not touching each other. *Pumpkins and squash* must be thoroughly mature. They should be dried from time to time and kept on a shelf, not touching each other. *Cabbages* should be placed in barrels with the roots uppermost. *Tomatoes* may be kept till January if gathered before frost, wiped dry, and placed on straw-covered racks in the cellar.

People who grow and store their own food have a great advantage over others. Those without orchard or garden may buy in quantity from farmers at the right season and store them.

Rice, currants, and raisins may be kept air-tight in wide-mouthed preserve jars. Stone and earthenware absorb fat, and meat should not be put in them. The cans containing tea and coffee must be kept air-tight or their flavor will be lost. Things kept in paper bags attract mice. House-keepers who understand sanitation know food must be dried before it is stored; that the cooler food is kept, the better; that to keep out rot, the skins of fruits and vegetables must not be broken in handling. They remember that bacteria, yeast, and molds grow best at 80° to 95° F. and love moisture and darkness. They wash the tops of jars, cans, and milk bottles to prevent soiling the contents when

opened. They wash fruit before it is peeled and nuts before they are cracked, since they have been in many hands and exposed to all sorts of dust. They know that cold-storage food spoils quickly when brought into a warm temperature. They air the cellar and pantry regularly

Courtesy of National Child Labor Committee, 105 *E.* 22 *St., N.Y.*

TENEMENT WORKERS PICKING NUTS. They use their teeth on shells that do not yield to the finger. Notice the mother has a sore throat. Careful people buy whole nuts, not kernels; lemons, not extract, cocoanuts not desiccated; breakfast grains whole, not crushed or rolled; raisins unseeded, etc.

and, unlike some housekeepers, they do not wait for house-cleaning once a year to wash the shelves and floor clean with soap and water, carefully dry them, and sun their contents meanwhile.

TEST QUESTIONS. — In what year was the National Pure Food law passed by Congress? Why are there difficulties in enforcing pure food laws? Name some injurious chemicals used to preserve food. How should food inspectors be selected? What are the three kinds

of impure foods? For what is benzoate of soda sometimes used? Of what are jellies and jams sometimes made? What kind of raisins are cleanest? What is used to color imitation flavoring extracts? What have you learned of saccharine? Glucose? Ginger ale? Summer drinks? Ice cream? Soda water?

What is said of the cold storage of fowls? The sale of fish? Describe an undesirable fowl. What did you learn of cold storage eggs? What is signified by the guarantee label on food and drugs? What is said of places of manufacture? What have you learned of cleanliness at soda fountains? What are the dangers of contaminating food in a kitchen?

What is said of honest weights and measures? What should you do when you are cheated? How is freshness recognized in each of the common vegetables? What is said of city markets? What plans are given for buying direct from the farm? Why is it important that food should not only be sound, but fresh? Give the ways of storing foods in cellars, and of keeping foods fresh and clean in the kitchen.

CHAPTER VI

FOOD VALUES AND ECONOMY IN FOOD

Experiment 1. **Test for Acids.** — For acid tests, use sour buttermilk (which contains lactic acid) or muriatic acid diluted in ten parts water, or strong vinegar (which contains acetic acid). Obtain litmus paper at a druggist's. Dip a strip of red litmus and of blue litmus paper into the acid. What result? Even dilute acids taste sour and make the skin thin.

Experiment 2. **Test for Alkalines.** — For alkaline tests, dissolve in a glass of water a spoonful of baking soda or some laundry soap. Test effect of alkaline solution on red and blue litmus paper.

Experiment 3. **To neutralize an Alkali with an Acid.** — Pour some of the alkaline solution into a dish, gradually add dilute acid (or sour buttermilk), stirring with glass rod and testing with litmus until the mixture does not turn red litmus blue nor blue litmus red. The acid and alkali are then said to have neutralized each other, and the resulting substance is called a salt. If the last experiment is tried with soda and sour buttermilk, the demonstration will show some of the facts involved in bread making with the use of these substances.

Experiment 4. **Test for Starch.** — Cooked starch turns blue with iodine. Obtain a few cents' worth of tincture of iodine and dilute it in a bottle. Get a half dozen pieces of paper and cardboard, all different, and test each for starch by placing it over mouth of bottle and tipping the bottle up. If much starch is present, the spot will be blue-black or dark blue; if little starch, pale blue; if no starch, brown or yellowish. Make pastes by boiling wheat flour, potato starch, and corn starch with water. Treat a little of each with a solution of rather dilute tincture of iodine. Raw starch does not turn blue with iodine.

Experiment 5. **Test for Proteids.** — Heat white of egg slowly. What change takes place in the egg? (White of egg is proteid.) Does heat harden or soften most substances? Proteid when burned has a characteristic odor of burnt feathers; this will be noticed if lean meat or cheese is charred in a spoon. The offensive odor from

decomposing proteid is also characteristic, whether it comes from stale beans, meat, mushrooms, or other things containing proteid.

Experiment 6. **Test for Fats and Oils.** — Place a little tallow from a candle on unglazed paper and warm. Hold the paper up to the light and examine it. What effect has the fat had on the paper? Place a little starch, sugar, powdered chalk, or white of egg on paper and repeat the experiment: is the effect the same? Place some of the tallow in a spoon and heat. Compare the effect of heat on fat and proteid. Water also makes paper partly transparent but the water soon evaporates.

Experiment 7. **Human Teeth.** — Study the form of teeth from every part of the mouth. Get a handful from a dentist. Break some of the teeth to make out their structure. Examine decayed places.

Experiment 8. **Study of the Teeth.** — Sit with the back to the light and look into a mirror, with the mouth wide open. Examine your teeth for cleanliness and decay. Examine gums. A small mirror placed in the mouth will show you the back side of the teeth.

Economy in Food. — Inspectors may see that the food is pure, and you may purchase it fresh and palatable at the market, but if you do not know the nourishing value of different foods, the body may not be well nourished, even with great outlay of money.

Ill-fed and rickety.

People sometimes use tea and coffee as fancied substitutes for real food. Thin soup, which is mostly water, has little nourishment. The nourishing value of food is an important question. Three fifths of defective children suffer from undernourishment. This is true, not only among the children of the very poor

who lack food, but also among children of the rich who eat so much and so often that they suffer from indigestion.

You learned in studying physiology and personal hygiene for beginners that foods do more than one kind of work. There are three classes of foods. There are tissue builders, or *building foods* (proteids), for constructing the body, and fuel foods, or *coal foods*, for keeping it warm and enabling it to work. The coal (or carbon) foods are starches and sugar, fats and oils. There is a third class, called *mineral foods*, such as iron, salt, and water, which helps the proteids in building the body. The *ash* that is left after food is burned shows the amount of solid mineral that was in the food. Artificially refined foods may cause mineral starvation and bring on disease. Refined white sugar has only one two-hundredth part the mineral matter of brown sugar.

Composition of hen egg.

The *proteids* are flesh-formers and they build and repair the body. A child needs proteid food in order to grow. If a man ate no proteid food he would starve, even though he ate plenty of the other kinds of food, for his body would wear out and could not be renewed. Examples of *food containing much proteid* are milk, eggs, cheese, lean meat, peas, and beans. Beans have been called the "beef of the garden." They contain much proteid food, but they also contain coal food and mineral food.

The things which contain more of *coal foods* than of any

other kind are potatoes, apples, bread, and other starchy things; also butter, lard, fat meat, and oily foods. There is one kind of tissue in the body which is made chiefly from coal foods, and that is *fatty tissue.*

To study the value of foods for our bodies, we must have an exact *unit to measure by.* We measure food by the units of energy it gives to the body, and the unit of energy is called the *cal'orie.* A calorie of energy equals the increase of heat in one kilogram of water when its temperature is raised 1° C. A boy of twelve requires about 1500 of these units of food in a day, a housewife, 2500, an outdoor laborer, 3500. It is useful to be able to calculate the fuel value which ten cents or a dollar will buy. The following list gives the number of calories per pound:

Farmers' Bulletin 295.

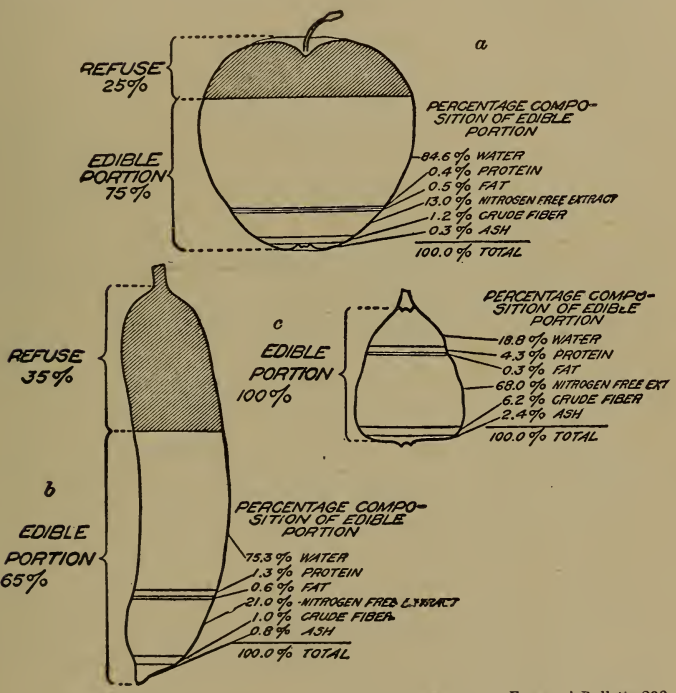
MAKE-UP OF CARROT. *a*, fiber, starch, fat. *b*, sugar. *d*, proteid. *e*, mineral. Slanting lines show food lost in boiling.

Peanuts	1775
Peanuts (edible part)	2460
Sugar (granulated)	1750
Wheat (roller) flour	1635
Corn meal	1635
Beef (round)	890
Fowl	795
Sweet Potatoes	440
Milk	310
Bananas (edible part)	400
Mackerel (fresh)	370
Grapes	295
Potatoes	295
Apples	190

Potatoes must be less than one cent a pound, and beef about two cents a

pound, to be as cheap a fuel food as flour at three cents a pound.

About 12 oz. of lard or 26 oz. of sugar contain a day's allowance of 3000 calories. But we must eat more than



Farmers' Bulletin 293.

Composition of apple, banana, dried fig. The nitrogen-free extract is sugar and starch. How do you eat a banana without touching the edible portion with the hand? Those who use judgment in selecting food do not forget fruits and nuts.

one kind of food, for the body needs food for various purposes. When more proteid food is taken than is needed for repair and growth, it may serve as fuel along with the coal foods. The intake and use of fuel should balance. If the intake is less, the body is underfed; if the intake is greater than the amount used, the body is overfed. If

you are very fat and wish to reduce your weight, do not starve yourself, but leave all fats out of the diet. If this is not enough, leave out some of the starch and sugar. A full-fed man has more energy and vigor than an overfed man or underfed man. A pound of peanut butter contains far more nourishment than a pound of beef and costs less. Another economical food is cheese, yet while the people of our land eat in a year only 4 pounds of cheese apiece, they use annually an average of more than 100 pounds of meat exclusive of poultry and fish. It is habit, custom, or

Farmers' Bulletin 332.

COMPOSITION of an OILY NUT (walnut) and a STARCHY NUT (chestnut). A half dozen pecans or other oily nuts eaten daily at breakfast will prevent constipation.

lack of knowledge which causes a people thus to neglect nourishing, cheap, and appetizing food. Pound for pound, cheese has more proteid than beef and half again as much fat.

Which food in the table on page 99 is the cheapest fuel food? Cheese, you notice, ranks fourth. You get more calories from ten cents' worth of cheese than of milk, and about twice as much for your money if you spend it for cheese as you do if you spend it for beefsteak. Compare fuel values and cost of a pound of beef and a quart of milk. Compare these with the cost and value of a dozen eggs.

A lunch of bread and milk weighing 16 oz., and costing about 8 cents, contains 1080 fuel units of food (calories); a lunch of soup, beef, potatoes, turnips, bread and butter, coffee with milk and sugar, costs 25 cents and contains 865 food units.

AMOUNTS OF PROTEIN AND ENERGY OBTAINED FOR 10 CENTS EXPENDED FOR CHEESE AND OTHER FOODS AT CERTAIN ASSUMED PRICES PER POUND.

FOOD MATERIALS	PRICE	10 CENTS WILL BUY —	10 CENTS' WORTH WILL CONTAIN —	
			Proteid	A Fuel Value of—
		Ounces	*Ounces*	*Calories*
Cheese	22 cents per pound	7.3	1.9	886
Beef, average . .	20 cents per pound	8.0	1.2	467
Porterhouse steak .	25 cents per pound	6.4	1.3	444
Dried beef	25 cents per pound	6.4	1.6	315
Eggs	24 cents per dozen	10.0	1.3	198
Milk	9 cents per quart	38.3	1.2	736
Wheat bread . . .	5 cents per pound	32.0	2.9	2,400
Potatoes	60 cents per bushel	160.0	—	2,950
Apples	1½ cents per pound	106.7	—	1,270

The proteid and coal food of the diet should be *balanced.* Milk, eggs, and meat at the same meal give an excess of proteid. Bread, potatoes, rice, and custard at a meal mean decidedly too much starch. As it cloys the appetite, an excess of sugar should be avoided. Because they cloy, sugary foods are usually eaten last.

Stimulating foods should be eaten sparingly; meat, pie, pickles, catchup, and coffee at one meal would not be fair to the stomach. "The stomach has to take what you give it, but it does not have to digest it." Sometimes it decides that one foot up will be less work than thirty feet down.

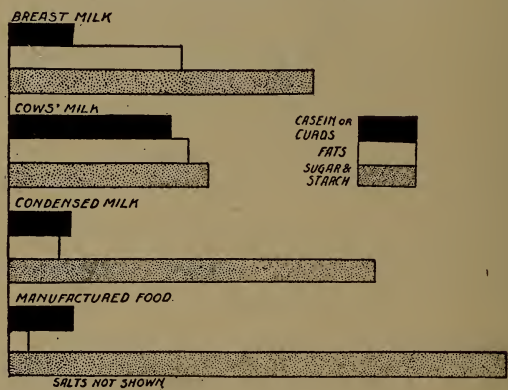
A diet *may be simple* and yet supply the various elements needed. It is not necessary to eat a great variety of foods to be perfectly nourished, for a single food, as milk, or bread or beans or grain, will contain not only one of the food elements, fat, sugar, starch, proteid, mineral, but several of

them. Indeed the fewer articles of food eaten, provided they supply various elements, the better for digestion.

The *Arab* on a diet of bread and dates, the *Japanese* rickshaman and *Chinese* coolie who live on unpolished rice, and the *Italian* navvy who lives on macaroni, do as much or more work than the British and American laborers on a varied diet.

In primitive ages man had times of feasting, when he was successful in the chase, and also times of scarcity and

CHART SHOWING COMPOSITION OF VARIOUS MILKS.



Which infant food is most lacking in fats? in sugar and starch? Which has most casein?

fasting. Christmas and Thanksgiving feasts, in spite of what diet cranks may say, accord with man's natural habits formed during long ages; so do occasional times of stint. A great variety of food at the same meal does not accord with the history of man's stomach. Savage man did not have half a dozen foods before him at once, and nibble first one, then another. According to the season, his meal was wholly of meat, or of fish, or of fruits and nuts. When many different kinds of foods are eaten, the glands must

furnish different ferments for their digestion. All people who reach extreme old age live on a simple diet. Some prefer to make one meal every day on fruit alone.

Many foods, before they are tampered with, have certain *active principles* (or *ferments*) in them that stimulate and help the digestive organs. *They are destroyed by great heat.* There are certain active principles in the outer layers of

Courtesy of New York City Schools.

Cooking lesson in a vocation school. A good cook is the strongest foe of the saloon.

wheat, rice, and other grains and in milk and meat, which are destroyed by heating to 250° F. Food cooked at or above this temperature has lost taste and flavor. To try to remedy the work of poor cooks by replacing natural flavors with vinegar, pepper, mustard, and spices is to make the matter worse. Bad food weakens people so that their weakened bodies demand overwarm rooms, stimulants, and narcotics.

The more simply foods are prepared and eaten, the better. The *Greeks* ate unleavened bread, made of coarse barley flour, fruits, olives, goat's milk, cheese, nuts, radishes, green salads (lettuce, etc., with no pepper or vinegar), weak wine, honey, fish, and dried figs.

People who cannot digest *boiled potatoes*, can relish and digest *potatoes steamed* in their skins; boiling takes out

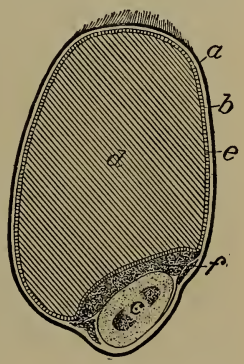
A pile of cotton "in the seed." Cotton-seed cake is a good food for man and beast. Cotton-seed oil is with difficulty distinguished from olive oil. Unless the olive oil is of the finest quality the cotton-seed oil may have the finer flavor. It is likelier to be purer oil than olive oil because of the many refining processes in making it.

valuable mineral salts. There are *mineral salts* in vegetables and milk which are needed to make the blood and bones of a growing child and to sustain the health of grownups. Certain mineral salts are required to aid digestion.

The *unspoiled appetite* relishes simple food and does not need to be stimulated with seasonings. Bad food does not satisfy, and leads to high seasoning and overeating, and overeating is the chief destroyer of good appetite.

The *craze for whiteness* in bread is a fruitful cause of bad

health. Some merchant or miller advertised a certain brand of *wheat flour* as whiter than all others, and thus caught the fancy of good ladies whose heads were able to hold only the idea that whiteness meant cleanliness. Other millers were driven likewise to throw out the brown part of the grain containing lime, iron, and phosphates. Then others began to bleach their flour with ozone or chlorine. The very white bread of to-day does not deserve the name of the staff of life, and it works great injury to public health. No wonder few people have sound teeth. Unless the children of our land are suitably fed, it is vain to hope that they will grow into staunch useful men and women. About *two fifths of the weight of food consumed by most families consists of flour or bread.* Hence good flour is an important step in the work of making the food of the people as nutritious as possible. For very white flour about 68 per cent of the grain is made use of; the rest, with its phosphates and other food for the teeth, bones, and nerves, is rejected. In making the tasteless white flour, not only the brown, outer layers are thrown out, but the central germ also, which is rich in proteid and fat, has a delightful aroma, and gives good bread its "nutty" taste.



GRAIN OF WHEAT cut through (enlarged). The innermost of the three outer layers contains a valuable proteid called gluten.

Coarse foods are the most wholesome. The outrage worked by modern machinery (abetted by unthinking housekeepers) upon *rice*, is even greater than upon wheat. *Unpolished rice* is more nutritious than the tasteless white rice which has lost a valuable outer layer, and is often made

white and glistening with talcum powder. An ounce of unpolished rice contains 90 grains of proteid and 48 grains of valuable mineral more than is found in polished rice. Living on polished rice is believed to be one cause of the disease called beriberi, and it is said to have been cured by collecting the material ground off the outer coating of polished rice and giving it as a remedy. Good rice has a dingy color.

Courtesy of New York City Dept. of Child Hygiene.

MALNUTRITION CASES in New York City Schools.

The *best wheat flour* is not dingy and dark, but *creamy in color.* Rats, mice, and pigeons fed on white bread and water cannot be kept alive; they live if some of the sharps and bran removed in milling, are replaced in the flour. *Indian corn* bread made of unbolted meal has a greater variety of elements needed by the body than starchy white meal.

The efforts of factories to boost their goods by appealing to finicky purchasers, has injured the general health. *Superfine salt* lacks traces of elements found in fresh sea salt and believed to be necessary to a hale body. *Golden sirup* is usually cheap glucose. Dark *molasses* and sugar-house molasses, like brown sugar, owe their dark tint to *iron*, the same element which makes the blood red. Reliable sirup for the children may be made by boiling brown sugar

with water. *Refined sugar* is not as healthful as *brown sugar*, and the extensive use of it has enabled a few to control prices.

The more factory processes the people are persuaded are necessary for food products, the easier it is for merchants to keep the producer and consumer apart, control the trade, and raise prices. Sometimes the farmer is even persuaded to sell the foods he produces and buy them back slightly changed and put up in pretty boxes. *Wheat or oats* can be cooked all night in a fireless cooker and be ready for breakfast next morning; they make fine *breakfast foods at two cents a pound*. They can be bought crushed, rolled, or puffed (and half cooked) in a beautiful carton at 30 cents a pound. If unclean, they cannot be washed like the glossy whole grains. Such prepared breakfast food is staler and less palatable than if it came direct from the farm. In the procedure, many middlemen have been paid. A can of beans or peas costs 15 cents a pound; a pound of lima beans costs 8 cents, and one pound of dried beans equals the beans in two cans; how many times cheaper are dried beans than canned beans. A farmer can hardly imagine that he likes citified food better than fresh food.

Sorghum sirup can be made in almost any farm neighborhood. Its sugar is cane sugar (sucrose), not glucose, and is much superior to "corn syrup." Dr. H. W. Wiley says: "Sorghum syrup has a peculiar flavor which is not disagreeable to those accustomed to its use. It is extremely wholesome, highly nutritious, and palatable."

Boxes and cans and tight packages protect food from dust, but it may be weevily or wormy because insects' eggs were laid in it before it was packed. Breakfast cereals are sometimes sold in boxes upon which are printed

extravagant claims as to thoroughness of cooking and wonderful nutritive power. Even if the pound in the box or can is not one to three ounces short weight, the grain is not as nutritious as when it was fresh on the farm. *Fancy foods are usually poor foods;* they are less easily digested than plain foods, and there is more chance for humbug. Be shy of advertised foods, but do not stint on good wholesome food of the old-fashioned kind.

There are *quack foods* as well as quack medicines. An example is "*brain food*"; there is no such thing as a brain food. Two cents' worth of vaseline is perfumed and dyed and sold for a dollar as *skin food*, "warranted to make old skins new, and dried-out skins fresh and rosy." The skin can breathe and perspire, but it cannot eat. You may hold your hand in milk for hours, but no milk will be absorbed by it.

Our bodies inherit *the wisdom of the ages*. Here is an example of this wisdom: the body manufactures oil to keep the skin supple and the hair soft, yet by no process has man been able to make oil by machinery. Man's reason often interferes with natural instincts and priceless powers, simply to follow a fad started by some schemer to fatten his pocketbook and flatten those of others. Man's instinct will guide him to select the things needed among simple, natural foods; instinct is hopelessly in the dark among the concentrated, spiced foods offered on so many tables. Nature gives *danger signals* to those who will heed them. The habit of overwork brings a *persistent fatigue;* too great mental excitement brings on *sleeplessness;* excessive eating or the use of wrong foods is betrayed by fullness, *gas*, colicky *pains*, or by headaches. Eat simple food and trust to your instinct. "Worry about diet is

the surest road to dyspepsia" (Dr. W. A. Evans). A sensible person can think about food without worrying about it.

When you eat, *how* you eat, and *how much* you eat are more important than *what* you eat, provided the food is pure. Office workers often eat too much. Scant outdoor life and little use of the muscles call for moderation at the table. A man who eats three meals a day, nibbles at snacks between meals and takes a little bite, sometimes a big one, before retiring, has no right to scorn those who drink alcohol.

MOVING PICTURE OF THE STOMACH, photographs with X-rays during ten seconds. The wave passes to the pylorus, or keeper of the gate. While one is teased, worried, anxious or angry the waves stop. (Bismuth in the food made movements visible.)

Workers in offices and at machines that furnish all the power must *either limit the food eaten or increase the outdoor exercise* taken. Either plan is good; the second is better. Addison said: "Temperance in eating in many cases produces the same effects as exercise, and may in some measure supply its place." *Plato, a wise Greek*, said: "The names given to diseases by doctors only serve to hide the fact that their patients have worked too little and eaten too much."

The food tube is the canal along which we send the food in order that the cells in its walls may absorb what is needed. This canal, or *tube, is a muscular organ* which contracts in waves to mix the food and move it along.

If food is too *concentrated and bland*, with all fibrous parts removed, the tube has no resistance to contract against, and cannot move the soft pulpy food along. This smooth pulp lacks all stimulating power, and does not arouse the muscles in the walls of the tube to contract. The tube is a motor organ, but it becomes weak and torpid, the food stagnates and decays, and the body is polluted. The way to avoid this is to eat food more nearly in its natural condition, and avoid food with its texture ground out of it, the coarse part sifted out at the mills, and the life cooked out of it in the kitchen.[1]

[1] Chewing and evacuating, the beginning and the end of digestion, are the only steps in it that are voluntary. Starchy food should be chewed long; the mill and the cooking stove should not make this impossible by doing all the work beforehand. Meat does not need long chewing. Milk and meat eaten together may cause clogging (constipation). Pasty, concentrated food often causes this condition. Not only whole wheat bread, but bran bread, may be eaten. There should be about an ounce of woody fiber (cellulose) in the daily food of every one. This fiber is found in most leafy and root vegetables. Raw cabbage is a better laxative than agar (a seaweed) used as a laxative, but because cabbage, unlike agar, is not sold in drug stores, most people will not believe so. Another health superstition is that onions must be very healthful, since they have such a bad odor.

Fasting or liquid diet is constipating. Fasting interrupts the daily rhythm of the intestine. This daily rhythm causes the call of nature which should be treated with respect. By the cleanly and refined, it is not disobeyed for the sake of other duties, however pressing. The only cause of bad health in some persons is that they will not clean out and keep clean. Even a daily movement may not mean freedom from constipation; for the lower bowel may expel part of its contents without becoming empty. This state is shown by the excreta being dry and hard from too long a stay in the intestine. For explanation of the call of nature, see "Hygienic Physiology," Fig. 125. Standing for a while after meals encourages the call of nature.

Purgative drugs only serve to fix constipation as a habit. Vegetables and whole-grain foods, walking, horseback riding, exercises requiring trunk bending and deep breathing, and cold baths make drugs unnecessary.

Self-poisoning may occur gradually from the products of putrefaction in the small and large intestine. Constipation makes people old before their time. Moderate eating is especially necessary as life advances. When

The Teeth. — Since the first step in digestion takes place in the mouth, the teeth should be sound that the mouth may be clean. If not, the filthy, fetid-smelling substance given off by decaying teeth becomes mixed with the food and goes with it to the stomach.

Americans have been called a race of food bolters. Those who live their lives in a hurry soon lose the art of dining. Of the thirty-two feet of alimentary canal, the owner can control the first three inches. But it is also important to control his hands; for if they shovel in the food too fast, the mouth cannot keep up with its work.

Chew with your teeth, you have no gizzard!

One who eats rapidly never knows how good things taste. We should chew, or rather munch, by the tasting method; that is, we should think of the taste and not of the chewing.

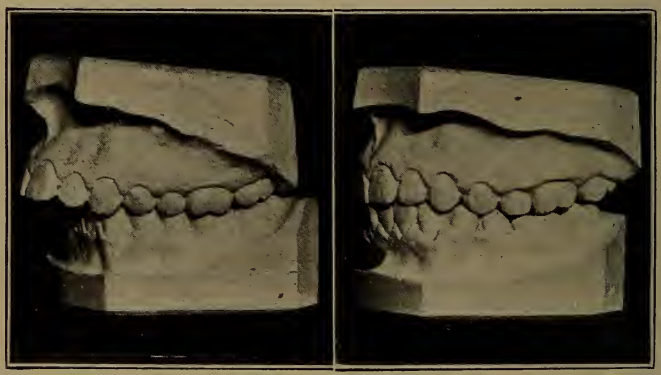
Not only is bulk and coarseness necessary in *food*, for the reason you have learned, but, likewise, *hardness and toughness* is needed, for the mouth is a grinding organ. Eat food that requires the teeth to be used. Remember that "there are thirty-two in the gang and you are the boss; make them work." If they do not work, they will decay.

Eat foods (which kinds?) *that supply the minerals needed* for making teeth. Toothbrushes and powders, though faithfully used, cannot make the teeth grow sound and

Edison was asked the secret of his remarkable vitality, he said: "Moderate eating. Cut down your food gradually until you start to lose weight. Then increase it a little and thereafter keep the weight constant. The food you then take will all be used, and the clinkers of the body furnace will pass into the large intestine free of food value and cannot putrefy and poison you, since they furnish no food for bacteria."

strong, instead of soft or brittle, if there is lack of mineral salts in the food. Whole-grain bread, vegetables and fruit, well-chewed nuts, prevent soft and decaying teeth.

The teeth and mouth should be kept clean. Flushing the mouth with warm water after a meal removes particles of food. Most toothbrushes are too large. They should not be stiff enough nor used vigorously enough to make the



Loaned by Dr. Herbert A. Pullen.

Showing teeth before and after straightening. Crooked teeth are caused by adenoids, thumb sucking, use of a pacifier.

gums sore. The teeth should be brushed up and down (from the gums) as well as from side to side. Brush their inner surfaces, the mouth being open; also the grinding surfaces of the back teeth. If the tongue is coated, it may be protruded and brushed. If a thread drawn between two teeth becomes frayed, this may have been caused by a cavity that is forming.

Four things help bacteria to grow: warmth, darkness, dampness, and food. They find all four conditions in food left lodged between the teeth. Starch and sugar clinging to the teeth may ferment and form an acid which

attacks the enamel. Go to the dentist before cavities have had time to become so large that teeth cannot be saved. One tooth lost throws several teeth out of work. Good teeth are the greatest aid to good digestion.

Besides the high *motive of health* there are two lower motives for not neglecting the teeth. First, missing teeth or *rotten teeth spoil the looks;* no one can be handsome with ugly teeth. Would a boy or a girl with white perfect teeth or one with rotten teeth find a job or position

Courtesy of Dr. Herbert A. Pullen.

Portrait of a girl before and after her teeth were straightened.

more quickly when starting out in life and looking for work? Second, *it is costly to neglect the teeth.* A toothbrush and a little labor costs less than dentist's work. But go to a dentist when your mouth needs attention. A small dental bill may save a large dental bill and may possibly save a doctor's bill as well as lengthen the life.

At two years a child should have as many teeth as it has fingers and toes. This completes the first set. The *sixth year molar* (the first permanent tooth) is the sixth tooth from the middle line above and below. Watch it. It

should be promptly filled if it shows a spot of decay, for no tooth will come in its place.

A child should eat hard crust and foods that give work to the teeth, for the baby teeth should stay in until the teeth of the second set appear and actually push them out. If the baby teeth do not hold the places for the permanent teeth to grow in, *the jaw will not grow large enough.* The teeth will be crowded for room and cannot grow in a smooth line. See the pictures. It will not help the looks much for a girl to grow up with a pretty little pointed chin if it makes the teeth set zigzag in the jaw with some of them pointed outward like tusks. A broader chin with a dimple in it would look better, besides giving room for the teeth.

Rub the inner surfaces.

Good toothpicks can be made of quills. Wooden toothpicks should be made of hickory or other wood that will not splinter and lodge in the mouth, perhaps causing an abscess. Prepared (precipitated) chalk bought at the druggist's, either alone or mixed with one fifth its weight of pulverized Castile soap, makes as good a tooth powder as fancy powders sold at a high price. To use, turn a tablespoonful of it into a hand or saucer, and touch with the wet brush.

If the gums are weak, a particle of grit or a deposit of lime called tartar may raise the gum from a tooth and cause inflammation. Sometimes in the effort of the cells to remove the intruding particle, pus may be formed. The dentist can cure these troubles if consulted in time. Otherwise the tooth may become loosened.

Bad teeth interfere not only with efficient citizenship, but they may prevent a man from serving as a soldier at all. If soldiers cannot eat and digest well, they cannot make long marches. The teeth of recruits are examined carefully. Good general health and good blood usually mean good teeth.

TEST QUESTIONS. — What is the relation between defective children and food? Into what three classes are foods divided? Name several of each class. What is the unit of value of foods? About how many calories should a day's ration contain? Name foods of high fuel value. Name foods which supply few calories per pound. Why are the several kinds of food necessary? How may a fat person reduce weight?

Compare the food values of beef and peanuts; beef and cheese. Name foods which supply much nourishment for little money. What food in the table given makes least return for ten cents? Compare two lunches. What is meant by a balanced diet? Give an example. Describe a too stimulating diet. What is the diet of the Arab? Japanese? Chinese?

What were probably food customs in the stone age? What disadvantage in cooking at a high temperature? What custom is followed by poor cooks? What foods did the Greeks eat? What is said of white bread? Of the best kind of flour? Of coarse foods? Salt? Sirups? Sugars? Breakfast foods? Quack foods? Man's instincts? Exercise and food? Repeat the quotation from Addison; from Plato.

What is the nature of the food tube? Why is coarse food better than bland food? Have you read the footnote on the clogging of the intestine? What evils follow decayed teeth? Why should we eat slowly? What kind of food makes sound teeth? How should the teeth be brushed? What conditions help bacterial growth? What are the advantages of sound teeth? What is best for toothpicks? What causes teeth to become loose? How may bad teeth affect citizenship?

THOUGHT QUESTIONS ON PREVIOUS CHAPTERS. — Why is it **to your interest** and happiness that tuberculosis patients be cured? Is an **epidemic usually due** to the misdoing of many or a few persons? Which do you prefer, Dr. Pound of Cure or **Dr. Ounce of Prevention**? Do you **do your part** to keep washroom, schoolroom, and home

clean and in good order? Is it the duty of the state to aid us in protecting against **fire in schoolhouses**? To aid us in protecting pupils against infection? What shall we do to keep the **chief gateways for germs** closed against them? They are as follows: breaks in the skin, sore gums, gums loose from the teeth (improper use of toothbrush), unsound tonsils, adenoids, unsound mucous membrane of nose, air passages, lungs. Why should we not sit too close to **snifflers** or coughers?

It costs about 2 cents more per quart to produce clean milk; is it worth it? Does the government **stamp on a piece of meat** prove that it is safe? Discuss these sayings: "An **apple each day** keeps the doctor away." "A tooth in the jaw is worth two on a plate." British workmen eat chiefly **white bread, tea, and jam**; suggest better food at less cost. Bacteria grow upon undigested food long delayed in the food tube and form **toxins**; **signs of** toxins are headaches, sallowness, sleepiness, nervousness, bad breath, bad taste in the mouth. Is it better to prevent this by decreasing the food or increasing the exercise? The body needs a **good shaking up each day**: does yours get it? A "**bilious attack**" is an effort of the body to rid itself of toxins; how may we avoid such attacks? Why are the lungs, liver, kidneys, and the blood itself better blood **purifiers** than any drug?

CHAPTER VII

THE PREVENTION OF INFECTION: HUMAN CARRIERS

DISEASES are not blown long distances through the air, but are carried by (1) insects, (2) higher animals, (3) most of all by human beings, and (4) by their discharges. These discharges may be scales from the skin, secretion from the nose, or excretion from the intestine. *That which man has contaminated is that which contaminates man.*

The moist breath of a patient should not be taken into another's lungs. It has been proven in several cases (scarlatina, tuberculosis) that *germs adhere to floating particles of dust.* Air that is free from dust is usually free from germs.

Sneezing or coughing is a source of danger.

Perhaps more deadly disease has been carried by *kissing* than in any other way. If the kissing of helpless babies is stopped, thousands of lives will be saved.

About 2 per cent of *typhoid fever patients continue to be carriers* for at least a year after having the disease. *Smallpox* is spread mostly by *mild walking cases* that do not take to their beds. It hardly goes through the air at all. The bacilli of pneumonia and diphtheria are found in the mouths and noses of many healthy people. They may be of harmless strains or races, but a sojourn in some particularly vile human body may render them poisonous. Known bacilli carriers should not be allowed to handle food products. The roadbed of railways is often polluted by train toilets. Campers (in construction

camps, etc.) may pollute the soil and affect the health of the whole community. Contractors and others should be required by law to burn every bit of refuse about camps.

HAVE A BITE! (Polite but unclean.)

It is a relief to nervous people to know that the doctrine that disease germs are everywhere has been exploded. We now know that *disease germs have their homes in the bodies of living hosts.* The dread of disease germs everywhere, — books and brooks and everywhere in earth and air, — need disturb them no longer. Living beings are the true reservoirs of disease. The rôle of human beings in carrying typhoid and tubercle bacilli has already been described. Some infectious diseases are hardly more than contagious; that is, they are spread by contact. Germs are most dangerous when fresh. They are more likely to infect when they come right from a diseased person or something that he has recently touched.

Why should we never use a public hairbrush or comb?

The many wonderful discoveries concerning the way infection is carried have led people to think that the ways of infection have all been explained.

This is an error. There are many problems yet to be solved, some of which will be mentioned in this chapter.

Diphtheria. — The *diphtheria* germ which grows in the throat was one of the first disease germs to be discovered. This disease is most likely to occur in childhood. It may be merely a sore throat, or it may become a very serious disease.

A few hours after the sore throat is complained of, fever may be noticed. In membranous croup, which is a severe type of this disease, a hoarse cough or difficulty in breathing is followed by the growth of a membrane in the windpipe. In most cases, after the fever makes its appearance, the child becomes drowsy because of a toxin formed by the germs.

Diphtheria is now treated with an antitoxin (meaning "against poison") formed in this way: Diphtheria toxin is injected into the blood of a horse in repeated doses. The horse has the disease in so mild a form that it is hardly noticeable, and the horse's blood works up a large amount of antitoxin to destroy the toxin. Some of the horse's blood is drawn from a vein and allowed to clot; the serum, or watery part which separates out, contains the antitoxin.

Some of this serum is injected beneath the skin of a patient with a tiny, hollow needle. *The antitoxin does not kill the germs, but destroys the toxins they have formed.* Thus the body is kept from being poisoned until it can kill the germs or stop their multiplication. If this is done the first day of the disease, it is almost certain that the patient will get well. Before antitoxin was used, about half the cases of diphtheria were fatal. If the antitoxin is not used until the second day, 95 cases out of 100 will re-

cover; used on the third day, 90 cases out of 100 will recover.

If any others have been exposed to the disease, they should be given the antitoxin at once. If they then have the disease at all, it will probably be a very slight attack, for the antitoxin is there ready to destroy the toxin. They should be kept at home. One person who has become infected with diphtheria is infectious to others from the day he was exposed to it.

By courtesy of the

How Disease is Spread, I.

Treatment with antitoxin blood serum is not exactly the same process as vaccination, for no germs are injected in the serum.

Many diphtheria patients carry virulent germs in the throat for a year or more after they are well. These *diphtheria carriers* cannot be kept in quarantine, and what to do with them is a problem. They should be careful not to use a public drinking cup, and we should not drink from cups which such carriers may have used. *Pet cats* have been known in some cases to spread diphtheria.

The mother wonders why her child has diphtheria, yet

she knows that a *neighbor's child with a sore throat* has played with her children. If a child suffers with a cold and stiffness of the neck, examine its throat. Of course a person with a sore throat should never kiss any one. A baby should be kissed on the cheek, if at all.

American Museum of Natural History.
How Disease is Spread, II.

Pneumonia.—The *dry air* of overheated houses is a predisposing cause of diphtheria and pneumonia.

Pneumonia goes hardest with those who have been habitual users of beer, wine, or whisky. The idle, the fat, the sluggish are predisposed to it. Most people have pneumonia germs in their air passages, but suffer no harm, for the body resists them well. Weakened by strain or excess, a *person may catch pneumonia from himself*. This may happen when the bodily resistance is lowered by sleeping in an unventilated room, by typhoid, measles, drunkenness, unusual exposure, or a severe cold. The germs in the body of a pneumonia patient are more poisonous than those found in people who are not sick. One who has been ill with it probably harbors a more dangerous strain, or race, of the germs (the pneumococcus).

Since it is slightly contagious, do not remain close to people in public places who are coughing, sneezing, or spitting. A big dose of new and perhaps worse germs, added to those you already have in your throat, may prove too much for the defending cells.

From "The Bitter Cry of the Children."

A CONSUMPTIVE MOTHER working on clothing for the general market. We cannot protect the health of one unless we protect the health of all.

Colds prepare for the development of pneumonia. To avoid colds, breathe plenty of fresh air and keep away from dusty air and the dried-out air of overheated houses; take cold baths, sleep in cold rooms; keep the purifying organs (skin, lungs, liver, kidneys, and bowel) in working order. Cold weather causes pneumonia by causing closed

doors and windows. The poor live in crowded rooms or hovels, the rich have roomy, hygienic homes, but often fail to live hygienically.

Grip or Influenza. — The germs of grip live in the mouth, throat, and windpipe. They sometimes remain for a year after recovery from the disease. These germs are also found in the spittle and in the discharge from the nose, but they are quickly killed by drying, and do not multiply outside the human body.

This label on clothing shows that it was not made under conditions that spread disease and the worker was paid a living wage.

The bacillus of grip forms a powerful toxin that affects the whole body. The poison is not so dangerous as that from the diphtheria germ, but it *leaves the body weak.* This weakness may linger for months and render the body an easy prey to pneumonia, consumption, or other dangerous disease. Hence *the after effects* are more dangerous than the disease itself.

An attack of grip does not make one immune to a second attack. Do not touch the hands, dishes, nor handkerchief of an influenza patient until they have been disinfected. Grip is avoided in the same way that colds are prevented. It comes on suddenly; a cold sometimes gives warning. Grip is usually accompanied by chill and fever, prostration, headache, backache, pain in the legs, yellowish and lumpy spittle. The sufferer should keep in bed, take no solid food, drink plenty of water and lemonade, have hot foot baths or sweating baths. All discharges from the nose, throat, and lungs should be disinfected.

Colds are probably caused by various germs. The germs

which at one time cause pneumonia or grip, may at other times cause the inflamed mucous membrane called a cold. A man may catch a cold from himself when his resistance to germs is lowered. Colds in winter are often caused by impure house air, or by overheated houses. Colds in summer may be caused by chilling the skin at night, especially when it is moist with perspiration. It is well to eat nothing but fruit during the first stages of a cold. Sleep-

Va. Health Bulletin.

Loathsome and dangerous diseases may be spread by the use of a public drinking cup. The delicate, well-dressed man or woman is more likely to be infectious than the vigorous day laborer.

ing on a porch prevents colds. Cold is the surest preventive of colds. Cleanliness is also a preventive. The habit of putting the hand often to the mouth, nose, or eyes, is uncleanly; for the hands may have touched unclean things — perhaps the hand of a person with a cold, a door knob, a toy, or utensil which he has handled. What habits of living have you already learned protect us from colds?

Scarlet Fever, Measles, Whooping Cough. — These are partly air-borne diseases and are hard to control, for we cannot disinfect the air. The droplets of saliva that fly out of the mouth while one coughs or speaks may spread

these diseases. Sneezing probably spreads the measles more frequently than the scales from the skin spread it. The eruption of both measles and scarlet fever may be looked for in the mouth before it shows on the skin.

Scarlet fever, sometimes called *scarlatina*, most often attacks children under ten years of age. The eruption on the skin usually begins at the neck and appears on the first or second day after the first symptoms (fever and sore throat).

Scarlet fever germs may live for a long time on clothing or material not exposed to sunlight. Scales from the skin and all secretions and discharges of the patient are infectious, and if not properly disposed of, may be carried in dust and infect others. The disease is often spread by "walking cases" so mild that they are not recognized. The *after effects of scarlet fever upon the ears or kidneys* may be bad. Before the body has recovered its strength, pus-forming bacteria may attack the ears and cause partial or complete deafness. The germ of scarlet fever has not been discovered. Some think it is akin to the pus-forming bacteria.

After a case of *measles* the *eyes* must have rest and care, or they may be weakened for life. Measles is a more serious disease than it is generally supposed to be. They make a mistake who do nothing to prevent catching the measles. Quarantine and disinfection should be strictly enforced. A patient is infectious as long as there is a discharge from the nose or eyes. This continues usually for about three weeks after the breaking out of the rash.

Whooping cough causes more deaths than scarlet fever and smallpox combined. Its victims are usually infants, and it is not greatly dangerous to children over two years

of age. *The older a child is, the better he resists the disease.* Grownups usually have very mild cases, if they take it at all. Very young children should be carefully protected from it. Contagion is greatest before the whoop begins; there is not much danger after it has run three weeks. It has been proposed that children with the whooping cough even in its later stages wear a band of green ribbon on the arm as a warning of danger to other children.

Granular lids (trachoma) is a disease of the eyelids that is easily prevented by cleanliness. It is spread by the roller towel and using a borrowed pencil or other article and then putting the hand to the eyes. The disease is rife among the Indians, and was spread among them chiefly by their schools. Whole tribes are now threatened with blindness. If untreated, granular lids cause permanent injury to the eyesight in three-fourths of the cases.

PAPER TOWELS. Do not use a public towel. A virus carrier may have just used it. The skin will dry in one minute.

The danger from human carriers of **tuberculosis** has been described in an earlier chapter. What did you learn concerning the habits of careful consumptives and of heedless ones? Not many tubercle bacilli are found in city streets, because drying and sunlight kill them. They live longer on the rim of a drinking cup or in a closed, unused room. A consumptive should sleep alone and, if possible, in a separate room. Not only he, but every one else, should pass a part of every day out of doors; for man is an outdoor animal, although he no longer trains his muscles, steadies his nerve, and expands his lungs in hunting and the chase.

Although we should avoid heedless people who carelessly

pass disease germs on, we should not forget that *most germs are harmless.* Sometimes 50 different species of germs are found in the food canal; they are legion in number and most of them are harmless. Many kinds are found on the skin and cannot be washed off with soap and water. A sound skin built out of healthy blood is a better safeguard than soap. We bathe as much to keep the skin vigorous as to keep it clean, for the reasons given in the "Hygienic Physiology," pages 27–30.

Disease germs are usually harmless to robust people. The mistletoe does not kill all the trees it grows on. Many vigorous trees are able to hold its growth in check on themselves, and bear it unharmed; thus they keep up a source of infection for neighboring trees. Rugged health is the best protection against the enemies of the body, each of which, after all, is only trying to live its life in its own way. These hurtful parasites would perhaps never have formed the habit of living in the human body if material for them to live on had not been allowed to accumulate by those who led unsound lives.

Let us recall *the methods of the body in defending itself against germs.* If the finger is pricked with a needle, and a drop of blood is drawn and examined with a microscope, its red and white cells are seen floating in a colorless liquid. One drop contains millions of red and many thousands of white cells. If a colony of germs is conveyed to the drop of blood, *the white cells will flow about the germs and engulf them.* The germs can still be seen in the white cells, or devourer cells, until they are gradually digested. There are 50 billion white cells, or devourer cells, in the body — a great standing army. They may multiply so rapidly that one cell may become a grandparent within an hour. If the

white cells have been weakened by ill health, or the bacteria are very poisonous, the bacteria may destroy the white cells instead of being digested by them. *The healthy body can whet the appetite of the devourer cells* by forming certain substances (opsonins) which serve as sauces to the bacteria and cause white cells to eat them greedily.

Disease germs do most harm by throwing off poisons, or toxins, which injure the tiny, invisible citizens, or cells, that compose our bodies. When disease germs gain entrance to the body, you have learned that there is a new activity in the cells and tissues. As a result of this, *new substances called antitoxins or antibodies are secreted* into the blood. These antibodies have the power of combating the poison formed by that particular kind of germ. Since more antitoxin than is needed is usually secreted, the body is protected from further attacks of the disease. Scientists have learned that it is well in some diseases to kill germs by heating them, and inject them under the skin through a hollow needle, to stimulate the forming of antibodies. Being dead, they cannot increase in numbers, and the devourer cells soon eat them. It is believed that the antibodies not only make harmless the poisons, which the live disease germs form, but they may also kill the disease germs, or weaken them and prevent their multiplying.

Meningitis is an inflammation in the membranes around the brain and spinal cord. Several kinds of germs may cause it. The pneumococcus of pneumonia, it is believed, sometimes causes it. There are also cases of tubercular meningitis. Influenza and typhoid germs may cause it.

One-third of the cases are caused by a special germ that causes no other disease. This kind of meningitis is in-

fectious. The germs are found in the nose of the patient. It dies quickly on drying, but it may be spread by the means of drinking cups, handkerchiefs, the hands, or droplets sent out while coughing or sneezing. The discharges from the nose of a patient should be carefully destroyed. Human carriers play a very important part in spreading this disease. Of twenty people who are infected with the germ, perhaps only one will have the disease, while the others continue to carry the germ and spread the infection.

In the first chapter you studied about the prevention of **smallpox**. Once a great scourge, vaccination has almost done away with it in communities that are careful. Where vaccination is neglected, it usually increases again. Cleanliness and a healthy body also help to ward it off. Vaccination protects for several years, in some cases perhaps, for ten or twenty years. If smallpox appears in the neighborhood, those who have not been vaccinated for a year should be revaccinated. Those who have already been exposed should be promptly vaccinated, as the vaccination may take effect before the disease can develop and make the case milder.

The tetanus germ cannot multiply unless it is shut away from oxygen of the air. This hurt was made by a nail. Never pass a nail point protruding from a plank until you have bent it down.

Tetanus or Lockjaw. — The germ of this disease is one of the few disease germs that form spores. Its home is in the soil. It is harmless to cattle and horses, is often swallowed by them, and passes with their droppings into

the ground of stables and streets. It cannot be transmitted by human carriers.

It sometimes gets into wounds. A boy's foot may be injured by a rusty nail upon which is a tetanus germ and the germ may be left in the wound. If it is the only germ

By Courtesy of Columbus N. Millard.

INDEPENDENCE DAY. This way of celebrating the national holiday results in many wounds, cases of lockjaw, and deaths.

present it will not grow unless the air is shut off from it. It grows best in deep wounds or jagged wounds which close over.

Since the germ's home is in the earth, wounds on the bare feet of children should be carefully disinfected and protected from dirt. Turpentine or peroxide of hydrogen may be used for this. Washing a wound with too strong a disinfectant, or with too much of it, may injure the cells,

weaken their resistance to germs and their power to repair the wound.

The tetanus germ makes a poison which is stronger than strychnine. The first symptoms of the disease are stiffness of the muscles of the jaw and neck. An antitoxin

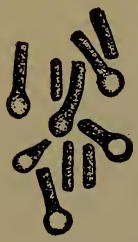
A SAFE AND SANE FOURTH. Here are some country boys starting in a race at an athletic festival. They also had hurdle, sack, relay races, three-legged, potato, leap-frog race and hoop race, broad, long, and high jump, and other events.

has been prepared but it must be used in a very early stage of the disease.

TEST QUESTIONS. — What used to be taught concerning infection through the air? What are the four most common sources of infection? How are disease germs carried in the air? What is said of kissing? How is smallpox spread? What is said of campers? What is the natural home of disease germs?

Where does the diphtheria germ live? How is diphtheria treated?

With what success? How is the antitoxin prepared? What is to be done when others are known to have been exposed to diphtheria? Are there diphtheria carriers? Who have pneumonia most severely? What is meant by a person catching pneumonia from himself? What is known of the germ of grip? In grip, what is it that does the harm? What is said of its after effects? How does grip differ from a cold? How is catching a cold from others avoided?



Tetanus Bacillus. Notice the spore at the end of several bacilli.

Name three air-borne diseases? Where does the eruption of scarlet fever first begin? What organs are most liable to injury after scarlet fever? After measles? At what age is whooping cough a most dangerous disease? Why should it be shunned?

How are granular eyelids most often caught? Tell of this disease among the Indians. How may danger from a consumptive be avoided? What is said of mistletoe? Describe the activities of white blood cells. What are opsonins? Antibodies? What have you learned of the lockjaw germ and of lockjaw? Why are human carriers so important in meningitis? What precautions are necessary?

Tag used on tag day at Oroville, Calif., to raise money for war on mosquitoes. Chills and fever decreased one half the first year.

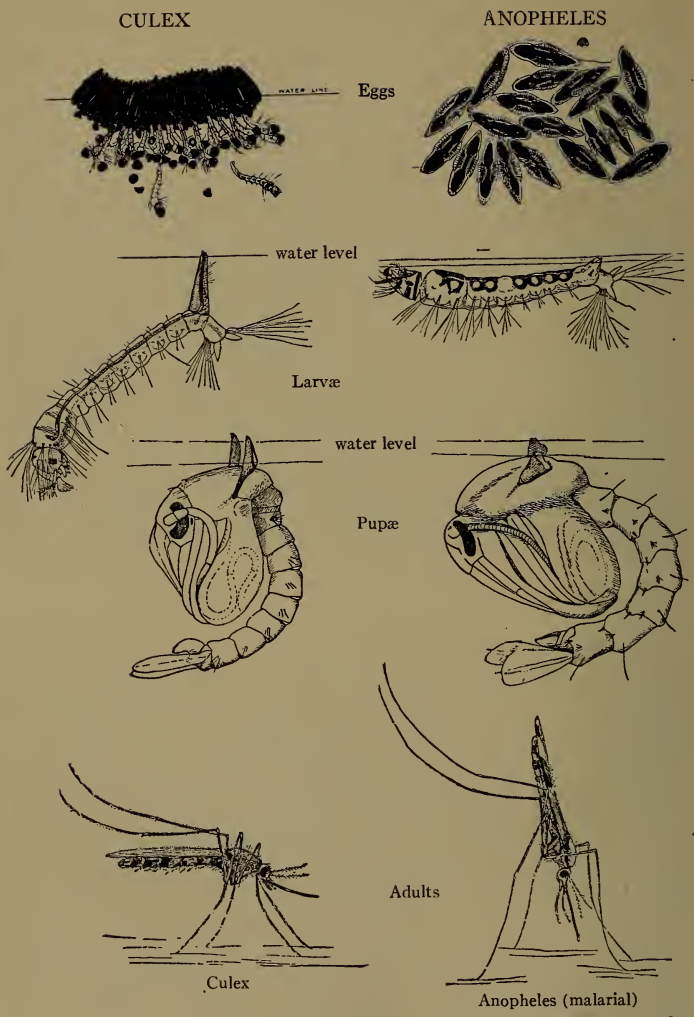
Mosquitoes breed in tubs and tin cans. Invert tubs, cut holes in cans. The malarial mosquito only moves 200 yards from breeding place. It flies at dusk. It does not fly about, but goes straight to victim.

Courtesy of Col. Geo. W. Goethals.

Applying Crude Oil to water in a ditch by use of knapsack sprayer, Miraflores C. L. Oil is also used for treating grass before burning. Vegetation so treated and burnt is very slow in growing again, thus leaving the ditches clear.

Courtesy of Col. Geo. W. Goethals.

Sanitary Drip Barrel at Panama. It drips mosquito oil automatically.



Courtesy of Dr. L. O. Howard, U. S. Bureau of Entomology.

Development of common mosquito (Culex) at left and malarial mosquito (Anopheles) at right. How are the eggs of each kind grouped? The wiggler of which kind lies close to surface of water? What is the resting posture of each mosquito? Which kind has five long parts on head? Which is more uniform in tint?

The eggs of the two species are differently shaped. Which larva (or wiggler) has the longer breathing tube? Which pupa (or bullhead) has the larger head?

CHAPTER VIII

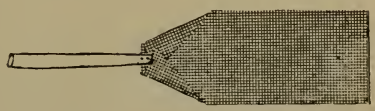
THE PREVENTION OF INFECTION: INSECT CARRIERS

Experiment 1. **To watch Flies hatch.** — Put half a spadeful of rotting horse manure containing the shiny brown pupa of the house fly in a glass jar. Tie a thin cloth over the top of the jar and observe it for a week. (Flies do not breed in manure which has become thoroughly composted or which has not yet begun to ferment.)

Experiment 2. **To study Development of House Fly.** — Place in a glass jar manure containing eggs of house fly, or cheese or meat upon which eggs have been laid by blow flies, and record date. At intervals of three days, remove some of the material and sketch larva (maggot) or pupa found. If flies and manure containing no eggs are placed in a jar, date recorded, and flies killed after eggs are laid, and a cloth tied over the jar, the time of development for the house fly can be found.

Experiment 3. **To find whether Flies can hatch in Garden from Manure plowed under.** — Obtain a quantity of house-fly pupa and bury in 12-, 18-, and 36-inch deep wooden tubes filled with soil, closed at bottom, and covered with net at top. Do flies appear at top?

Experiment 4. **Home-made Fly-swatter.** — All members of the class may construct as good fly-swatters as they can. Test by use, and the class may decide which is: (1) most effective, (2) most durable, (3) the easiest made, yet efficient. As in other experiments the teacher will doubtless credit scholarship grade of those who excel in this work.



A Fly Swatter, made by sawing a slit in a wooden handle to receive a bit of screen.

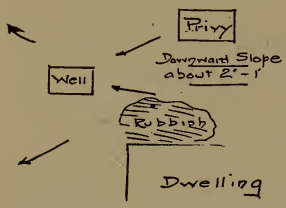
Experiment 5. **Sanitary Fly Survey.** — Examine damp rotting papers and trash: wash out samples from manure, garbage, and trash heaps to separate larva and pupa of fly. Draw a map showing all breeding-places and unscreened outdoor closets found. Put a colored mark by all sources rendered harmless as result of survey.

Experiment 6. **To test Fly Traps, etc.** — By counting flies caught in a certain length of time, test value of fly traps and sticky papers,

and report. Make the tests side by side at garbage can, or elsewhere.

Experiment 7. **The Effectiveness of Screens.** — Examine every screen door and window at home. What percentage of them have cracks or holes large enough to admit flies? Why is there a passageway open for insects if window is raised only part of the way?

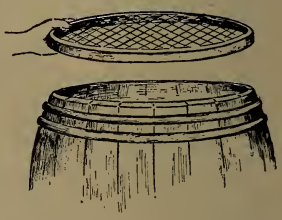
Experiment 8. **To breed Mosquitoes.** — Obtain mosquito eggs by leaving a wooden pail filled with water overnight in the back yard. After they hatch, place them in water in a glass jar. Study their hatching and later stages; manner of breathing, swimming, molting, with the changes to the wiggler, bullhead, and mosquito. (Tie net over mouth of jar before mosquitoes hatch.)



One of the notes made in sanitary study of a home.

Experiment 9. **Effect of Oil on Wigglers.** — Place wigglers in jar of water; watch them breathe. Pour in several drops of oil. How long until they cease to breathe?

Experiment 10. **To learn the Several Kinds of Mosquitoes.** — Collect eggs, wigglers, and mosquitoes from as many different sources as possible. Compare them with each other and with the figures in this book. Learn the difference in eggs, larva, and adult of the "rain-barrel" mosquito (Culex pipiens) of uniform color, the "spotted-winged" (Anopheles), or malarial, mosquito, the "striped-legged" (Culex sollicitans), or salt-marsh mosquito, and the "striped-bodied" (Stegomy'ia; its name is to be Aëdes calopus) or yellow fever mosquito. Study the differences in position of eggs, larva, and adult. (See figs.)


PREVENT BREEDING OF MOSQUITOES by screens on rain barrel, cistern, and shallow well.

Experiment 11. **Do Mosquitoes breed in Moist Soil or on Damp Plants?** — Look for eggs and wigglers under these conditions. Place suspected soils and plants in pure water and try to find wigglers.

Experiment 12. **A Mosquito Sanitary Survey.** — Procure white enamel spoons and tin pails, divide the territory, assign pupils to work in couples. Map all breeding place discovered. Do not omit examination of: old tin cans (cut holes), bottles, jugs, and jars (break them), that may have been scattered or dumped in your territory;

Courtesy of Dr. L. O. Howard.

A SANITARY SURVEY. Examining pools for mosquito larva.

rot-holes in trees, stumps, and logs (chop them out); track-puddles in road (fill them); plants (Spanish dagger, yucca) that hold water at foot of leaf stalk; rain barrels, cisterns, house gutters that sag or are dammed up with leaves; ponds and small lakes; sewer traps and sewers.

Experiment 13. **The Enemies of Mosquitoes.** — Test several kinds of fishes by placing them in a small aquarium or a large glass

Courtesy of Prof. C. F. Hodge.

Studying the breeding places of mosquitoes.

jar with wigglers. Test also the water boatman (notonecta), water spiders, water tiger. (Bats, dragon flies, and birds catch mosquitoes only while flying.)

Experiment 14. **To stop the Breeding of Flies.** — A teaspoonful of Paris Green (poison!) is stirred into a common garden watering pot of water. This sprinkled upon manure will kill all maggots in it and improve it as a fertilizer. Sprinkle in box of outdoor closet.

Experiment 15. **To make Sticky Fly Paper.** — Boil one pint of castor oil with two pounds of resin. Spread it on newspapers with an old paint brush.

Experiment 16. **To make a Fly Trap for the Garbage Can.** — Cut a round disc of wood 6 in. in diameter, bore a hole in the center for the flies. Fasten upon the disc a cone made of wire net. Lay two sticks across the top of the can, lay a barrel top upon the sticks and set the trap over a hole made in the center of this top. (See page 147.)

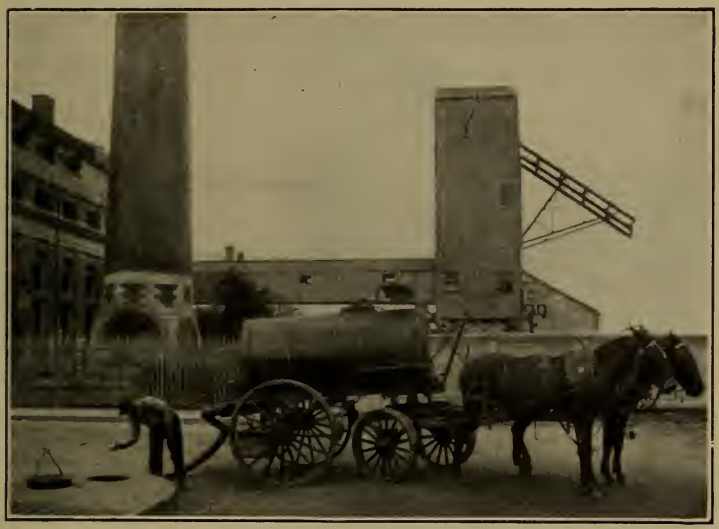
There are several kinds of disease germs that cannot be conveyed from person to person or carried in food or water. These are not bacteria. They are animal germs, and depend upon insects or other animals to carry them.

Flies and mosquitoes are so great a torment to man and beast that they should be destroyed even if they were not the greatest danger to health.

Malaria is the commonest disease carried by insects. It has been proved that the mosquito is its carrier, so that we now can say, No mosquitoes, no malaria. The bite of a spotted-winged mosquito that happens to have been infected with the malarial germ is more dangerous than the bite of a dog.

A Ruined Countryside and the Cause. — The country doctor drew up his horse and stopped on the crest of the hill. "Yes," he said sadly, "this is the place. It used to be the prettiest part of the country, rich, fertile, and inhabited by the best people you ever saw in your life. But

they built a dam down the creek and neglected to drain the country above. Pretty soon mosquitoes began to flourish and with mosquitoes came malaria. The result is that practically every family in the community is ruined. They have chills and fever, they cannot work, they are



Courtesy of Capt. Phillips, Sewer Dept., Washington, D.C.

Oiling a sewer trap, Washington, D.C. (garbage disposal plant is seen in the rear). By draining the Potomac marshes near the city, and by attention to drains and sewers, Washington has been made free of malaria.

hopeless. Yet, if the stagnant water here could be cleared up, the low grounds ditched, and the creek confined to its banks, the malaria would disappear. Isn't it wonderful what a little ditch kept clean will do to prevent malaria?" (Virginia Health Bulletin.)

The first person to suspect that mosquitoes could carry disease, was Dr. Nott of Mobile, Alabama, who published a work in 1848, in which he upheld the mosquito origin of yellow fever. A New Orleans physician, in 1853, claimed

the mosquito obtained the poison from decaying matter. *Dr. Laveran of France found the malarial parasite in the blood in* 1880. After nearly twenty years' search to find how this germ got into the blood, the truth was discovered by Dr. Ross of England, while in India. He proved that *it was brought by a mosquito that had sucked the blood of a malarial sufferer.*

Courtesy of Prof. C. F. Hodge.

School children of Worcester, Mass., spraying a pool by Beaver Brook.

This tiny animal germ (plasmodium) *burrows into the red cells;* there it subdivides (in common malaria) into sixteen germs which go outside the cell and later enter fresh red cells. *The chill comes on as this multitude of little creatures is set free* into the blood liquid.

When a mosquito draws blood from a malarial person, it sucks these germs into its stomach with the blood. They multiply in the walls of the mosquito's stomach and form many spores which pass to the salivary glands of the mosquito. When the mosquito pierces the skin of a person with its beak, *it injects some of its saliva* so that the blood can be pumped out more freely, and with this saliva it puts the malarial germ into the blood of the new victim.

There are *malaria carriers* among the native citizens of malarial regions who harbor the germ without having the fever. Since the mosquito is necessary in the life cycle of the germ, the germ must disappear from the blood of malaria carriers if mosquitoes never reach them; hence the human malaria carrier is not as great a problem as the human diphtheria and typhoid carriers.

The common mosquitoes probably do not fly over half a mile if not driven by hard winds or smoke; hence a house-

A useless mosquito bar (at left). An effective mosquito bar (at right) is tucked under the mattress all around bed.

hold can obtain relief for a time by stopping the breeding of mosquitoes near them. One stray tomato can may breed enough mosquitoes to make a whole neighborhood miserable. Do not wait for the mosquito brigade, but do your share for the public good by pouring petroleum on any stagnant pools near your home; also fasten wire net between two hoops and keep it on the rain barrel. See that the cistern is tightly screened, and that the gutter is not choked and holding water. Cut holes in tin cans, bury ink bottles, etc.

A community cannot be rescued from malaria unless all coöperate for the common good. What are the breeding

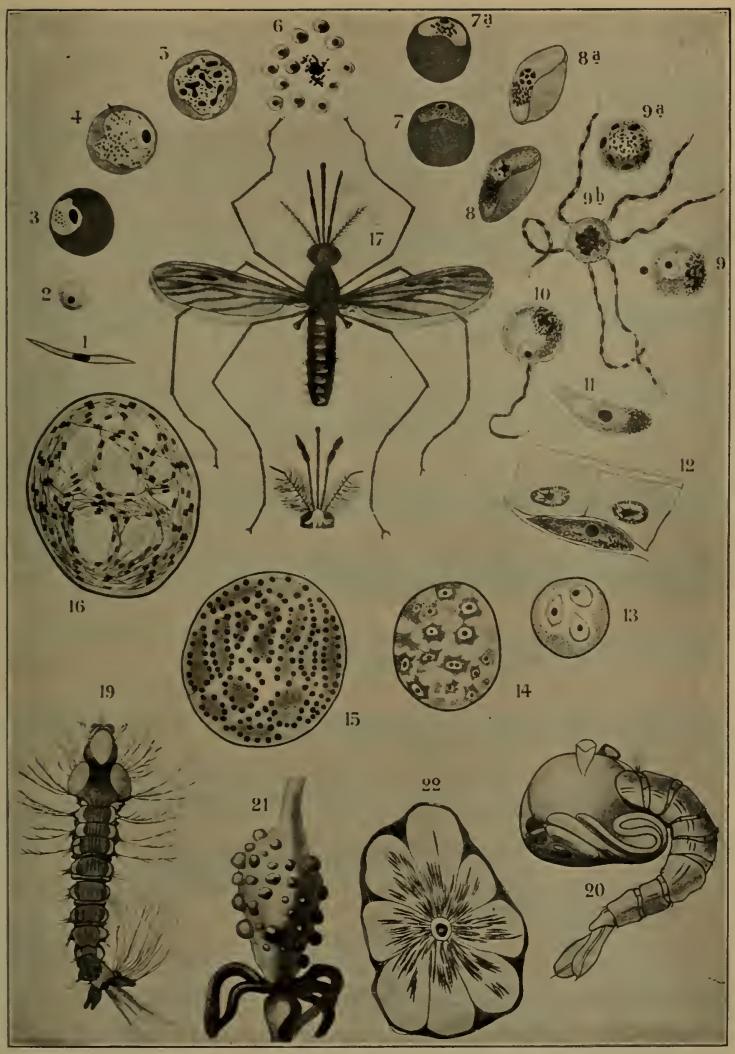
places of mosquitoes as revealed by the sanitary survey (see Experiment 12)? The smothering of wigglers (the early stage of the mosquito) by oiling the water *destroys fish and other natural enemies*, and unless the oil is applied every ten days or oftener, if it rains, the mosquitoes, will become worse than they have ever been. The use of kerosene should be only a makeshift for the time. The

Courtesy of Prof. J. E. Peabody.

Staten Island marshes before and after drainage.

mosquito can only be exterminated by general coöperation in *destroying their breeding places*. Places that cannot be drained must be filled in. The sides of drainage ditches should be kept upright. If *tall grass and undergrowth* in which mosquitoes take refuge during the day are destroyed, most of them will perish or be blown from the neighborhood.

Houses may be *fumigated* by the use of camphor and carbolic acid in equal parts (the crystals to be dissolved by gentle heat); four ounces of the mixture will fumigate 1000 cubic feet for two hours. Fumigation by the burning



Life History of Malaria Parasite (Sedgwick). 1, 2, the germ which is put into human blood by a mosquito bite. — 3, 4, after entering red blood cell. — 5, 6, multiplying (fever begins). — 7, 8, forms of the germ before it is sucked from man's blood by mosquito. — 9, female germ cell in mosquito's stomach. — 9 *a*, 9 *b*, male germ cells. — 10, union of 9 with one of the moving arms of 9 *b*. — 11. male germ resulting from this union in stomach of mosquito. — 12, 13, 14, 15, 16, dividing into spores and forming cysts on walls of mosquito's stomach (shown by 21). These spores become like 1, and pass to the mosquito's salivary gland, 22, ready to enter another human. This completes the cycle. — 17, female Anopheles mosquito, with head of male below (its feelers are more feathery). — 19, 20, mosquito larva and pupa.

POOLS LEFT BY A STREAM falling in dry weather. They should be filled in or drained or at least oiled every twelve days.

DRAIN DITCH dug to empty a standing pool. Look along railroad cuts and in lowlands for pools. Picture from Herms' "Malaria, Cause and Control." (Published by Macmillan Co. This is a useful guide in an anti-mosquito crusade.)

of sulphur is preferable if there are no gilt picture frames to be tarnished.

Imperfectly fitting or *neglected screens are a danger.* A certain family never had a case of malaria so long as they slept under mosquito nets at night. Later the house was screened and the bed netting discarded. The family soon suffered from malaria, for the screens did not exactly fit the windows.

The **Yellow Fever** mosquito, because of the white bands upon its legs and its striped body, is sometimes called the tiger mosquito. This is the little insect that prevented the French from digging the Panama Canal; 240 of their laborers in every 1000 died each year of yellow fever. But the loss was only $7\frac{1}{2}$ per 1000 during the years the United States were digging it. This was after the discovery that mosquitoes were carriers of yellow fever; millions of dollars were spent in destroying their breeding places on the Isthmus.

This mosquito is not infectious to man until twelve or fourteen days after taking its meal of blood from a yellow fever patient; and the man is not infectious to the mosquito except during the first three or four days after the onset of the fever.

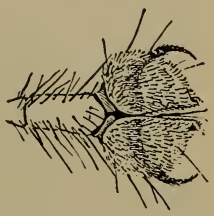
The germ of yellow fever has never been discovered. The *proof that the mosquito is the carrier of the unknown virus of yellow fever* is one of the most heroic chapters in the history of science. Dr. Lazear, one of the four physicians appointed by Surgeon-general Sternberg to seek the cause of yellow fever, permitted an infected mosquito to bite him. He became ill with the disease in a few days and died. Volunteers for further experiment were then called for among the soldiers in Cuba. John R. Kissinger,

a private from Ohio, was the first to respond. John J. Moran also volunteered. Major Reed explained the danger of suffering and death which might come, but, seeing they were determined, he offered compensation in money. Both young men declined it, Mr. Kissinger saying that they volunteered solely "in the interest of humanity and the cause of science." Major Reed touched his cap, saying, "Gentlemen, I salute you." Reed afterwards wrote: "In my opinion this exhibition of courage has never been surpassed in the army of the United States." Both went into a room and allowed themselves to be bitten by mosquitoes that had bitten yellow fever patients. On Christmas morning (1900) John J. Moran was stricken with yellow fever and had a sharp attack. He bore it without a murmur. In the next room three brave soldiers slept for twenty nights in close contact with the soiled clothing which had been taken from the beds of yellow fever patients, some of whom had died of the disease. These men remained in perfect health. Thus was it proven that yellow fever is not transmitted by contact, but indirectly through a certain kind of mosquito.

John R. Kissinger, U. S. Army.

There are three ways of preventing yellow fever and malaria: 1. Destroy breeding places of mosquitoes. 2. Keep mosquitoes from biting you. 3. Prevent mosquitoes from becoming infected by screening patients.

In earlier chapters you learned of the part played by water and milk in conveying typhoid fever. The **House Fly** is another carrier of typhoid germs; indeed, Dr. Howard has named it the typhoid fly. Many cases of typhoid fever occur because flies go from poisonous human discharges to crawl on meat in a market or on the food of a dining table. Dr. Jackson found that flies were attracted by sewage floating in the slips between the wharves of *New York harbor*. He also showed that the majority of typhoid cases were in the parts of the city nearest this polluted water front.



FOOT OF FLY: an ideal germ carrier.

In the Spanish war officers whose mess tents were protected by screens suffered less from typhoid fever than those whose tents were not so guarded; and in the fall the new cases suddenly diminished when most of the flies were killed by frost. This suggests that screens should

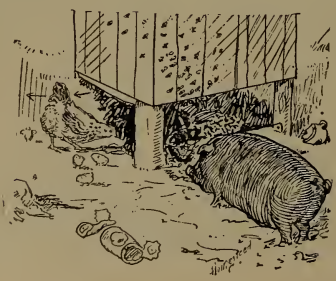
Assistant Health Officer of Washington counting flies by measuring them (3200 to a pint) in the *Evening Star* campaign.

not be taken from windows until after severe frost; otherwise flies may find a warm refuge for winter instead of being frozen.

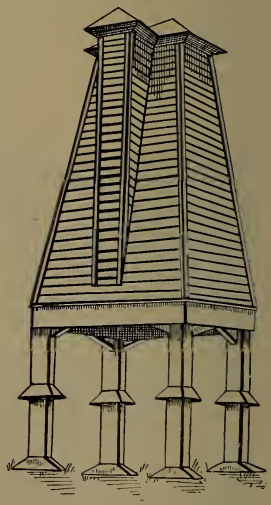
The two stages between egg and house fly. 1, larva (or maggot) above; 2 pupa, below (both enlarged).

The *house fly, or filth fly, may carry a variety of disease germs.* Pus germs, germs of leprosy, diphtheria, and consumption have been found on its hairy legs. Flies often eat too much and then vomit. Many fly specks are vomit stains.

The house fly prefers to *breed in horse manure.* It will also breed in moist, rotting waste paper, trash heaps, and human excrement. Within twenty-four hours after the egg is laid, it hatches into a small footless white maggot which grows and turns into a brown pupa, and this becomes an adult fly within ten days after the egg was laid. One way to stop their increase is to spread the matter in which they breed upon the fields once a week so that it will dry and the eggs and young perish, for they develop only in fermenting material. Manure left in heaps should be carefully screened. If only one or two



The best way to prevent the breeding of flies and escape their dangerous work is to keep the premises clean.



A Bat roost, designed by a citizen of the Southwest. Other enemies of disease-bringing insects (and friends of ours) which should be helped are birds, frogs, lizards, spiders, dragon flies.

horses are kept, the manure can be thrown into a covered barrel or box which will keep it fly-tight until it is removed. Because of their rapid multiplication, killing a few flies in May may mean millions less in August. A carelessly managed stable may bring the efforts of a whole neighborhood of fly fighters to naught. The efforts of one family will amount to little, unless their neighbors take equal pains. A farm household with no near neighbors can stop the fly pest with their own efforts.

Courtesy of Mr. Warren H. Booker, North Carolina Board of Health.

Simple and very successful fly trap for a garbage can. Cloth curtains turned up to show cleats. It catches the flies outside the house. Flies enter the garbage can between the cover and the can, and also around the edge of the trap placed over a two- or three-inch hole. After feeding they fly toward the light and come out this hole in the cover into the trap.

Most public appeals for fighting flies end with the slogan "Swat the fly." This is a good motto, but a better motto would be "Starve the fly." This can be done by thorough cleanliness. No food should be placed within their reach; the cover should always be on the garbage can. *The starving can best be done in the earlier stages of the fly's life.* Give them absolutely no place in which to breed. Where there is no filth, there are no flies.[1]

[1] A LETTER ADAPTED FROM BULLETIN OF INDIANA BOARD OF HEALTH.

DEAR CITIZEN:

I am a fly, now. Once I was a maggot. I live on garbage and slops and stable filth.

I carry all kinds of filth and disease on my hairy feet. This I wipe off

Infantile Paralysis. — *How to prevent it and how to help Recovery from the Effects of It.* — Although described in this chapter on insect-borne diseases, this disease is also spread by human carriers both sick and well. Infantile paralysis was probably more common years ago than any one reckoned. Little children fall and get hard bumps almost every day, and when the effects of this disease began to show there was always some recent bump or fall by which to explain the strange lameness or inability to walk. Cases of "brain fever," weak backs, or feebleness of an arm or leg were often unrecognized cases of infantile paralysis.

It is believed that the disease may be carried by the *house fly.* After contact with the nasal or throat discharge of the sick child, the fly goes to an exposed scratch or open sore in the skin of another child. It is

ROLL OF THE GUILTY.

Anopheles mosquito (malaria).

Stegomyia (yellow fever).

Bed bug (typhus fever).

Flea (the plague).

on the sugar bowl or the baby's bottle when I come to see you, or wash off when I take a bath in your coffee cup or your glass of milk.

I cannot live where there is no filth. I think you must love me because you have kept such nice nasty places for me to live in. I hope you will do nothing to disturb your filth so that I may be with you again next year. The fact is, I have already laid many eggs in your refuse, and if you do not destroy my babies, many millions of us will be ready to call on you again.

I shall take no offense if you have screens. They are, I know, quite the fashion. They have many convenient cracks and the door screens are often open. All we ask is to be allowed to hatch out in our usual haunts, and we promise to dine with you every day.

Good-by till we meet again,

A House Fly.

believed that the *biting fly* more often carries the germ and inserts it when it pierces the skin to suck blood. Professor Rosenau let biting stable flies bite monkeys having the disease and later he let these flies bite twelve healthy monkeys. Six of them developed the disease in ten days.

ROLL — continued.

Biting fly (infantile paralysis).

House fly (typhoid fever, etc., etc.).

Western wood tick (spotted fever).

Body louse (relapsing fever).

The disease is most common in children from two to six years of age, possibly because they go with arms and legs bare. It is probably also carried by *droplet infection.* A healthy carrier may send the germs into the air when sneezing or coughing, and the germs may be drawn at once into the nose or throat of another. *The biting fly breeds in manure heaps.* Regular removal of manure, and other measures for preventing house flies, will also help to do away with the biting fly. This fly is about the same size as the house fly, but has a long bayonet-like beak; it rests with its head up and its abdomen and wings slanting towards the supporting surface: The fewer the stables, the less of these two kinds of flies we will have. Horses, a few years hence, will probably not be allowed to enter residence districts in our cities.

When the disease is epidemic, children should wear frocks cut high in the neck and long, loose pantaloons, since the fly bites through stockings. During this time the war against dust and flies should be redoubled. Patients should be isolated for

three or four weeks, and brothers and sisters of a patient should not attend school. The discharges from the nose and throat should be disinfected.

To help recovery the patient should be kept in rest and quiet for a month; then the child should live out of doors as much as possible, sleep in the open air except in severe weather, and the weakened limb or part should be massaged and gently and gradually exercised. Thus the use of the limb will be regained.

Rocky Mountain Spotted Fever. — The infection of this very fatal disease is borne by the wood tick. In the

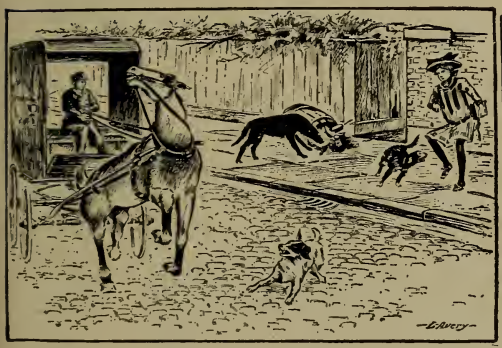
Stages in the life of the Wood Tick that carries the germ of Rocky Mountain Spotted Fever. In the first stage it has only six legs. In the last stage it is shown gorged with blood. (Enlarged.)

earlier stages of its life the tick lives upon squirrels and other small animals; in its adult stage it lives upon cattle. The disease occurs in several western states in a mild form; the most dangerous form is confined to the Bitter Root Valley of Montana. The infection is fought by destroying the ticks. This is to be done, as in the case of the cattle-fever tick, by dipping the infected cattle into a kerosene solution, thus killing the ticks.

Many causes have been assigned for **Pellagra** ("rough skin"). Some think that it is caused by a monotonous diet of rotten or musty corn. Avoid corn grown in a cool

climate where it does not ripen thoroughly, or corn harvested by cutting the entire stalks in the green state and piling them together in fields. Not even horses should eat corn that is not thoroughly sound. Some think pellagra is carried by the tiny sand fly or gnat. Recent investigations in the Carolinas seem to show that it may possibly spread by the biting fly, the same fly which is believed to carry the germ of infantile paralysis.

Which would you rather have in your town } THIS? OR THIS?



MUZZLING LAW. By enforcing this law for four years England caused rabies to disappear. Germany is doing the same. Rabies is increasing in the United States. Can we not enforce this law, save lives, and much terrible suffering of dog and man?

Rabies is a disease spread by neither human nor insect carriers, but chiefly by the dog, man's faithful friend. We should be suspicious of a dog that shows change of disposition, alteration of voice, inability to swallow, leaves home and returns exhausted and thin, has paralysis of the jaw, or swallows wood and stones. Such a dog may have the furious type of rabies. There is also a dumb type with similar symptoms, except that the dog is not very irritable, and paralysis appears early. Rabies has been increasing for some years in the United States. The head of a

suspected dog may be sent for examination and the Pasteur treatment may be obtained for patients from Pasteur Institutes or State Health Boards at the following places: New York City, Chicago, Baltimore, Richmond, Atlanta, New Orleans, Houston, Austin, Pittsburgh, Ann Arbor, St. Paul, St. Louis, San Francisco.

TEST QUESTIONS. — How are animal disease germs carried? What disease may be brought by the spotted-winged mosquito? Describe the possible effect of a mosquito-breeding mill pond upon a countryside. Give the history of the discovery that mosquitoes carry malaria. How does the mosquito affect a human being with the germ? What is said of malaria carriers? How far does the common mosquito fly from its breeding place? Describe the means of getting rid of mosquitoes. What is said of screens?

Describe the yellow-fever mosquito. Compare it with the malaria mosquito. (Figs.) What effect has this mosquito had on the Panama Canal? Tell how the proof was obtained that it conveys yellow fever. How was it proved in New York City that the house fly carries typhoid? What proof was obtained in the Spanish War? Where does the house fly breed? Tell its life history. How is it best kept down? (Flies travel 700 yards from the breeding-place; a few go a mile.)

CHAPTER IX

HYGIENE OF WORK AND PLAY

THE recent growth of cities and factories has not been favorable to public health. *Chronic diseases, especially of the nerves, kidneys, and stomach, have had a more rapid increase in the last fifty years than has ever been known before.* The triumph of public sanitation is all the greater that, in

Photograph by Miss Ellen Hope Wilson.

Camp fire girls dancing.

spite of weakened individual life, infectious, or germ, diseases have greatly decreased, and the average length of life shows a marked increase. Chronic diseases are more common because of the artificial conditions and strain of civilized life, acute diseases are fewer because of successful work in public sanitation. Men in cities work too much

with their tongues and brains and not enough with their bodies. This is unfortunate, because there is no good brain work without body work.

People who live in houses as closely as moles live in burrows become pale and flabby for want of sunshine.

Human beings are *not suited to spend most of their lives sitting in chairs.* The growth of baseball, football, and other *sports* has been favorable to health. However, fewer and

Courtesy of C. N. Millard, Esq.

Riding a bicycle in a posture which squeezes the lungs.

fewer play them. The office worker and machine tender need the activity of the games but they hire others to play while they sit on a plank and yell. Since they are in outdoor air, this yelling is, of course, fine for their lungs.

Indoor workers in towns and cities should *so locate their homes that they will be compelled to walk several miles daily* to and from their work, or from the cars that take them to their work. If the distance to the work is too great to walk twice a day, it will be well to walk one way and ride

one way; thus will daily exercise out of doors be insured. Unless the manner of living has been so arranged that exercise is absolutely necessary, it will usually be neglected, as has been proven in millions of cases. Man has not yet attained the broad and reasonable view of life that assigns to health its proper place. If there is any chance at all, health will be neglected for want of time, amidst the hurry of modern life. As a boy studying hygiene wrote:

> "A walk for a mile in the open air
> Will save you more than a nickel fare,
> And bring you more of vigor by far
> Than you can get in a stuffy old car."

To develop the lungs use the legs. *A good carriage of the body* is one of the greatest helps to health. This means to walk with the chin in and the chest up and the hips back. (The head should not be drawn back.) Only in this way can one get the full benefit of exercise and breathing. To walk with the toes out ("slew-footed") wastes energy. Tight clothes and especially corsets restrain the growth of the muscles of the back. A strong spine is the true secret of a good figure. It gives a well-poised head and easy carriage.

Man has devoted so much attention to lifeless machines that he has sadly neglected the living human machine and failed to keep it up to its natural, original standard. Town dwellers and domestic animals have small hearts compared to rural dwellers and wild animals. *The physiology of exercise* is explained in the author's "Hygienic Physiology," pages 62–67 and 98–99. Here we cannot do better than adapt a statement of Leonard Hill, a great English physiologist: There is nothing so terrible in its effect on health as neglect of exercise in the open air, and nothing equal to

such exercise in restoring soundness, beauty, and happiness. Every muscle fills with blood as it relaxes, and squeezes this blood on past the valves in the veins as it shortens. Each muscle together with the valves in its veins, to prevent a back flow, forms a pump to help the heart circulate the blood. The heart sends the blood to the capillaries;

Courtesy of Dr. C. Ward Crampton, Director Physical Training, New York City Schools.
CHINNING is good for the arms, chest, and spine.

it is the work of the muscles to bring it back to the heart. Nature arranged the circulation for a restless, moving animal. Mankind becomes diseased by attempting to lead a life unsuited to the nature of the body. With rapid exercise, the breath becomes deep, the liver is squeezed like a sponge at each breath, and the organs in the abdomen are thoroughly freshened by being kneaded between the sheet-like midriff (diaphragm) above and the stout muscles forming the walls around the abdomen. The brain worker is kept in a nervous state by his habits of life. He thinks

of doing things, yet he scarcely moves; his heart and blood vessels are tightened, his breathing shallow, his digestive organs sluggish and weak because they are no longer stirred and freshened. In many cases he tries to obtain relief from meanness of spirit and dull sameness of

Courtesy of Toledo School Board.

PLAYGROUND with wading pool, TOLEDO, OHIO.

life by the use of alcohol, tobacco, drugs or highly seasoned food. The whole life of his body runs on a lower plane of action.

Women in towns and cities are usually weaker than the men. They are in the house more; housekeeping is tedious and hard because the house is not simply furnished, the family simply clad, nor the table supplied with simple food. Woman's work does not call for great vigor, yet it

is constant and tedious. The women who do no work at all, but spend much time fretting with servants, have even worse health. *Muscular work* is absolutely essential to woman's health, and some of *it should be vigorous* enough to cause the lungs to expand fully and the blood to flow fast. The abdominal organs, for the reason you have

Photograph by Miss May Belle Brooks.

Washing in the wrong way bows the back and flattens the chest. Notice the higher bench at the right and that the washer expands the chest and bends at the hips.

learned, are liable to stagnation if the life is so inactive that they are not stimulated by full breathing; shallow breathing causes clogged intestine (constipation). A daily grind of gentle tasks is not best suited to encourage the cells properly to assimilate food.

The phrase of a woman being "fair, fat, and forty" usually means being fat and forty; but by right living she may be fair at forty and to a far greater age. The more a woman eats, the more exercise she should take.

Some hygienists think that it is the *lack of lively, vigorous work* that makes civilized woman so delicate. Others hold that the chief cause is her manner of dressing. Doubtless both are to blame. If *the clothing* is not loose and comfortable, lively, vigorous work will be shunned.

Courtesy of Dr. C. W. Crampton, Director Physical Training, New York City.
RUSSIAN FOLK DANCE.

Physical culture has become a settled, public policy in many intelligent communities. Playgrounds and parks are multiplying. Games and play make children self-reliant and original if the play is not closely supervised by an adult.

Every one must learn to be his own manager in arranging for healthful habits. This book will be studied in school at about the time of life when a boy or girl will, if ever, come to a full determination to develop and pre-

serve the body. To do this, one must avoid doing like those silly people who try to follow all the fashions, but must choose to form habits suited to health and the needs of life. One should go in for some athletics, but not try for immense development if the life is to be chiefly an indoor one. Big unused lungs and heart give no advantage, but in fact are a disadvantage, for they soon degenerate.

Courtesy of Nat. Child Labor Committee.

Making artificial flowers indoors instead of gathering natural ones outdoors. The pay is 5 cents for 500.

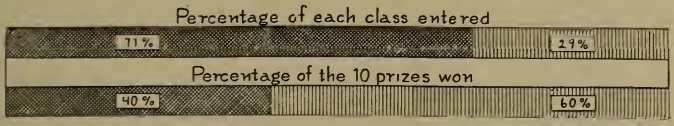
Violent exercise in youth, followed by inactive life, is not the best course. What is needed is moderate exercise all through life.

Violent exercise may be continued as long as breathing with the nose is possible; it must be stopped before the face becomes pale. If you become so out of breath that you have to open your mouth to breathe, you should stop. If the exercise has not been overdone, the pulse will return to its normal beat within fifteen minutes. If not urged too fast, the heart acquires new strength by exercise.

While seeking *physical development in the holidays*, one must not start out on long tramps the first week, if unused to much walking. Boy scouts sometimes sleep next to the damp ground and usually suffer from it.

The skin should be tanned gradually. Quick tanning may injure it.

Few, if any, can trust themselves *to live right by daily will power;* besides, constant exercise of the will would be a nervous strain. One should so arrange his work, his home and his duties, as to make it necessary to live right. *A feeling of restlessness* should not be resisted, but relieved by outdoor life; thus the body will be spared injury. The play instinct, the restless feeling, and the feeling of fatigue, or instinct for rest, exist as *safeguards;* yet many deaden these instincts with narcotics that they may keep on their way for a while longer. Beer, coffee, tobacco, dull the sense of pain so that one goes on using up the



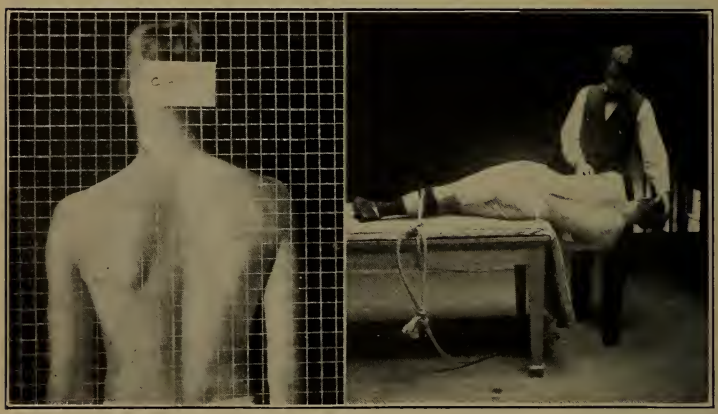
Courtesy of Sci. Temperance Federation.

A Sixty-two Mile Walking Match in Germany. Non-abstainers from beer, etc., at left, abstainers at right. A majority of the drinkers fell out. Germany's poor showing in the Olympic games at Stockholm has been attributed to beer.

body's strength, but thinks the strength comes from the narcotic.

During marked fatigue we are being smothered and paralyzed by our own waste products which are formed by the burning taking place in the body. Mill workers and housekeepers, because of long, monotonous work without rest, often become rheumatic. Long fatigue without times of refreshing is a fruitful cause of rheumatism. There is

no use for the mother of a family to work until she is so weary and worn out that her presence has a depressing influence upon the family circle; it lessens her present and future usefulness. There is often a tragic breaking down of factory workers who are then cast aside like old iron thrown to the scrap pile. The breaking down comes



Courtesy of University of Wisconsin.

A crooked spine (notice shoulders). Exercise for straightening spine.

quicker to those who work in close, warm, impure air, and in restricted posture over desk or machine. To overdo either athletics or daily labor will shorten the life.

The heart beats faster during severe exercise so as to send the much-needed oxygen to the tissues. When the heart squeezes out the blood, the arteries are stretched by the rush of blood; they, in turn, force the blood on and become small. In the muscles the iron in the red cells, which is the oxygen carrier, gives up oxygen to the tissues and the red cells become darker, giving all the blood a darker tint. The muscular strength, and especially the endurance, depends upon *elastic, healthy arteries.* The

body should stay supple and graceful, not only long after the fortieth but after the fiftieth and in many cases the sixtieth year.

Courtesy of Univ. of Wisconsin.
Exercise for poise and carriage.

Any one who *habitually slouches* along and flops down in a heap will lose good tone of the muscles. Those who stand straight and carry themselves well will find themselves thinking straight and feeling well. Digestion puts the food into the blood but it will not pass into the cells unless it is needed. Work or exercise causes the cells to need food. The person does not live who can thrive without plenty of exercise.

TEST QUESTIONS. — Have germ diseases increased or decreased in recent years? Have other diseases increased or diminished? Explain why. What has been the effect of sports? How should the life be arranged for needed exercise? Why? How do the hearts of most city and country dwellers differ? What, according to Leonard Hill, is the nature of the body? How does a muscle move the blood? Why is exercise a benefit?

How is woman's health affected by modern life? What kind of work does a woman need for health? What are the two chief causes of so many women being out of health? For whom are large muscles and large hearts not desirable? What is the caution about holidays? When exercising, what sign warns not to go beyond a safe limit? What is said of a feeling of restlessness? What is said of the play instinct? Does the manner of standing and walking influence the thinking?

CHAPTER X

MENTAL HYGIENE

DISEASE is a condition of disorder. When *the body is out of adjustment to the conditions amidst which it lives* and is striving to readjust itself, it is said to be diseased. *Disorder of the nerves is* increasing because civilized man lives too fast, crowds too much work, too much play, too much excitement, into a day. Nervousness results because of lack of quiet and of too much indoor life. "Nightmare" often follows "daymare"; it comes because of excitement during the previous day. When a person finds that he cannot sleep, he ought to do some physical work out of doors daily. The outrageous custom of confining children in closed rooms most of the day makes even young children nervous.

To take little things hard and magnify them entirely beyond their importance is a sure sign of nervousness. In many cases the only *remedy for nervousness is to stop worrying and to rest*, but this is the very remedy such people refuse to take. Mental tension means muscle tension. It is best to spend an hour or two each afternoon in peace and quiet and allow full time for sleep at night. Overwork for the sake of others is not so dangerous as overwork for one's self; but to slave for one's family and not have enough energy left to be pleasant and happy around the hearthstone at night is a wrong, both to the family and one's self. Only he who is sound and healthy can be tranquil and

superior amid many cares. "He that would be good must be happy, and he that would be happy must be healthy."

Mental health and mental disease are "catching." The herd instinct, or instinct to go with the crowd, causes us to be easily affected by the mental and bodily states of

Boys playing on roof of a New York public school. Games train in self-control, alertness, decision of character, fairness.

others. Coughing in an assembly makes others cough. A fidgety pupil should never be placed on a front seat.

Cheerfulness is a great help to good health. It is an essential condition of a healthy home or school. Cheerfulness keeps one from getting tired. In some factories workers should be allowed to talk and sing at their work. Worry not only makes one look older; it makes one really older. Beauty is more than skin deep, for it depends upon a merry heart, a steady mind, and a loving soul. Work is

the best cure for the blues; it keeps one from thinking of one's self. Those who live in the present are not anxious for the future.

A fretter is easily upset and upsets others who have to be with him. *The habit of fretting* is like the drink or drug habit; every time you give way leaves you weaker and

Permission of "Little Folks," Salem, Mass.

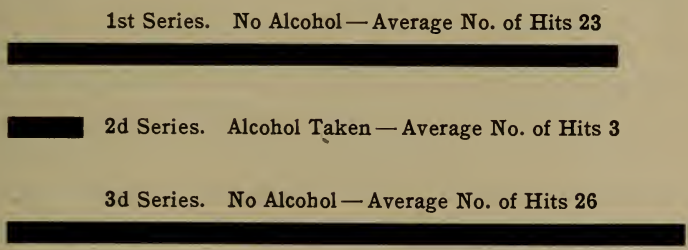
"We've got the measles" — (but are still happy).

less able to resist the habit the next time. It is best to keep one's bad states of mind to one's self. There is nothing that makes troubles grow like thinking about them and talking about them. Shun the habit of giving vent to each passing feeling. Its importance is usually fanciful and comes from magnifying trifles. It is *our duty to the public health* not to scatter abroad thoughts of weakness, fear, and sadness.

Thoughts are as important as germs in their effect on

health. Did you ever notice the halting breath of the fearful or the shallow, cramped breathing of the despondent? A nervous person who is bitten by a dog that is not really mad, but only believed to be so, may have a disease called false rabies, and even die of it.

The nervous system is the balancing power in the body. The currents up the nerves of feeling and down the nerves of motion pass through nerve centers in the spine and brain and are modified and harmonized in those centers. The state of the nervous system varies with the thoughts. Some recover from dangerous illness, and others die of less dangerous illness, when the only difference noticeable is a



Courtesy of Scientific Temperance Federation.

RIFLE SHOOTING IN SWEDEN, showing the effect of alcohol upon steadiness of nerve. Length of black bars shows average number of hits of soldiers in 30 shots, three tablespoonfuls of alcohol being taken on the second day.

different mental attitude. It is believed that when you think of a part of the body, for example the face, the nerves cause the amount of blood in it to be increased. The amount of blood in different parts of the body at different times is controlled by nerves that go to the walls of the blood vessels. The stomach, when at work, needs several times as much blood in its walls as at other times. Excited feelings can cause indigestion. The human machine when sound is the most economical, perfect, and beautiful of all machines. Man's brain and nerves are

the most highly developed among animals. That man is straining the balancing power in the nervous system is shown by the number of impaired minds and by the many that are threatened with mental breakdown. Nearly 200,000 persons in the United States have unsound minds. One out of every 200 people either has had or will have disorder of the mind. Asylums for mental disorders have no vacant rooms. Those with diseases of the nervous system are the most numerous class of sick cared for in hospitals. Many, if not most of them, might have kept their minds sound if they had known certain facts of mental hygiene and acted upon them; for, as a rule, mental disorders come on very gradually.

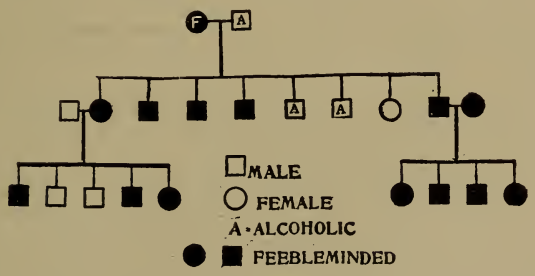
It is believed by many that *the foundation for an uncontrollable temper* lasting a lifetime, *is usually laid in infancy.* If a baby's habit of getting into tantrums is not corrected by the time it is a year old, the chances are against ever correcting it entirely. If not corrected in childhood, it will probably remain a deplorable weakness through life. Good habits can best be formed while the body is tender and the nerve cells are growing and forming new branches to connect with other cells. Monotonous steadiness is not the only good way of working, however. Some people work best by spells, with periods of complete rest between.

Nervous, irritable weakness in the home is a sign that a family stock is becoming degenerate; it is the first step the mind takes in acquiring a wrong twist.

Nervousness is not only caught by association and by bad training, but *it may be inherited.* Those who believe in public hygiene care also for *race hygiene*, or hygiene that will help future generations. If a person is born or grows up with an unsteady nervous system, his influence will

not only be a handicap to the community, but some of his children will inherit his bad nervous system. It should be known to all that if two imbeciles marry, their children will be imbeciles; when imbeciles marry normal persons, about half the offspring are feeble-minded or degenerate. When both parents are industrious, nine tenths of the children may be industrious. When both parents are indolent, three fourths of the children may be indolent.

The marriage of people of unsound or feeble mind is a great evil that should be stopped. Defective parents cause



FAMILY CHART: A FEEBLE-MINDED WOMAN MARRIED A DRUNKARD; they had eight children and nine grandchildren. How many of them were drunken or feeble-minded? A grown idiot is mentally 3 years old, an imbecile between 4 and 7; feeble-minded are between 8 and 12.

the race to degenerate. Vitality depends upon two things, habits and heredity. The father who objects to his son marrying a tuberculous woman, and the mother who opposes the marriage of her daughter to a young man who drinks, are acting the part both of good citizens and of good parents. Some ministers, careful of the welfare of the race, refuse to marry couples when each does not show a certificate of sound health. The children of healthy parents are more likely to be sound and strong than the children of sickly parents.

An average community of one thousand persons has

four insane persons. For the sake of race protection and betterment, the marriage of the insane, of criminals, paupers, inebriates, opium and cocaine users, should be restricted. The need of this is plainly shown by the science of eugenics, which means the science of beginning well. Such degenerate persons are called defectives. They are most numerous in remote country districts and among the very rich in cities.

Local health officers in most states are required to report the feeble-minded and epileptic to the state health department. By the regulation of marriages, insanity would practically disappear, or at least very little of it would remain.

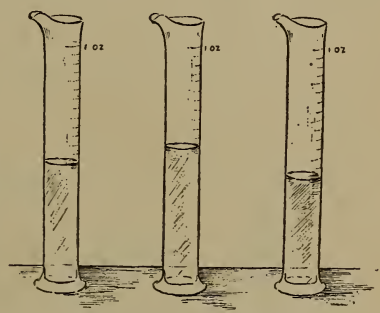
One who inherits an unsteady nervous system has a predisposition to form faulty habits. One who has a weak nervous system from the start will become stronger amidst right associates. By cultivating the right mental attitudes, by not giving way to excitement, we as a people will come to think better, feel better, and act better than we do now. Sounder nerves mean longer life, more efficient work, a greater number of hale, happy old people.

Precocious children should be guarded against strain. Many children that appear to be dull are capable of longer and higher development than very bright children. A child who has a very active mind with quick and eager brain processes, but whose body is weak, may exhaust himself early in life and become commonplace, while a slower child goes on to great personal achievements or to great social usefulness.

A plain proof of the lack of self-control is the use of narcotics to deaden and stimulants to excite. There are many natural nerve stimulants; among these are fresh

air, sunlight, cold, heat, change, interest, and emotion. There are natural narcotics, such as monotony, gentle warmth, fatigue, and especially the gas called carbon dioxid which is formed by the burning always going on in a living body.

Man deprives himself of natural stimulants by his artificial life, and attempts to control himself by smoking, drinking, and the use of drugs. A drug is anything taken to stimulate and regulate the body with the view of controlling the body or curing disease. On the other hand, foods are taken because of their nourishing qualities. Alcohol, spices, opium, quinine, are drugs. When an artificial stimulant or narcotic which has been used for a while is left off, the body misses its effect and there is a craving for it. Hence such things lead to the formation of habits.



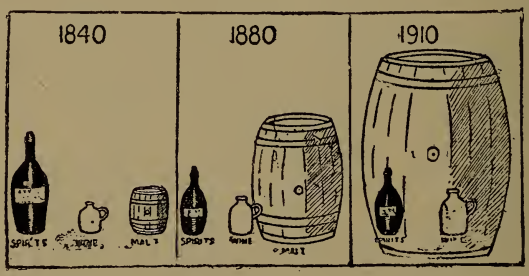
This figure shows the amounts of alcohol in a drink of beer, whiskey, and wine. The difference is very slight.

Drug habits begin with the use of small amounts which are gradually increased. Such habits make one more liable to the infection of disease germs. The little white soldiers in the blood become drunken and stupid because of alcohol or opium, and are asleep at their posts when danger comes.

Many of the so-called soft drinks contain two habit-forming drugs, cocaine and caffeine. There are about thirty "cures" advertised for catarrh, asthma, colds, and consumption now on the market that contain cocaine.

The millions of dollars collected by patent medicine manufacturers are a measureless expense to the nation, for the only true wealth and greatness of a nation consists of strong, wise people. Such things kill men or wreck their lives.

The patent medicine fraud is doubtless the greatest fraud to be found in the world. It could not exist but for the lingering belief of mankind in magic and voodoo. The man who practices self-drugging would not attempt to



This figure shows that the drinking of spirits in the United States has decreased and the drinking of wine and beer has increased. Because of the great hurry and strain of modern life the use of alcohol has not decreased. Those who cultivate cheerfulness and kindliness feel no need for a narcotic.

repair his own watch, which is simplicity itself compared to the human body. The poisons in plants are not there for the use of animals; they are formed by the plants to prevent animals eating them. The really curative drugs are of the body's own making. The cruelty of these shameless frauds is the most terrible part of it. A diseased man will be caught by anything that gives the faintest hope. A sufferer with a cancer will believe any lie that offers hope. Thousands of dollars are filched from poor consumptives who need their every dime to buy food and to follow advice from careful doctors that so they may obtain conditions which will allow nature to cure them.

Patent medicines contain no secret remedies. You can

buy a book ("Nostrums and Quackery") for 25 cents, which gives the composition of every one of them. A "rheumatic cure" is found to be a little rhubarb and alcohol; a "hair grower" is made of a little borax and glycerin. One who is ignorant enough to believe in a "skin food" will believe in almost anything. A restorer of youthful complexion contains glycerin, red coal tar dye, and alcohol. An "electric" belt contains a penny magnet, an "obesity cure" a harmless but useless powder.

The advertisements of these professional liars and thieves are not stupidly written, but are worded with great skill to frighten and deceive. They can persuade a man with a pain in the muscles of his back that he has a dangerous kidney disease.

After the passage of the pure food and drug law, an alcoholic remedy which was known as the "temperance man's booze" could not be sold unless the amount of alcohol was stated on the bottle. It was found to contain more alcohol than brandy. A fig laxative had senna, which had all along been the principal drug, added to its label. The law prevents lies on the label in most cases, but it has no effect upon the falsehoods in drug advertisements in the newspapers, nor on circulars distributed separately from the bottle. The straightforwardness of any newspaper containing many patent medicine advertisements is to be doubted.

The law should be so amended that soothing sirups and other medicines containing morphine, cocaine, or other poison should be marked with a skull and cross bones; such drugs to be sold only on a physician's prescription, to be filled only once and a record kept of the sale.

There have been hundreds of cases of poisoning by

acetanelid. Some of them resulted in death. The following is a sample newspaper report: "Physician called to Miss Black. Headache tablets nearly fatal." Here are notices about the effects of other patent medicines: "Overdose of liver pills — thirteen in a few hours — kills Ben Rosen." "Took Spring tonic and died." "Infant is killed by soothing sirup. The drug may be barred from Wyoming." "Patent medicine kills Indian. A Choctaw near Marlow drank a bottle." "Headache powder kills Henry Wehnker" (Fort Wayne, Ind.). "Medicine kills baby. Mrs. Holtgraver (19th and Cherokee Sts.) gave her baby a half teaspoonful of cough medicine. It died two hours later."

If patent medicines do only harm, why is it that such glowing testimonials of them are published? None are so credulous as sufferers from disease. A consumptive in the first flush of hope over a new treatment always believes he has been benefited. He writes a letter praising it, and perhaps dies a few weeks afterwards. But the letter is used for years. Nostrum vendors publish many letters recommending their medicines and drugs as cures for diseases. Many testimonials are paid for; others are fictitious. Advertisements offer to send a valuable remedy free. Applicants are not answered, but their names are made into a "sucker" list and sold to patent medicine makers at ten dollars a thousand. Other advertisements offer free prescriptions, but charge for filling them.

NOTE: — **Preventing the Development of Nervousness in Family Life.** — Older brothers and sisters owe a duty to the younger ones. Great mental steadiness and self-control will never be reached if the foundation for it is not laid in early childhood. To tease a child beyond its self-control, and to frighten so as to shock, are great wrongs,

for they injure the nervous system and prepare the way for an unstable mind. A nervous baby should not be played with.

A child should not be *too tenderly brought up*. Protection from all strain and trial prevents hardening of the body and mind and growth in self-control. Children should have no coffee, tea, nor stimulant, but they should be required to eat all foods that are suitable to them. If a child does not learn to eat and digest all wholesome foods, he will become finical. This is the first step to dyspepsia, and dyspepsia is a certain cause of nervousness. A child who does not learn to take cold baths and to bear changes of temperature lightly may become one of those chronic grumblers about the weather. Childhood is the time to learn to bear pain and discomfort well.

Playmates should be sought for a child when there are no playmates of a suitable age in the family. To associate much with adults, to travel, to go to theaters and picture galleries before the age of twelve, deprives a child of its childishness and makes it nervous.

If a child has learned that by crying and rage, or by pouting and sulking, *it can gain what it desires*, it is being given a bad start. It should be led to realize that it is making a stupid donkey of itself when it flies into a fury. The family should be indifferent to its temper, and not yield to requests until it becomes quiet and says "please." Thus the child will learn that the only way to get its wish is by controlling itself.

To yield always to cravings for sympathy and to the desire of a child to be petted, may be an unkindness to it. Indecision, or hesitating before acting, is a nervous sign, and children showing it should be given work to do and be required to act promptly. There is little hope that a child's nervous system will escape damage if it is reared in a family in which uncontrolled nervous states are frequent. Next to heredity, example best assures the growth of steady nerves.

TEST QUESTIONS. — Why are nervous disorders increasing? What is a sure sign of nervousness? What is the best remedy for nervousness? Are states of mind "catching"? What is said of cheerfulness? Of the habit of fretting? Compare the importance of thoughts and germs in their effects on public health. What is the chief use of the nervous system? Are mental disorders frequent? May they be prevented? Why is it easiest to break bad habits and form good habits in childhood? What is race hygiene? What is said of the children of imbeciles? Who should not marry? What is said of precocious children?

What is the demand for artificial stimulants a sign of? Name

natural stimulants and narcotics. What is a drug? A food? What is said of drug habits? Soft drinks? What kind of patent cures contain cocaine? Why are people caught with patent medicine frauds? What was a certain "rheumatic cure" made of? A "hair grower"? A "skin food"? An electric belt? What changes have been brought about by the pure food and drug law? What change in the law is needed? Give some newspaper headlines. Explain the glowing testimonials.

CHAPTER XI

A SANITARY HOME

Courtesy of Henry Phipps Institute, Phila.

Two home-made ice boxes (at left) and two home-made fireless cookers (at right) ready to cook rice and potatoes.

Experiment 1. **Making a Fireless Cooker.** — Put a five- or ten-pound lard bucket in a fifty-pound lard can or a candy bucket or a square box; pack it under and around with finely cut hay or straw. Fasten a thick layer of straw to under side of outside lid by a cloth tacked around edges of lid. A fireless cooker is used for food requiring long slow cooking without watching. It saves work and fuel.

Experiment 2. **To test a Fireless Cooker.** — Fill the inner bucket with boiling water which should register 140° F. at the end of eight hours. Boil beans or grain in the smaller bucket for a few minutes on a stove, put on lid, and place immediately in the hay box or bucket, close outer lid, remove after a few hours and taste.

Experiment 3. **An Iceless Cooler.** — This is made on the plan of a double-decked table (see figure). A large vessel containing water is placed on top. If made of galvanized iron, the upper deck has a water trough around its four sides. The supply of water slowly passes down a cloth that surrounds the entire cooler. The cloth (not shown in picture) must be wet before it is put on. As the water becomes vapor and goes into the air, it takes heat from the food and air in the cooler.

Courtesy of Walkup Bros., Waco.

ICELESS COOLER.

Experiment 4. **Proper Way to dust Furniture.** — In the morning before school let pupils dust the desks with a damp cloth prepared as directed in this chapter.

Experiment 5. **Study of House Furnishings.** — Cut pictures from furniture catalogues and paste them in place on drawings of rooms, selecting and arranging them.

Experiment 6. **Do you breathe Dust?** — Darken the room and hold a window shade a little to one side to admit a beam of sunlight. Is the air dusty? Or keep a shallow white dish containing water in the room for 24 hours. Does the bottom of the dish become coated?

The *only sure foundation* of a prosperous state is healthy, happy families, and no family can be healthy and happy that lives in an unsanitary home.

The most sanitary home is not built directly on a noisy, dirty street. It is not built in a bare, cheerless spot, but is surrounded by green grass and protected from the glare of a summer sky by trees that shed their leaves in autumn. The planting is in clumps with open spaces between the masses of shrubbery or trees; the plants are not set in straight lines, and if there are flowers, too many colors are not jumbled together.

The most pleasant *farm homes* are so located that trees or hills to the north or west break the cold winds; the barn is lower than the dwelling house, and the well is uphill from the barn, so that the water is not so likely to be

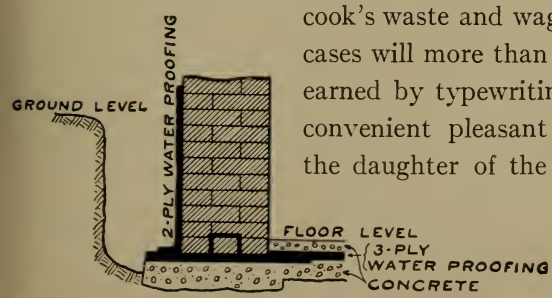
contaminated by seepage from it. Trees help to dry the ground and cool the air in summer.

The *cellar* is so built as to be easily aired. Dirt, Darkness, Dampness, and Dust are the four demons of bad cellars. The concrete or cement for the cellar floor should be waterproofed as it is mixed.

The *kitchen* is the most important room in a sanitary home. It is large enough and the walls and floor so finished as to be easily cleaned. The floor may be painted with a mixture of one pound of paraffine to a gallon of linseed oil. To save steps the stove, work table, cupboard, and sink are close together. The table cannot be cleaned perfectly unless it is covered with zinc. A zinc cover may be put on without soldering if the edges are carefully folded under at the corners and fastened beneath the table with nails.

A kerosene or gas stove (under a hood) is necessary for *hot weather* and a *fireless cooker* is useful in all seasons (see Experiments 1 and 2).

The kitchen of our grandmothers was large with plenty of windows. Many *a girl leaves home* and takes up laborious unhealthy office work or typewriting rather than work in a little, dark, dirty, smelly, overheated kitchen. The broken-down health, the medical and drug bills, the cook's waste and wages in most of such cases will more than balance the salary earned by typewriting or the cost of a convenient pleasant kitchen in which the daughter of the house might have had more suitable and womanly work at home. Buying and cook-



Waterproof cellar wall and floor (from Ogden's Rural Hygiene).

ing healthful food require more intelligence than typewriting.

Girls should study the science of foods at school; only *the mother can train* the daughter to love housekeeping and home making. Forty girls around a lady dressed like a nurse, cooking dainties on little gas stoves may learn

Courtesy of C. N. Millard, Esq.

A Sanitary Kitchen.

cookery scientifically, but they may not learn about food from the point of view of a home maker. But cookery has become a lost art with many women and they cannot train their daughters in it. The domestic science teacher supplies that defect.

People must have good food to eat if the human race is to be saved from degenerating and becoming weak, both in mind and in body. The mother who, because of great

riches or dire poverty, has no time to train her daughters in kitchen arts, fails to inspire them with the ambition to be home makers. The *mill girl or office girl* marries; the food she cooks swims in grease or is half raw, the beans and pease are so hard that they almost rattle in the pan, the

From Exhibit, Tuberculosis Congress, Washington, 1908.

COMPARE the walls, bedsteads, table, floor, chair, window curtain of the room before and after hygienic furnishing.

bread is in doughy hunks, and she is too ignorant of food values to choose nutritious food.

The *home* should be *furnished* with regard to health. People may use as much soap and water as they like, but so long as they have thick carpets tacked down, cushions and portieres, lace curtains, bric-a-brac, and dust traps, heavy, immovable furniture, and many pictures, their home will not be clean. Bad taste and the love of having and hoarding will litter up the home with useless things and make housekeeping a burden. A house crowded with furnishings wears out the nerves as well as multiplies germs.

Good taste allows only a few choice ornaments. A hardwood floor costs less than a carpet and is more durable. Stained or painted or bare floors with a rug or two are more sanitary than carpets. Outdoors there should be a "horse," or bar fastened to two posts, on which to hang the rugs for thorough beating.

A *single shade is enough for a window.* Lace and net curtains are *dust traps.* No one should think of having them in living rooms. Simplicity is the mark of a refined taste.

The *walls* of a home should be of soft tints. Walls of adjoining rooms are seen at one time while a door is open, and the walls of both rooms should be of colors that harmonize.

In every clean and happy home the whole family *co-operate;* they have the habit of helpfulness that conquers selfishness; each feels responsible for doing a share of the work and keeping a cheerful spirit. In such a home *dirt is prevented* rather than cured; muddy and dusty boots are cleaned at the door, instead of the dust of the street being beaten off in the house. Clothing and hats are taken to the back porch or yard to be dusted. Bits of paper and other trash are dropped into waste baskets or waste boxes, instead of upon the floor. Food waste is put into a *garbage can* out of doors, never in the cellar, and the garbage is burned when possible. The top is always kept on the can to prevent the breeding of flies. The well-fitting screens of the windows and doors are not left open.

The rooms in a sanitary home are often sunned to prevent mustiness and mold, for a good housekeeper knows that *sunshine is the cheapest and best disinfectant.* Upon

retiring, the clothes are spread upon a chair to be *aired*. Upon rising, the bed clothes are thrown over the foot of the bed or a chair that the bed may be aired before it is made up.

STERILIZING by dropping in boiling water on the stove.

In such a home dishes and *utensils used by the sick* are kept separate. In case of contagious disease, the rugs (and curtains and carpets, if there are any) are removed and a sheet is hung in front of the sick room door.

A sanitary housekeeper fights *dust* as one of the greatest enemies of health and a frequent bearer of contagion. She will not allow the modern barbarism of *dry dusting*. She sees no especial good in moving the dust from the carpet to her lungs. Dust must not be simply moved, but removed. She prefers a damp mop for *floor cleaning*, but *if a dry broom is used*, she chooses a windy day, opens every door and window wide, sweeps with the wind, and leaves the rooms open

A patient may be isolated at home.

for one or two hours afterward. A good sweeping done in this way twice a week removes dirt and dust better than a daily sweeping that simply moves and stirs it. Walls may be dusted with a damp cloth or bag tied over a broom. Feather dusters and brooms are never used for cleaning living rooms in Europe. If a *dust cloth is wrung out of water containing a little kerosene* and allowed to dry for a while, it will hold enough oil to take up the dust without injuring the finest furniture.

DUSTING with a damp cloth wrung out of water containing a little kerosene.

A sunny sitting room is more necessary than a sunny bed room. *Snobbish people* who have small houses give up half the house to a rarely used parlor, spare bed room and hall, and the family sleep in the smaller dark crowded rooms where there is danger of tuberculosis.

In the chapter on pure air how many gallons of water did you learn must be vaporized daily *to moisten the air* of a small furnace-heated home? How is the air kept moist if a stove is used? The *water pans* of a furnace must be against or above the fire box, not down by the ash pit. With the air moist a less degree of heat is perfectly comfortable. *Dust will rise* from the furnace if the *damper* in the smoke pipe cuts off the draft, or if the *fresh-air inlet* is closed and the cellar air is used — a most vicious

custom followed by some with a false idea of economy. You have learned that the air in steam-heated houses can be kept moist in what way?

The dusty, dry, unhealthful air of most houses has led to the admirable custom of *using sleeping porches.* "I don't mind telling the story on myself," said a college president, "because it illustrates the new order of things. I always imagined we slept with plenty of fresh air in my room and never gave the matter any thought. But my little boy got hold of a health bulletin on Fresh Air and decided that he wanted to sleep out. He worried us until we let him move his bed on the porch and after a few nights, he sang the praises of the open air so loudly that my wife decided to try it. She did and finally she was so enthusiastic that I tried it myself. I've been sleeping out on the porch for six months now and I wouldn't change for worlds. I am in better health than I ever was and can do my work with much less effort. I've found out that the good Lord never meant for men to sleep indoors!"— (Virginia Health Bulletin).

Courtesy of Mr. E. R. Sanborn.

Colonies of bacteria developed from dust lodged on plates during sweeping with a carpet sweeper (above), a broom and wet paper (middle), and a dry broom (lowest). Each spot shows a colony grown from a germ borne by a dust particle.

Housekeeping is a noble art and practicing the art makes *sound and beautiful women.* The *physical-culture exercises* of the beauty doctor go all right for two or three days, but because of boredom they come to nothing by the end of a week or month. The feeling of compulsion exhausts as much as the exercises recreate. Physical culture in the form of *intelligent housework* is interesting, varied, and sure. The lady of the house notices that the woman who comes every week to shake the rugs and beat the carpets has *well-shaped arms* and a plump, *graceful neck.* The twisting movement of sweeping is an excellent exercise for *keeping the abdomen within limit*, the *waist supple*, and the shoulders poised instead of stooped or round. This is true if the sweeper stands erect with chest high, and most important of all, with the windows and doors open. Of course sweeping is bad if done with the back bent and the house closed. Turning a mattress or scrubbing clothes on a wash board is excellent for the trunk, making the abdomen firm and giving a fine curve to the back. If one only remembers to stand up straight, bend from the hips, and not at the waist or neck, and keep the windows open, any kind of housework is better for the looks than office work, mill work, or idleness.

References. — Cornell Reading Course for Wives (Ithaca, N. Y.), No. 1. *Saving Steps;* No. 3. *Practical Housekeeping.* Farmers' Bulletins (U. S. Dept. of Agriculture), No. 270. *Modern Conveniences for the Farm and Home;* No. 345. *Some Home Disinfectants.*

NOTE (*For all the girls and some of the boys*). — It is the daughter's place to help the mother with the little baby sister or brother. If there is no daughter, a manly son will gladly help his mother. The mother may be tired or have other work to do or be compelled to leave home for a time, and must trust the baby to a daughter or son. A bright girl or a business-like boy can be relied upon to carry out this trust in a safe way. A careless, lazy boy, or a giddy, silly girl, should

Photographs by Miss May Belle Brooks for "The Housekeeper."

Right and wrong way to sweep and to climb stairs. Bend at the hips, not at the shoulders. The broom should have a damp bag over it, or it may be dipped frequently in a near-by pail of water.

not be given this responsibility unless their love for the little one is so great as to arouse a keen sense of duty.

Long experience has shown the need of the following safeguards:

Keep the baby out of crowds. (Why?) Don't make it show off. Don't let any one kiss it on the mouth.

Don't tease or fret the baby. Don't bounce it up and down.

Don't let it suck its thumb or give it a pacifier to suck (unless you want to have an ugly brother or sister).

Don't give it soothing sirup; many babies have been killed by it.

A milk bottle easily cleaned.

Don't take the baby into dusty places. Keep the flies off. Take the baby much into the fresh air.

Don't let the baby remain in a hot or closed-up room to sleep or even to take a nap. Open the window or take the baby to a porch, a park, or a garden, but keep it warm with clothing or coverings.

Don't let the baby use a public drinking cup. Don't chew the baby's food for it. Don't put food into the baby's mouth that you have bitten.

Feed it regularly and not too often. Don't feed it solid food before it has a few teeth. Don't feed it every time it cries, but try a drink of water; especially in summer it must have plenty of water. Don't give it coffee, tea, or beer. If there is any doubt that the water is pure, use cool. boiled water.

Shoes for baby.

Don't place it so that the sun will shine in its eyes. Keep it in the shade in very warm weather. Let it sleep as much as possible.

The baby's clothing should not be so tight as to bind and be uncomfortable. It should be so held and carried that its soft bones, especially the backbone, are not deformed. Dropping it, or turning over the baby carriage, may deform or partly paralyze it for life.

TEST QUESTIONS. — Describe the situation of a well-placed home. Name the four demons of bad cellars. Describe a sanitary kitchen. Compare typewriting and cooking as work for girls. How is home making learned? What will follow if a race is poorly nourished? Give instances of bad cookery.

What kind of a home cannot be kept clean? What kinds of floors are sanitary? What is said of windows? Walls? How may the

family coöperate to keep the home clean? What is the cheapest and best disinfectant? What is to be done in case of a contagious disease? How is dust prevented by good housekeeping? How may it be removed? How may a good house be misused by a snobbish family? How must the furnace be managed to prevent dryness and dust? What is said of sleeping porches? How may housekeeping contribute to the good looks of the housekeeper? Repeat a dozen "don'ts" and some things to do to keep your baby brother or sister sound and well.

Illustrated Studies. I. It will be interesting and instructive for the pupils to draw on blackboard and explain the figures, pages: 95, 96, 97, 98, 100, 103, 107, 112, 121, 122, 124, 127, 132, 133, 134, 136, 139, 145, 146, 161, 167, 169, 172, 179.

II. *Chap. V.* From what sorts of nests come eggs of doubtful freshness? Describe the laboratory of a food expert. What are common adulterants of ice cream? Describe a sanitary meat market. Which illustration suggests that the pure food law is merely an honest label law? What does trichina look like? What was effect of private dairy at Annapolis? Describe an unsanitary grocery. How is a fresh-air food box made? Why not buy shelled nuts? *Chap. VI.* Describe a rickety child. By blackboard sketch show composition of egg: also carrot, apple, banana, fig, walnut, chestnut, cow's milk, condensed milk. Sketch a grain of wheat to show its parts. Describe a stomach contraction. *Chap. VII.* How do well-bred people avoid droplet infection? Why is borrowing a pencil especially risky? How may disease be spread by readymade clothing? By drinking water? What kind of towels are safest? In sketches of nail wound infected by tetanus why was wound reopened to air (third sketch)? *Chap. VIII.* How do wigglers escape from mosquito eggs? How does the tumbler, or bullhead, get air? Describe fly's foot, larva, and pupa. Describe bat roost. Why are martin-boxes of public benefit? Explain garbage-can fly trap. *Chap. IX.* Is the boy or the bicycle, p. 154, to blame for the scorcher's position? How is lateral curvature of spine treated? Explain chart of defective family. Compare fit and unfit bedroom furniture. How should dusting be done? Of what could you make a fireless cooker? Describe a sitting-out suit. Name six uncommon features in the Gary school. How ventilate room with a jacketed stove?

CHAPTER XII

SCHOOL SANITATION

Experiment 1. **Temperature of the Schoolroom.** — A daily record of temperature at 9.15 and 11 A.M. and 2 P.M. should be kept in a book by a committee of two pupils appointed monthly. It is well to find the temperature nearest to and farthest from the source of heat. Has your school a thermometer? Will it work? (The

KEEPING THE TEMPERATURE RECORD.

teacher will probably add to the scholarship credit of those who do this work well.)

Experiment 2. **Color Blindness.** — Provide a number of yarns of the same and different tints. Let each pupil assort the yarns and match the tints.

Experiment 3. **Test of Hearing.** — Whisper to pupils standing equal distances away. Select those, if any, who cannot hear the whispers as far as most of the others. Test each ear by stopping up the other one.

Experiment 4. **Test Eyesight** with standard types.

Experiment 5. **Astigmatism.** — With flat end of crayon draw 8 straight, even lines crossing at one point on the blackboard. Do any pupils report that a line in a certain direction is blurred? Inquire whether these pupils have frequent headaches (from eye strain).

Experiment 6. **Is each nostril clear for breathing?** — Close one nostril by pressing with the finger; close the mouth tight. There should be no difficulty in getting enough breath through one open nostril. Test the other nostril in the same way.

Experiment 7. **The Cause of Nasal Tones.** — Let one pupil stand behind the others and read a paragraph, holding his nose until partly through. Or the teacher may read with his face and hand behind a large book. Pupils raise their hands at a change in the quality of the reader's voice. Does the experiment prove that a "nasal" tone comes through the nose? How does catarrh cause a nasal tone?

Because *a free state* must have citizens with *intelligent minds*, it establishes public schools. But it needs citizens with sound bodies as well as sound minds. The school must protect and develop the bodies of young citizens in training while it is caring for their minds, if we are to have stanch citizens able to endure trial.

Keeping children still for a long time is a risk to their health, and the risk is greater if there is imperfect ventilation and *they breathe each other's breath.* The school age includes the years when diseases are most readily caught from other persons, and the *schoolroom is the most crowded spot in the community.*

Soon after a school was started among the Yuma Indians in Arizona, the Yuma chiefs found that the children were becoming less robust; they had colds and indigestion. This change was caused, not only by the want of exercise

in roaming over the hills and by the crowded schoolroom, but also because the teachers furnished hats, shoes, stockings, and more clothes than were needed in that climate.

It used to be the case that, *to be a learned scholar, meant* almost always to be flat-chested, nervous, delicate, if not a chronic invalid. These defects among scholars are not now so numerous, for schools are now provided with

Courtesy of New York City Schools.

TESTING THE HEARING of their right ears. Whispering gives a better test than a watch unless it is a stop watch.

athletic fields, playgrounds, ventilation, gymnastics, bathing pools, and many aids to health.

With an overcrowded course of study and an overcrowded room, many wrecked bodies will go out from the schoolroom into the world. Those crippled in health by going to school are still easy to find. Education obtained by damage to the body is hardly worth while. Bad schools destroy the *natural love of activity* so that exercise is avoided all through life. Good schools preserve this love of activity. *Arts*

and crafts form a healthful rest from books. If it is not encouraged, the natural instinct of children for such work will die out by the time they reach the high school. Work with the fingers instead of with the free arm, such as fine sewing or fine writing, puts a strain upon young nerves.

Medical Inspection of schools, if efficient, raises the health standard. No child should have to suffer injury from going to school. A sound, clean child may suffer from contact with an unsound or unclean child. The school should protect the clean child by a change in the unclean or diseased child. With the help of the teacher and the school doctor, *many may grow up to be sounder in body than if they had never attended school.*

Even in a compact city a *school physician* should not have more than 2000 pupils to inspect. The teacher may make the first tests for eyesight and hearing, and aid the physician in many ways. If a child has any defect, the school physician will find it out *before it is too late* for remedy. He can show the pupil and the parent how to remove the condition that is causing the weakness, so that the child may outgrow it as his young body develops, and be sound when he has grown up. *Defects* found *should be followed up until corrected.* Because there are careless or ignorant parents who will not do this, *a school nurse* is employed in some schools to see that the doctor's orders are carried out. Otherwise, his careful search for defects will be useless. Of the 20,000,000 children in the schools of our land, it is estimated that 1,000,000 have a deformity such as flat foot or crooked spine, 1,000,000 have defective hearing, 5,000,000 have defective eyesight, 5,000,000 are undernourished, 6,000,000 have enlarged tonsils, and 10,000,000 have defective teeth. Some children have more

than one of these defects; half of them have none at all.

A child with *bad teeth* often has little appetite, bad digestion, and suffers pain. Constant *tilting of the head* to help out a *squint* may lead to spinal curvature. Holding the work close to the eyes shows *eye strain.* The school nurse, physician, and teacher will watch for *crooked spines* and *flat chests*, *decayed teeth*, *sore or weak eyes*, *headaches*, *colds* (which they will consider a sign of neglected ventilation), *mouth breathing*, *adenoids*, *dull hearing*, *consumption*, *weak nerves*, and, above all, *infectious diseases.*

She gets no hard food so she chews gum. Filth pockets in her aching teeth should be cleaned and filled.

Because they are helped in caring for their health, the pupils will be *absent less than before*, their minds will be brighter, and they will finish the course earlier. This watchfulness about the health under successful medical inspection will impress its importance and *educate pupils into the habit of looking after* anything that harms the health — a habit that will last when school days are over.

It is *more sensible to pay a physician to keep you well* and help you to grow strong many years before the strain has to be borne than to pay him for the often hopeless task of repairing a broken-down body. It is not only a cheaper and easier, but it is a much pleasanter, way.

The Delicate Child. — In spite of all that can be done for the children, some of them will remain pale, undersized, languid, and unfit for the work of an ordinary school. Young and delicate children might well attend for only half-day sessions; the other half of the day might well be spent on the playground.

Some delicate children are *tuberculous*. It is not well to try to educate children who are in ill health in the ordinary school. They may be removed to *a school in an open shed*

SITTING OUT SUIT planned by Mr. Mann of New York Society for Prevention of Tuberculosis and made by Kenwood Mills, Albany. Detachable piece at bottom to prevent wear, hood for shoulders, snaps instead of buttons. Notice the windows.

and taught more by means of things than of books. For example, arithmetic may be taught by means of counters, coins, weights, and measures. The children should lie down for one or two periods each day, and they should eat nourishing food. Since tuberculosis does not usually show itself for

from 2 to 10 years after infection, cases developing between 20 and 30 years of age probably began during school days.

Open-air and open-window schools show surprisingly good results in changing stupid children into bright ones and making strong ones of the weak. The children cease to be limp and listless; the faces soon grow rosy and bright. It is wonderful how quickly the coughs, running noses, spitting, and swollen tonsils cease, and how free the children are from new infection unless they return to shut-in schools. A school should build up the health instead of breaking it down. Fresh-air schools do this, but the children must be *equipped for it with very warm clothing.* If the children are not equipped with special clothing, the temperature of the schoolroom is quite a different proposition. With the ordinary clothing, the schoolroom must be kept nearly closed in very cold weather, or the room cannot be made warm enough.

The way to protect children from tuberculosis is to keep the windows open. The *surroundings which cure* a delicate or tuberculous child *will still more effectively prevent* such conditions. The time will come when the community will be logical enough to realize this. Prevention schools will make recovery schools unnecessary. In the Gulf States the window ventilation should be doubled in all but the severest weather by removing both sash from all the windows. The house may be protected from rain and closed by means of wooden shutters.

With open-window schools, the children have to bring larger lunches, for, in these schools, even the sickliest child does not have to be coaxed to eat. In ordinary schools children sometimes cannot study well because *they are hungry.* The food at home is perhaps not of the

right kind, or they do not eat enough, or perhaps to chew well their teeth need attention. In Chicago 15,000 children were found who, whether underfed or illfed, were backward in their studies because of undernourishment.

If a poor widow has all her children taken away from work and placed in school that they may grow up to be

A school athletic festival in Crotona Park, New York City.

intelligent citizens, it is right for such children to have their lunches free. But there should not be free lunch for all. The London schools have tried the general free lunch and have given it up as undesirable. *Lunches should be furnished at cost.* If the basement is used for a lunch room, and there are no rents and no profits to pay, the lunches will be cheaper than could be bought elsewhere and will teach a lesson of economy in youth. Three cents will pay for a *plate of good vegetable soup* and *two large*

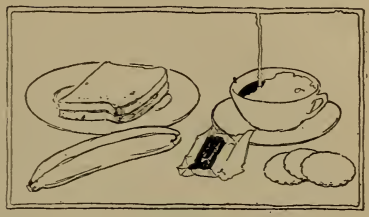
TYPICAL SCHOOL LUNCHEONS PHILA.

Baked Beans & Roll	5c
Half pint of Milk Bottle & straw	3c
Sweet Chocolate Four Buds	2c
Total	10c

Food value 700 Calories

TYPICAL PUPIL'S MENU

Corn Chowder & Roll	5c
Beef on Toast & Roll	5c
Cocoa & Whipped Cream	3c
Milk in pint bottles	5c
Milk in half pint bottles	3c
Buttered Roll	2c
Ham Sandwich	4c
Jam Sandwich	4c
Fruit Tapioca with Whipped Cream	3c
Ice Cream mixed in brick	5c
Sliced Banana with Cream	3c
Banana or Apple	2c
Half Canteloupe	4c
Sweet Chocolate	1, 3 or 5c
Figs in paraffine paper	2c
Dates ,, ,, ,,	2c



Cocoa & whipped cream	3c
Egg sandwich	4c
Banana	1c
Four Dates	1c
Three Cookies	1c
Total	10c

Food value 700 Calories

A TYPICAL LUNCHEON PURCHASED ELSEWHERE

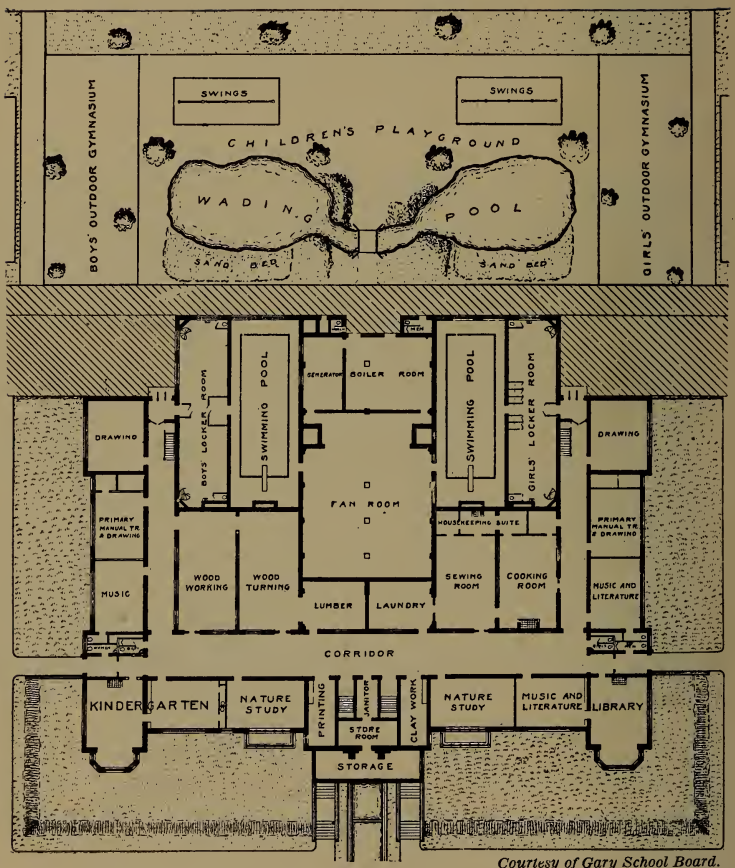
Three Crullers	5c
Cup of Coffee with cream & sugar	5c
Total	10c

Food value 250 Calories

EMMA SMEDLEY SUPERINTENDENT

High School Luncheons, Philadelphia, are served to more than 500 teachers and 10,000 pupils of Central High School for Boys, Girls' High School, Wm. Penn, Southern Manual Training, West High Schools.

Notice that the price is the same (10 c) but the luncheons bought at school give 700 calories, the luncheon bought elsewhere gives only 250 calories. Another typical luncheon bought elsewhere of about same price and food value is: one cut of pie (5c), glass of milk (5 c). The above menus are used through the courtesy of Miss Emma Smedley, Supt. of Philadelphia High School Luncheons.



Courtesy of Gary School Board.

PLAN OF BASEMENT and part of the grounds of a school in Gary, Indiana, a town which has become famous because its citizens decided that its schoolhouses and grounds should be the most complete and best appointed houses and grounds in town. On the school grounds there are also (not shown in above plan) walks, gardens, basket ball grounds, tennis courts, football and baseball fields. Such schools will not hinder but help the health of all that attend.

slices of bread. Some of the children may pay for their lunches by acting as waiters; some public-spirited woman or woman's club will doubtless manage the lunch free of charge. A warm lunch is a better help to study than the cold lunch children would otherwise have. If children are allowed to choose their lunches, they should not buy *pies, buns,* and *sweet stuffs* instead of simple food. The most foolish ones even prefer a penny's worth of *candy* and *pickles* from a pushcart to a warm, nourishing lunch.

Country schools may have the best lunches. A committee of the oldest pupils and the teacher decides what each pupil is to bring for the following month, and if the girls are studying cookery, they cook a part of the lunch. In the rural schools of Oregon the girls prepare hot lunches on the school stove; the dishes are kept in cupboards made by the boys.

An empty stomach prevents a full mind. *Undernourishment shows itself* in thin blood (anemia), paleness, swollen tonsils, readiness to catch disease, and in other ways.

The Schoolroom should be properly constructed. If the law compels a child to go to school, it should not force him into an unhealthful schoolroom cared for by one of the most ignorant men in the community as janitor. The building should be in a *well-drained place,* and if in the country, should stand in at least *one acre of ground.* Loam is better for a location than clay. The inner walls and ceiling should be of some *neutral tint* that is easy on the eyes, such as gray, slate, buff, light blue, or green. Windows should reach almost to the ceiling, as the *light* from above is best for reading. Most of the light should come from the left side and none of it from the front. At least one fifth

of the *desks should be adjustable* to accommodate unusually large or small pupils.

All *doors should open outward* to prevent a crush in case of fire. If your schoolhouse is a large one, does it have *fire drills?* Is it provided with *fire escapes?* The door of the *closets for wraps* should not be left open; such closets

Public School 153, the Bronx, New York. How does its situation fulfill the conditions advised in the text ?

should have a window or outside opening protected by slats. While the wraps are in the room, this opening should not be closed.

A dark, foul storage *basement* for rubbish should not be tolerated, but a dry basement is a great advantage. It is useful as a playground in wet weather, or for a lunch room, gymnasium, or manual-training room. If the house is of wood without a basement, it should be built, except in

cyclone regions, on pillars high enough to provide a wet-weather playground.

The *spread of infection* by the school should be avoided with the greatest care. If the school board and teaching staff are not watchful, the school may easily become a center of infection. School boards supervise inspection for weakness, chronic defects, and diseases which do not spread; boards of health usually have authority over infectious diseases; but the school doctor, teacher, and nurse also keep a keen lookout for suspicious cases and promptly exclude them from school. Schoolroom dust carries germs. Indoor dust contains ten times as many germs as outdoor dust. A school in which contagious diseases appeared every year had none the year care was taken to avoid all dust in the schoolhouse. Even when it does not carry infections, dust irritates and weakens.

A sanitary drinking fountain.

Va. Health Bulletin.
THE SCHOOL DIPPER spreads many diseases.

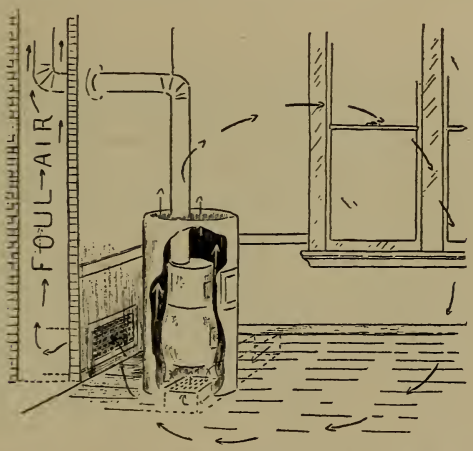
The *signs of eruptive disease* (scarlet fever, measles, diphtheria) must be carefully watched for. These signs are: flushed face, listlessness, vomiting, eruption on skin, red eyes, discharge from nose or eyes, cough, scratching, sleepiness. Suspected cases should be promptly sent home. *When cases are recovering*, they should still be kept out of school for the sake of others

and for their own sake. Injury to eyesight, or other injury lasting for life, may be caused by a few days' study while the eyes are weak. Books used by pupils with contagious disease should be burned. If the school supplies books and they are not new, open them wide and stand them in the sunshine for several hours the day they are given you. Sunshine, nature's gift, is the best and cheapest disinfectant. Each pupil should *have his own drinking cup* kept in his own desk. Old, rusty tin cups are unsafe. Pupils should not borrow from each other, but the teacher may have a smooth enamel drinking cup to be lent if unavoidable. It should be thoroughly rinsed before use. Dipping the cup into the water should not be allowed. If there is a public water supply, there should be a sanitary, or *bubbling, drinking fountain;* otherwise a covered tank or cooler, having a spring faucet or bubbling faucet, may be used. Water should not be wasted, and boys should not be allowed to try the stunt of shutting off the bubbling fountain with the mouth. By this uncleanly act the rim of the fountain is inclosed in the lips.

Courtesy of Gier & Dail Mfg. Co.
A School Water Holder with a fountain faucet.

Paper towels instead of cloth ones should be used. Each pupil should have his own *pencil*, and pencils should never be taken up and given out again.

Dust and Dry Air are a curse to the health in many schools. The schoolhouse should be built away from a main road. Grass, shrubbery, and trees will make it more healthful. The *playground*, if not graveled, may be sprinkled in dry weather. Much dust will be prevented by wiping shoes and brushing clothes on entering. Marching in the halls with stamping feet raises much dust. Damp sawdust must



JACKET STOVE FOR SCHOOLROOM. The fresh air led through conduit made of three planks comes in through grate under stone. Foul air leaves near floor and is drawn up through flue warmed by smokepipe of stove.

be used in *sweeping*, furniture wiped with a damp cloth, and the windows left open for several hours afterward. The walls should be swept down often. If turpentine and beeswax is rubbed into the *flooring*, the floor will not have to be scrubbed hard, but can be cleaned by merely wiping with a damp cloth. How often are your floors and *blackboards* cleaned? The *erasers* should be cleaned *daily out of doors*. The amount of *chalk dust* in the air of most schoolrooms is horrible.

If the school is heated by a stove, the stove should stand

in a corner and should be jacketed. The cold air should come up through a fresh-air pipe under the stove. It will be kept close to the stove by the jacket until it is warmed. The smoke pipe passes through a brick flue. This flue is the foul air outlet and warms the air so that it rises through it. A large pan of water should be kept on the stove and filled daily. It is easier to heat the room comfortably when the air is moist and when there is some ventilation than when the air is foul and heavy with stale odors. Still air is harmful, and air of unchanging temperature is harmful. If *a furnace* is used, great care must be taken to *moisten the air*, either by driving it against a damp cloth or through a compartment in which jets of spray or steam are playing. The last plan is used with good results in several Chicago schools. The *janitor's work* should be constantly watched and tested by the teaching staff and medical inspector. A careless or untrustworthy man should be promptly dismissed. It is unthinkable in a civilized community that to give a man a job because of politics, the health of the children should be endangered.

If the children are to receive the full benefit of the school, and the taxpayers' money, instead of being wasted, is to be well used, the condition of both the pupil and the schoolroom must be kept right.

An increase of *10° above the right temperature* of 68° F. *cuts off one third of the working power* of pupils. In September, or whenever the weather is very warm, both sashes must be taken out of every window to prevent the pupils from sweltering, and so wasting their time.

If *health inspection* by the medical officer is thoroughly made in the first grade, and the condition of each pupil recorded, it need not be generally repeated until the fifth

grade. If thoroughly done and followed up it will lead to material improvement of our future citizenship. Gladstone said: "The strength of the nation hangs upon the health of its men and women." The foundation of that health must be laid in childhood.

Medical inspectors watch out especially for **obstructions in nose and throat** and *defective teeth.* If a child has fresh air, with a clear nose and throat to breathe it through,

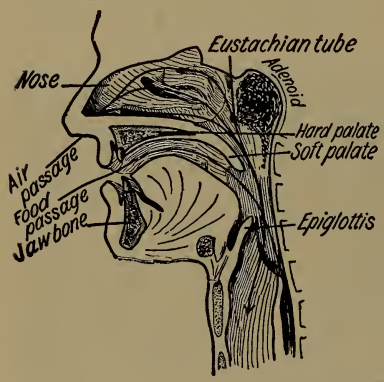
Courtesy of Dept. of Child Hygiene, New York City.

GIRLS WITH ADENOIDS. Notice the narrow nostrils, projecting lower lip, drooping upper eyelid.

simple food, and a clean mouth to eat it with, he has the basis of health. Sometimes the *tonsils,* located in the upper part of the throat, become so swollen as to interfere with the passage of air from nose to lungs. Sometimes, what is called an *adenoid* growth forms in the same region and has the same effect. Either will cause *mouth breathing,* a serious evil. You would hardly think so, but *another common cause* of the mouth-breathing habit is that children with colds neglect to blow their noses and the nostrils become plugged with mucus. The child, being without a

handkerchief or untrained in its use, allows the nose to stay stopped up and breathes through the mouth. When the nose becomes permanently stopped, the upper part of the throat behind the nose becomes a breeding place for germs (see Experiment 6).

Adenoids are enlarged lymph glands. They are overgrown and become a poisonous festering mass because they have absorbed too many germs from an unclean mouth and throat. When adenoids are removed, the child puts on flesh, sleeps better, the entire expression changes, he becomes alert instead of listless, and the breath loses its bad odor.



The road the breath travels, showing where a gland-like spongy growth (adenoid) may block the road.

The *mouth breather* sleeps with his mouth open. *Sleeping on the side and in a cold room* may correct the habit. Closing the lips at night with strips of sticking plaster is sometimes effective. To give the child a chance to breathe right, adenoids must be removed if they exist. Mouth breathing causes deformity of chest, makes the ordinary mind dull or stupid, and bright minds less efficient. Notice in the pictures, the expression of face, *the undeveloped nostrils*, the mouth, the teeth.

The nose warms and moistens the breath. Mouth breathing dries the throat, and the injured cells in its lining are less resistant to germs. Enlarged tonsils or adenoids may prevent the air entering the tubes which lead from the

throat to the inner part of the ear. Then the circulation in the ear becomes weak and the hearing dull. Frequent colds may injure the hearing for life. If a child escapes ear disease until he is grown, his ears, barring accidents, are safe for life.

Some children disobey because they have a weakness that prevents understanding. There is said to be a black sheep in every flock, but often it is only a weak sheep. If a child does not quite hear, does not quite see, cannot breathe

Marked cases of adenoids. If you would not have adenoids, keep your mouth shut, sleep with open windows, eat simple food. Use your muscles.

freely, it cannot pay attention. Scolding, punishing, bickering will not help. Fitting glasses, snipping the tonsils or adenoids, or changing to a front seat, may make the poor, puzzled, discouraged child happy and successful. Medical inspectors look also for *signs of nervousness* (see next page) in school children. A noisy schoolroom strains the nerves of teacher and pupil. All should talk in soft tones and as little as possible. Of 127 teachers that retired from the New York city schools in 1909, 46 stopped because of nervous breakdown. Quiet, considerate teachers and pupils have the best health.

A few Pointed Questions. — Is your school room too light or too dark? What can be done if there is a window in the

front wall of the schoolroom? If the room is very broad, are there windows on both sides? Is the schoolroom dusty? Are the outdoor closets sanitary? Are you ever without appetite and do you fail to eat breakfast? Do you drink coffee? Do you have toothache? Have you been to the dentist? Do you use a toothbrush? Is it a good one or a cheap one? Do you clean it well after use? Do you have earache? To prevent catching diseases must you look out more for people or for things? Is there usually too much heat in your schoolroom (see thermometer)? Are you in robust health? If not, what are you going to do to become so?

NOTE. — "Three thousand dollars of public money will be spent among the farmers of Buncombe county in improving their stock, their plants, and their soil while there is nothing being spent to guard or improve the health of their children." (Asheville Health Bulletin.) Buncombe is one of the most intelligent and progressive counties in the nation. The last part of above note is true of all counties that are without medical supervision of schools or practical study of hygiene.

NOTE. **Physical Examination of Children.** — The teacher or the parent will find it useful to work carefully, through this list (adapted from Hoag); write yes or no after each question and encircle each answer which indicates a defect in the child examined.

General: Is the child healthy in appearance? Color good? Body well developed? Any apparent deformity? Standing posture good? Shoulders even? Normal walk? Heels on both shoes worn evenly?

Mental: Normally advanced in school for age? Mentally alert, answers intelligently? Plays normally?

Nervous Condition: Good tempered? Freedom from tantrums, blues, and spells? Good control of muscles? Spasmodic movements? Bite nails? Stammering? Irritable? Very timid, easily embarrassed? Cruel? Fits? Headaches?

Teeth: Clean? Sound? Regular? Fillings? Six-year molars sound? Use toothbrush? Gums sound? Upper teeth protrude? (See chapter on Food.)

Testing the Eyesight.

Courtesy Mass. Charitable Ear and Eye Infirmary.

Reading without glasses and after glasses are fitted.

Tooth Brush Drill.

Children at flat desks. Notice the heads bent down. The left-handed bend head and spine to right, the right-handed bend to left because edge of desk is higher than elbow hanging naturally. Reading and writing are unnatural and wrong desks should not add to the strain. *Courtesy of Geo. H. Heltmuller, M.D.*

Nose and Throat: Breathe with mouth closed? Open? Nasal discharge? Nasal voice? Nostrils close together? Good chin? Usually free from sore throat? Hard palate broad?

Ears: Hearing good? Must questions be repeated? Fairly attentive? Fairly bright in appearance? Expressive voice? Spell fairly well? Frequent earache? Hear a whisper as far as other children? Discharges from ear?

Dr. Heitmuller's adjustable desk for preventing flat chest, crooked spine, and weak eyesight.

Eyes: Eyes straight? Chronic headache? Easily fatigued by study? Squint or frown? Leans over desk or holds head to one side? Eyes red or with discharge? Eyelids healthy? Writing on blackboard easily read? Have the eyes been tested separately with test type?

Skin: Red circular patches (ring worm)? Spots with crusts and pus (impetigo)? Red, scratched lines and spots on hands, arms, between fingers (itch)?

TEST QUESTIONS. — Why have public schools been established? How may a school become the source of as much harm as good to the state? State facts which show that schools may be a source of danger to a people's vigor. What good habit of childhood does the school tend to destroy? How may the school care for the body? What is the best way to use a physician? What are the duties of the school doctor and nurse? What defects are common among school children? Why is medical care of pupils a saving to the public purse?

MOVABLE DESK ON TABLE. It is better to prevent defects than to find them.

What may be done for the delicate child? What is the effect of open-air schools upon the pupils? Compare the merits of prevention

schools and recovery schools? What is the connection between backward children and undernourishment? What plans are suggested for school lunches in town? In country? Describe the proper location for a school. What is said of its walls? Lighting? Desks? Doors? Cloakrooms? Basement? Fire protection? Discuss school and the spread of infection. How do we know that school dust is a danger? What are the signs of eruptive diseases? What precautions are to be preserved in regard to books? Drinking water? Towels? In what ways may dust be prevented? How is a schoolroom to be ventilated that is heated by a jacketed stove? How may the schoolroom air be kept moist enough? Who should supervise the janitor? How does temperature affect working power? For what defects do medical inspectors watch most carefully? What is the cause of adenoid growth? What are its consequences? What results when it is removed? Why is mouth breathing injurious? What is often a cure for disobedience? What are the (1) general, (2) mental, (3) nervous signs of defects? What are the signs of defects of (1) teeth, (2) nose and throat, (3) ears, (4) eyes, (5) skin?

Courtesy of Surgeon General Torney, U. S. Army.

MEASURES FOR PUBLIC HEALTH AT THE ISTHMUS OF PANAMA.

SEWER AQUEDUCT of a sewer passing along the hillside at Culebra, Canal Zone. A house for workmen on the canal with the veranda screened is seen at the right. Canal Zone is a distant part of our country, but it is reached by wireless telegraph.

Courtesy of Washington State Board of Health.

A Dirty Alley. What kind of people do you think live here?

Courtesy of Washington State Board of Health.

A Clean Alley. What kind of people do you think live here?

CHAPTER XIII

THE PUBLIC HEALTH DEPARTMENT

Observational Studies. 1. *Water Supply.* — Two pupils may be appointed to study and report upon the public or private water supply of the community.

2. *Sewerage.* — Two pupils may report upon the disposal of sewage.

3. *Duties of Local Health Officers.* — A committee may report the names and duties of officers having control of sanitation.

4. *Local Sanitary Survey.* — To complete the local sanitary survey, after reports on the above have been read, the following may be studied: The Disposal of Refuse; The Public Market; Bakeries; Parks and Playgrounds; The Lighting System; Breeding Places of Disease-carrying Insects. Some may take a trip to see where the milk comes from.

The health of one cannot be perfectly guarded without guarding the health of all. We are interested not only in the health of our own nation, but in the world's health. About two hundred years ago the plague, or black death, killed one fourth of the people of Europe. It has been lurking in the interior of China ever since and it reappeared in civilized countries in 1893. Cholera is always in India, ready to be carried over the world. But since the discovery of germs as the source of infection, and the enforcement of sanitary rules, our dread of these diseases is greatly lessened.

Long before man knew how infectious diseases spread, the value of public health measures was understood. Moses was a wise sanitarian, as the Bible shows.

If, like the Athenians, we "revere and obey the laws and do our best to arouse like reverence in those who are

prone to set them at naught" (page 1), we can do much to enforce sanitary rules and prevent the spread of disease. Each can aid in the great movement for better health conditions which has accomplished so much in the last fifty years. A citizen now runs only one half the risk of dying of tuberculosis that his grandfather ran. The death rate, or number of deaths in a year among 1000 people, has decreased about one half in fifty years.

If you would be prepared to "uphold the ideals of our country, both alone and with many," do not forget that sanitary knowledge is as important as sanitary laws, and make a careful study of the conditions of public health and the ways of preventing disease not only as they are presented to you in this book, but wherever the opportunity is offered. You will not follow health laws blindly, but intelligently. When you learn the underlying principles, you can be a better citizen.

When you are old enough to vote, remember that health is one of the ideals to uphold, "both alone and with many," and that health officers appointed because of political influence are usually of little good. Only trained and intelligent men should be placed on guard to ward off disease and protect the people's health. Health officers should not be politicians, but scientists; that is, they should know how to base their actions on the study of facts.

Society seeks to protect itself against the ignorant, careless citizens and prevent them from becoming carriers of disease and sources of danger to all. Each must first take care of his own home; do not object to your neighbor's manure heap which breeds flies if there is a rain barrel at your home that breeds mosquitoes.

We used to think that the health of each person was his

own business. Now we recognize that conditions producing disease in one are liable to produce it in others, and that one case of illness may endanger a whole city. You may not escape the carelessness of your neighbor. No family has the right to live in filth. A man is a bad citizen if he merely keeps himself worried, nervous, or surly; for,

Tuberculosis cases must be reported to health office. This is the TUBERCULOSIS HOSPITAL at Washington. Notice the highest story is open all round. The grass and trees prevent dust. Washington has the most picturesque situation of all the world's capitals — forests, high hills, deep vales, waterfalls, rapids, cliffs, islands, rivers and bays are within the city or in sight of it.

as you learned in studying mental hygiene, his bad state of mind is liable to spread to others. Even in the country where people live on separate farms, all the contagious diseases will spread, either through the school or in some other way, if there is a loose handling of local health problems.

In the city the physician visits the slum, the lawyers

go to the courtroom where vermin are brought in by the vicious, the servant spends her half-holiday in a house crowded with the ignorant or careless, the newspaper is sold by a boy from a disease-infected home, the clothes meet and mix in the laundry with the clothes of all sorts of people, the trunk of a respectable traveler is stored with trunks containing roaches and bedbugs, the book from the public library has just served to pass away the time for some one recovering from illness, and was returned without a sunning or airing, men, women, and children crowd each other and breathe each other's breath in street cars, post offices, schools, picture shows, and churches. Without a Board of Health the hygienic standard for the town will be fixed by the most worthless and stupid.

Cost of New York State Capitol $25,000,000

Annual Cost of New York State Government about $32,000,000

Yearly losses caused by consumption in New York State $70,000,000

Some people who do not take care of themselves say they do not have time to think of self: but if they haven't time to think of self, *they should take time to think of others.* To weaken one's own body so that a disease which you may spread to others is caught as soon as a disease germ touches you, is like providing inflammable material where there are matches; one may cause a fire, the other an epidemic, and health is more valuable than property. It is easier to prevent a fire than, after it has started, to put it out before it burns down the house. The community can organize and coöperate to fight disease. Thus only can it hope to ward off disease. Since the interests of the citizens are the same, protection can best be secured by all working together. Health officers,

physicians, school inspectors, teachers, nurses and all good citizens, coöperate for public health.

The town, like the average man, is willing to pay well for stopping disease, but is not so ready to pay for prevention. It usually takes some disastrous outbreak of disease

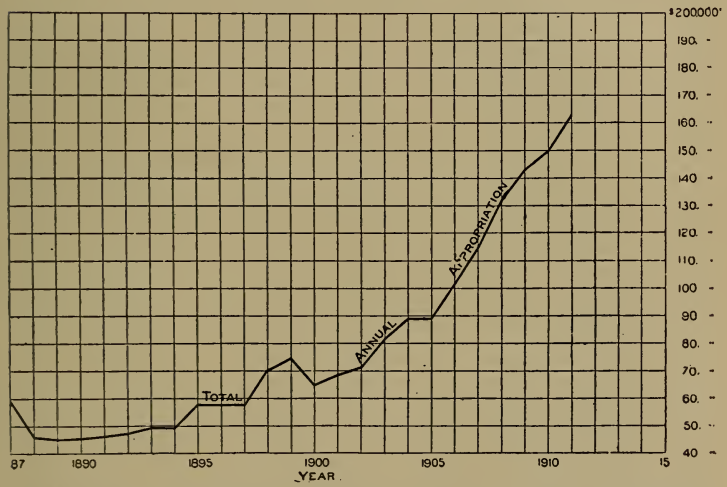


Chart showing how a state which is very careful for the health of its citizens has increased the yearly money for its board of health, in 24 years, from $58,000 to $162,000. Compare with amounts in chart on page 220.

to stimulate a town to pay for a good water supply or sewerage.

No other money spent brings so much return as the *taxes paid for good government.* For it we get schools, good roads, courts, and protection for property and health. Those who rob, destroy material wealth; those who scatter disease, destroy what is more valuable than property, health, and life itself. Many people in the world have little respect for other people's rights, even when they know

them; an efficient health department enforces respect for other people's rights.

In matters of sanitation, the rights of the individual must give way to the general welfare. Those who pledge themselves "never to desert a suffering comrade" will be still more eager to avoid doing anything to bring suffering upon their comrades. They will be willing to submit to exact inspection and weary quarantines, and willingly obey every regulation for the prevention of disease; for are not life and health "sacred things, for which we will fight both alone and with many"?

A good citizen does not neglect personal hygiene, for he knows they make a serious mistake who rely on laws and officers to do anything for them which they can better do themselves. But he *has a right to demand* from his city government freedom from flies and mosquitoes, pure drinking water, a proper disposal of sewage and waste, clean streets, rules against the building of insanitary houses, freedom from infection for his children at school, that all infectious diseases shall be promptly known, and that quarantine be strictly enforced, and that tainted or adulterated foods and impure milk be kept off the market.

Vital Statistics. — For the future welfare of the citizens, accurate *records of diseases, deaths, births, and marriages* should be kept. Records of births and marriages are necessary in proving citizenship, and claims to property on the death of relations. Even if the weather and roads are bad, and the office some distance away, the health officer should be given the information the law requires. The blanks should be carefully filled out. Only by such records can it be known to health officers and law makers what are the sanitary defects and what is needed to guard

the health of the people. When the death rates from the several diseases are accurately known, their cause and prevention can be intelligently sought.

Every one can do a little for the public health. He can refrain from spitting on the sidewalk. He can help keep the streets clean by placing fruit skins, paper, and rubbish in the trash boxes fastened on posts for the purpose. He

ST. PAUL	214,744	2558	11.9
MINNEAPOLIS	301.408	3739	12.4
MILWAUKEE	373,857	5205	13.9
LOS ANGELES	319,198	4538	14.2
CLEVELAND	560.663	8047	14.3
ROCHESTER	218.149	3215	14.7
SAN FRANCISCO	416.912	6319	15.1
ST. LOUIS	687.029	10888	15.8
KANSAS CITY	248,381	3966	15.9
DETROIT	465.766	7452	15.9
INDIANAPOLIS	233.650	3824	16.3
BUFFALO	423,715	6940	16.3
JERSEY CITY	267.779	4401	16.4
DENVER	213,381	3533	16.5
NEWARK	347.469	5784	16.6
LOUISVILLE	223,928	3756	16.7
BOSTON	670.585	11562	17.2
CINCINNATI	363.591	6319	17.3
PROVIDENCE	224,326	3980	17.7
PITTSBURG	533.905	9603	17.9
BALTIMORE	558.485	10753	19.2
WASHINGTON, D. C.	331.069	6511	19.6
NEW ORLEANS	339.075	7250	21.3

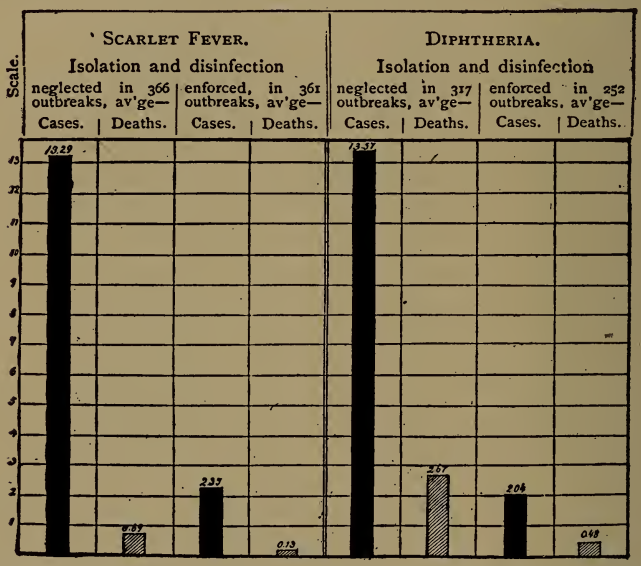
Annual death rate per 1000 of the chief cities of the U. S. Seattle, Washington, has the lowest, and Portland, Oregon, next; but they are not included in this table which is based on U.S. census of 1910. The negro death rate in Washington, Baltimore, and New Orleans is about twice the white rate and raises the average.

can warn any storekeeper that violates the pure food law, and report him if he breaks it a second time.

Sometimes, in order to save themselves trouble or expense, selfish people try to hinder the enforcement of health laws made solely for public protection. But the courts protect the public welfare and force obedience to law. "*The safety of the people is the supreme law*" has been a rule since Roman times. "So use your property as to injure no one" is another established rule of law. The law holds a man

responsible whose factory pollutes a stream, or who maintains a slaughter house with a bad odor.

The staff of the health department should be men of such character that the people's sense of fair play will never be outraged by reports of any one using improper influence with an inspector to escape a fine for maintaining an unclean store or market, selling adulterated or impure milk, or

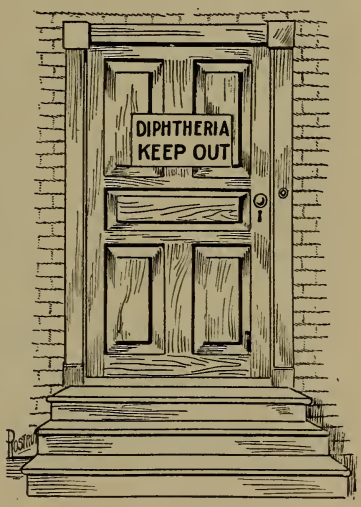


Effect of isolation and disinfection on Scarlet Fever and Diphtheria in Michigan (Report of State Board of Health).

to have a quarantine raised because it interferes with his business. A man who gets drunk or borrows money from the dairyman whose milk he inspects, should be promptly turned out of office. The health physician should be selected for character and ability, not because he is too young or too old to practice medicine. The salary for his services to the public should be large enough to support him without his practicing.

A Quarantine, when necessary, is set up by the chief health officer. You can no more have an infectious disease unless the germs of the disease reach you than a farmer can grow a crop of wheat or cotton without sowing seeds in the soil.

It is criminal to keep a case of scarlet fever or other *dangerous disease concealed* instead of reporting it at once to the health officer. If the *first case* of infectious disease that appears is promptly dealt with, a pestilence, with its untold evil and suffering, may be prevented, and people will not be liable to carry the infection to distant places and cause other epidemics. Epidemic is from the Greek, and means "upon the people."



Va. Health Bulletin.

Careful inspection at school prevents epidemics of diphtheria, measles, etc.

House quarantine is called *isolation*. If only one person in a family has an infectious disease, the patient is isolated in one room, preferably an upper room. The house is itself isolated and placarded, and only the physician and nurse are allowed to come and go. House quarantine is sometimes modified so that the wage earner of the family, if he never comes in contact with the patient, can go out to his work. The placard is not removed until the disease is over and the house has been disinfected. "Dogs, cats, and other pets should be thoroughly washed with soap in

a tub of hot water containing 5 per cent solution of carbolic acid" (Iowa Health Bulletin).

Inland quarantine between towns and states is enforced by armed guards. *Maritime quarantine* is easier; the ship

Courtesy of Dr. Arthur L. Murray.

Sterilizing Plant at the Quarantine Station, Washington. Articles are placed in the wire cage, rolled into the steel chamber, shut up, and treated with steam.

is stopped at the entrance of a port and anchored unless it proves a clean bill of health.

Periods of detention for those who have been exposed to infection: Small pox, 12 days; Measles, 10 days; Scarlet fever, 3 days; Diphtheria, 3 days; Cholera, 19 days; Typhoid fever, 14 days. If there is no new case among those detained for the period of quarantine, they are released. The law requires that infectious cases be reported as soon as known by physician, parent, teacher, householder, or

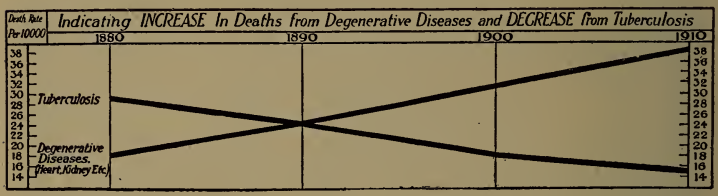
neighbor. Pestilence will return to do its terrible work so long as people are lawless and unfair to their neighbors and community by failing to report such cases. As sanitation is perfected, quarantines will become rarer and less necessary. The living human capital, or wealth, of the nation is estimated at a money value of five times all its natural resources. This is the calculation of Professor Irving Fisher of Yale, who years ago was given up to die of consumption, but who recovered through the fresh-air cure. A statesman who would strengthen and enrich a nation must do everything possible to strengthen the health of the people.

An old farmer said: "I wanted to send my boy to college, but my apple crop failed and I couldn't raise the money. I wrote the government, and they sent directions for spraying my trees and a man to show me the method. The next fall I harvested the biggest crop of apples I ever had. I sold them and sent my boy to college. I never was so happy in my life, sir, but when he had been there a month he took typhoid fever and died. They found the drinking water at the school was polluted with filth, and a public danger. The State saved my orchard, but the State let my boy be killed. Does the State take more pains to save the lives of fruit trees than of its citizens?" (Virginia Health Bulletin.)

Sanitation, together with fewer wars, has lengthened the *average human life* to 42 years, — about twice what it was in other ages. The awakening of the community conscience in regard to the poisoning of infants by impure milk, and the improvement in the milk supply, has saved many babies. This and the prevention of epidemics have helped to increase the average length of life.

The longer life at the present day is a triumph of public, preventive measures, and is *not the result of stronger, health-*

ier citizens. On the contrary, it is in spite of ever weakening bodies, as is shown by the fact that while pestilence and infectious diseases have decreased, those diseases have increased which are the result of bad habits and wrong living. Acute diseases, caused by germs, are being mastered by science and kept down by efforts for the public health. Chronic weakness and disease, such as mental disorders, weak nerves, idiocy, epilepsy, dyspepsia, diabetes, and Bright's disease and diseases of the heart are twice as frequent as they were a long time ago. They increase every



Courtesy of Metropolitan Life Insurance Co.

Showing that the death rate per 10,000, from degeneration, or chronic diseases, increased from 18 to 38 — more than double — in 30 years. Do we mean to go on in this way or to wake up to personal hygiene as we have to public hygiene?

year. The great blessings of public hygiene should not cause us to *overlook this great need of personal hygiene.* Sensible people acknowledge the need of plain food, pure water, right living, and of knowing how to take care of the body if they expect to accomplish anything in the world. Yet most people injure their health by slow and continued poisoning from unnecessary food, bad air, and inactive muscles. Seldom do they work or move with enough vigor to cause deep indrawing of the breath, send the blood bounding to enlarge the blood vessels of the skin and freshen it up, renew the blood in the gorged blood vessels of the liver, and wash out the poisons stored up in the cells, because of inactive, indoor life.

We need to have more *faith in the body and its perfection*, but to remember there is a limit to its endurance. We should be grateful for its power to make its own medicine, to repair its elastic covering and broken bones, for the watchful white warriors in the blood, the wonderful little chimney sweeps in the windpipe sufficient for those who

Courtesy of Dr. E. F. McCampbell.

Laboratory of the Ohio Board of Health, Columbus. Microscopic search for germs of typhoid, rabies, tuberculosis.

live in decent air, the glands which make oil and all needful things, the tears to wash the eyes, the ear wax, which like sticky fly paper, protects the ear from insects, the slippery fluid which keeps the joints in order, and the many other wonders of the body. The body tends constantly to health and only gives way after long, outrageous abuse or foolish strain. The man who boasts that he has an iron constitution usually has a muddled head.

Many can learn how to *prevent ill health* and grow old without losing enjoyment of life; few that wait until the evil day of sickness comes, can learn how to live so as to make the body grow strong again. It is easier to learn how to keep well when we are well, how to follow the laws of health, than to unravel the tangle of disease.

We should learn how to attend to personal hygiene for a public reason. The reason is this: The bacteria of the same disease, for example, typhoid, have differing races or strains of different degrees of virulence, so that one outbreak of the disease may be in a mild form, another a very severe one. A person with a vile body seems to make the germs more virulent if they sojourn in his body. They flourish and learn to multiply more rapidly, and when they leave him they have become a stronger menace to the community. When we so plan our lives as to make our bodies strong and efficient, we are doing the very things that will enable us to resist disease, and remain safe citizens.

Things that the local or state health departments will probably do for the community. It will make chemical and microscopic examination of doubtful drinking water; test for adulterated or impure milk; give or sell diphtheria antitoxin; send vaccine for typhoid, smallpox, and rabies; examine the brains of dogs suspected of rabies; examine the sputum for tubercle bacilli; test cattle for tuberculosis; examine for the eggs of hookworm and other parasites; examine specimens of blood for the malarial parasite; examine cultures from the nose and throat for diphtheria bacilli; establish quarantine; fumigate and disinfect houses and contents after quarantine is raised.

TEST QUESTIONS. — Show how the health of all peoples is connected. Who was the first great sanitarian known? What has sanitation

achieved with tuberculosis? The general death rate? What kind of health officers are usually of little use? Why is one's own health not entirely his own concern? Give some of the dangers of contagion to which citizens and travelers are exposed? Name things that we have a right to expect of the health department. Give the reasons for keeping vital statistics. Name two very old rules of law that apply to public health measures. What kind of men should the staff of the health department consist of? Tell of the need and the kinds of quarantine. What is an important duty of statesmen?

Tell of the old farmer's apple trees and his son. What is the average length of human life? What has chiefly helped to lengthen it? Has personal health increased or decreased with the average length of life? Why? Name some of the wonders of the body. State a public reason for keeping the body sound. Name things that a local or state health officer will do. How is fumigation to be done?

NOTE. *To Fumigate a Room.* — 1. Close all openings. 2. Paste strips around the windows, doors, and on keyholes. 3. Open all drawers; disarrange all bed covers. 4. Sprinkle everything thoroughly. 5. Soak sheets in formalin and hang them on ropes in the room. 6. Use a pint of formalin for every 10 square feet of floor space. 7. Leave room closed for 8 hours. 8. Open the windows, and air for a day. 9. Scour all woodwork with soap and water. 10. Boil all washable goods, and sun everything for a day or more.

Preparing to fumigate a room. It would be better to stand the books in the sun with leaves open or to burn them. A metal vessel on bricks is used for the disinfectant. Sulphur may be burned to kill insects, but formalin is used for killing germs.

CHAPTER XIV

HEALTH AND CITY LIFE

THE recent *growth of large cities* has been a severe blow to national health. Cities, as now built, tend to cause a decay of the race. Urban families are small, and the children are often weak and delicate. People from the country are constantly moving to the city. This raises the stand-

Courtesy of the Hebrew Alliance.

Children playing on a roof, New York City.

ard of health in the city, if they do not come from villages where the conditions which lead to weakness and waste of human life are no better than in cities.

A city could be so built as to be as healthful as the country; each possesses an advantage that the other lacks.

The average child of 7 years, brought up in one of the *new garden cities of England* is three inches taller than one

Mulberry Bend, New York City, as it was.

Mulberry Bend as it is.

Courtesy of Mr. Jacob Riis.

City children on a trip to the country. Playing in the pure air will increase their resistance to disease.

of the same age living in a densely built English city. At 14 years old the difference was found to be five inches, and the difference in weight was 30 pounds.

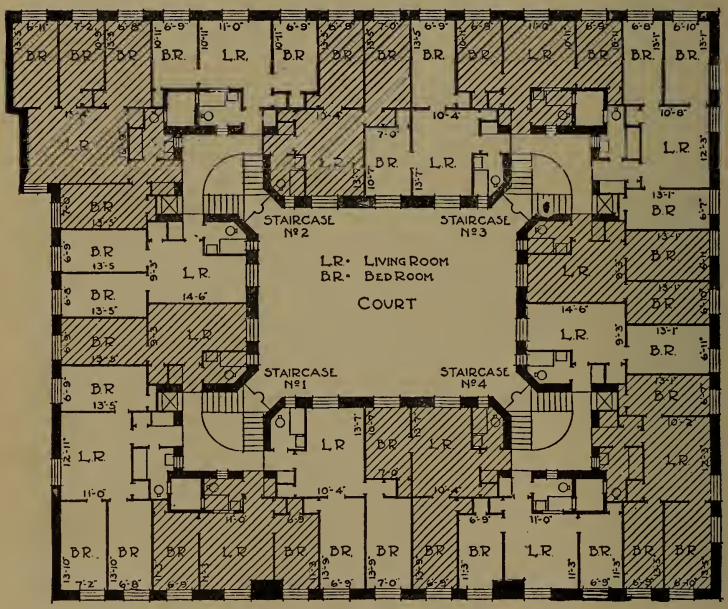
Courtesy of N. Y. Ass'n for Improving Condition of Poor.

An Open-stair Building. Half of this building contains a home hospital (for curing consumptives at home) planned by Jno. A. Kingsbury. Compare windows and balconies of the two portions. There is a playground on roof.

In laying out cities, *the early settlers of America*, although they had the whole continent before them, built the oldest portions of our Atlantic coast cities almost as crowded as the cities in the crowded Old Country. The oldest streets of such cities are narrow, dangerous, bare, dusty, and unfit

for man or beast; no tree can grow in them. Skyscrapers on broad streets reduce them to narrow chasms, sunless except for an hour each day. Lower Broadway, New York, is thus being made into a narrow, dark street.

Streets where people dwell should have a parking, with trees in the center and a strip of parking with a row of trees between footway and driveway. *In planning a garden city,*



ONE FLOOR OF AN OPEN-STAIR HOUSE. Each flat has its own public entrance, and the whole house can be shut off from the street by closing the court.

native trees are left untouched wherever possible. Not over two houses are built to an acre; there are many parks and playgrounds. The handsome public buildings are placed at the ends or turns of streets, or facing squares and open spaces. The streets are laid out to follow the easy slopes of the hills. Factories are built in a space set apart

for them, so that their noise and dust are removed from the homes, and they are so placed that the prevailing winds will blow the smoke and odors away from the city.

One who lives in a city cannot possibly keep well by his own efforts, however carefully he lives. *Every citizen's health is dependent upon people* he doesn't know and may never have heard of. These people are studying and planning day and night to keep disease away from him. By isolating disease they often stop it before it gets fairly started. The supplies of water, milk, meat, and other foods must be guarded. If the sewers should be neglected for 24 hours, the citizens would be dying by thousands. The house must be guarded against bad plumbing; the air must be guarded from pollution.

If a city is to be kept clean, *pavements* must be often washed. *Dust* blows up more easily from a pavement than from a country road. *Spittle* does not sink into it as it would into the ground, but dries in the dust, and the dust is whisked into the faces of passers-by. Street dust kills not only people, but trees.

It is a pity for *families with children* to live in flats and other kinds of tenement houses, especially if there is no park or playground near. The "apartment" is often smaller and more cramped than a tenement flat. Hundreds of children playing in the streets are killed or injured every year, and thousands die or grow weak and sickly because they do not have enough outdoor life. Lodgers in flats have to take a vacation in the country every summer to preserve their health, but this is not enough for growing children. Tenements and apartment houses should always have playgrounds and gardens on the roof. "A boy without a playground foretells a man without a

job." A city with many places of recreation means that in the future many barkeepers will be without jobs.

A *dark house* is an unsanitary house. Sunshine bleaches the carpets and wall paper; the lack of it bleaches the face. A "cliff dweller" *selecting an apartment* in a house should demand: at least five hours of sunshine or clear daylight in every room, a playground for the children, fresh air untainted by sewers or factory, walls and floors deadened to noise, no unnecessary noise in street or house, freedom from vermin, whether insects, rats or mice.

The stuffy, unclean air and want of privacy in tenements with indoor stairways may be avoided by *open-stair buildings*. Then no public hallways are needed, and the entry to each flat is private. Many such healthful tenements are now being built in place of the old dismal houses built around a vent shaft.

The worst *slums in our cities* are inhabited by Chinamen and other poor foreigners who disregard hygiene even more than the native-born. Some negroes are especially neglectful of the laws of hygiene and eat cheap and often decayed food. In cities both North and South, the quarter where poor negroes live is often low and flat with unpaved streets, imperfect plumbing, and drainage, and becomes a breeding place for disease, affecting the health of the whole community. Women go from the quarter directly into kitchens all over the town. There is a danger to all in neglecting the health of any.

Quiet is as necessary for sound nerves as light and air. City noises wear out many people and cause them to break down. The noise of street cars is added to the endless clatter of trains on elevated tracks and wagons on rough pavements. The trolley cars could run smoothly except

Seven-cent Lodging House, New York City. These men are out of work. There is plenty of healthful work in the country.

Baxter Street, New York, as it was. The drains extended only a few feet from these houses and did not reach the sewer.

at curves, and would make hardly any noise if the rails were separated from the pavement by strips of wood, as is done in Frankfort and some other German cities. Street cars are now being built so large that they jar the earth as they pass.

Many of these noises last until late at night; and then at three o'clock in the morning the milkman, baker, and

Dupont Circle, Washington, D.C. Dust is prevented by promptly removing droppings from horses. Notice the beautiful trees. Have you such trees in your town? If not, are you planting trees? The author enjoys these trees every day, and hopes you have as fine ones at your home or will plant them.

errand boys begin their noisy rounds. *Many noises could easily be stopped.* There should be a fine for running a street car with a flat wheel. Inmates of apartment houses who play the piano after ten o'clock at night, and are noisy at other times, should be given notice to leave. Many noisy people would take the hint and correct their bad manners, and the others would move to houses where all are noisy. Houses should be so arranged that the heat can be turned on and off in each room, so that those who do not

wish great heat need not have it. Many Americans are fond of overheated rooms, and throat and nervous troubles are common because of it.

Because strangers in cities are suspicious of each other, cities are very lonely places. Suspicion and loneliness, moreover, are bad for the nerves.

Only streets with *smooth pavements* can be kept really clean. *Several methods of street cleaning* are in use: the *rotary broom* creates nuisances in the streets by raising dust

Alley Gang, Washington, D.C., sprinkler, rotary broom, brushes, cart.

or scattering mud when the sprinkling is not just right; the *flushing method* of washing the streets, using hand-force pumps on the tank wagons and applying the water through nozzles with considerable pressure, is more sanitary. It creates a fine spray in the air, however, and the rotary rubber *squeegee* which scrubs the streets just behind a row of nozzles is preferable to any machine except a vacuum cleaner. Street cars are often shamefully dirty and dusty. Their floors should be washed at least once a day. Some conductors seem to think the ventilators are merely for ornament, and others are much more prompt in closing

than in opening them. What did you learn about the dust of cities in the chapter on Pure Air?

Carrying *food through dirty*, dusty streets is a risk to the health of those who eat it. *Bread* is sometimes handled like kindling wood. The baker's wagon is kept in a dusty stable at night, yet is never scrubbed or cleaned, and is unprotected from dust in front and rear. The hand that holds the reins and pats the horse carries the bread or holds

Courtesy of Dr. W. C. Woodward.

THREE SQUEEGEES scrubbing New Jersey Ave., Washington, D.C. The National Capital is noted for its broad avenues, fine shade trees, and clean streets. Every citizen considers travelers as guests, and is glad to help them find their way and see the city.

the loaves against an unclean coat. Delivery men should wear driving gloves and remove them before handling food. The bread should be wrapped at the bakery. Fruit should be peeled, cooked, or washed before it is eaten, if it has been exposed on carts or stalls. Do not eat street dirt.

Every town should have a public market place, and every city a number of market places, and the farmers should be encouraged to come with fresh food and sell directly to consumers. This food will be fresher and cheaper than it

will be if taxes and restrictions force it to pass through the hands of middlemen. Food can be more thoroughly inspected in markets than if it is scattered over the city in stores. The fewer the towns and cities with such market places, the higher will be the cost of living.

TEST QUESTIONS. — How has the growth of cities affected national health? Compare a child in an English garden city with a child in a densely built English city. Describe how a healthful city should be laid out. Show how one's health in cities depends largely upon others. What are the disadvantages of family life in tenements and apartment houses? What is said of playgrounds? What points should a city "cliff dweller" require when selecting a flat?

What are the advantages of open stairs? What class of people often inhabit slums? What are often the needs of a neighborhood in which poor negroes live? What is said of city noises? Describe methods of street cleaning. (Study photos also.) What is said of cleanliness of food brought through the streets? What are the advantages of a public market?

CHAPTER XV

RURAL SANITATION

Supplementary Study.—As this chapter is begun, the teacher may issue to the pupils the following bulletins obtained from the Department of Agriculture at Washington; also state bulletins or books on farm life, and require reports or summaries on stated days: Farmers' Bulletins, No. 155, *How Insects Affect Health in Rural Districts.*—270, *Modern Conveniences for the Farm and Home.*—345, *Some Home Disinfectants.*—444, *Remedies and Prevention against Mosquitoes.*—450, *Some Facts about Malaria.*—459, *House Flies.*—473, *Tuberculosis.*—478, *How to Prevent Typhoid Fever.* Bureau of Entomology, Bulletin 78, *Economic Loss in U. S. from Insect Carriers of Disease.*—*The Farmstead*, by I. P. Roberts (The Macmillan Co.).—*Rural Hygiene*, by H. N. Ogden (The Macmillan Co.).—*Household Hygiene*, by S. Maria Elliott.

In studying public health in the previous chapters *we have already* studied many questions of rural hygiene from several points of view. Let us now see *what we remember* on that subject: What did you learn about clean milk, sanitary dairies, clean barns, healthy cows? What disease of cows is passed on to babies in dairy milk? How is mire and muck in the stable lot prevented? (Situation, slope, gravel, ditches, drains.) What diseases are transmitted in milk?

Why is typhoid more easily passed on to others in the country than in the city? Where are patent medicines most largely used? Why? Where is it easiest to have healthy surroundings? Why is the country man less dependent on public hygiene than the city man? (Chapter I.)

What advantage does the most badly constructed country house have over the city house? What advantages may farmers have in the food supply? What is the best way for distant farmers and consumers in towns and cities to deal with each other? (Chapter VI.) Why is it against the interests of most town people to put restrictions on the use of the market place by neighboring farmers? How may a farmer's wife test eggs before sending them to market?

Courtesy of Mr. G. A. Bricker.

A Class of Boys spraying fruit trees.

What advantages in health has the farmer who neither buys nor sells much food, but grows what he needs at home? How many profits will he save?

Is man by nature an indoor or outdoor animal? In the chapter on Pure Water what did you learn were the dangers of shallow wells? How is a safe well provided? How do the useful bacteria near the surface of the ground protect the well? About how deep do they work?

What insect carriers of disease are more abundant in country than in town? How may town and country each affect the health of the other? How may damming the

waters of a creek prove a curse to a countryside? What insects breed in stables?

Which of the natural stimulants and narcotics mentioned in the chapter on Mental Hygiene are in the farmer's reach? Has he as much reason as the town dweller to imagine he needs artificial stimulants? What great advantages has the country for nervous people? What suggestion was made for lunches in the country school? Does a coun-

From Bricker's Teaching of Agriculture in the High School.

BOYS JUDGING SWINE. (Agricultural High School, Douglas, Ga.)

try school spread infection? Does public opinion allow visiting in your community in a home where there is contagious disease? Are the other children of a family promptly excluded from school when one child has a contagious disease?

Do the state and national health offices work for rural as well as urban health and protection? Does the county health office work for both? Has the city health office any power in the country? Have you selected a community, or district, health office?

Many young people go from the farm to the city. A

young man tires of the farm and moves to the city, hoping to have an easier job and to earn more money; but too often the ruddy, vigorous farmer boy changes into a fat and waddling or pale, stooping worker at a desk, more dependent financially than before.

Farm life is often lonesome, but it need not be so. The best rest and refreshment for a tired plowboy is a game of baseball, and every neighborhood should have a ball ground for a game at the end of each week. This will develop the boy's social nature as well as prevent his losing interest in lonesome work. The schoolhouse should be a social center. For political and business meetings it may replace the courthouse, saloon, and loafer's corner. Sociables and play parties at the schoolhouse once a month, with occasional dramatic and musical entertainments by home talent, will combine with other forms of recreation to make life interesting.

Iowa Health Bulletin.

CRIMINAL IGNORANCE. Washing the clothes of a typhoid patient within two feet of a well. Besides the seepage, her hands on the rope may infect the well.

Food in the country is the freshest and purest. The air is not contaminated by the smoke nuisance or a plague of dust. The farmer's life in the sunshine and pure air,

far from crowded places, insures escape from germ diseases for those who are cleanly and careful. If a country baby is bottle-fed, it gets the freshest of milk.

But there are some families on farms who are so careless that they are more sickly than the average family in a crowded city. Consumption, to which pure air is such a

Courtesy of Indiana Board of Health, Hon. J. M. Hurty, Sec'y.

Typical rural tuberculosis home (Crawford Co., Ind.): windows few, walls tight.

foe, ought to be a disease of the city only, yet there is much tuberculosis in some rural districts among families who try to close the house like a sealed box and overheat it with stoves. Others work constantly and allow the children no recreation, or will not protect their wells, and suffer from typhoid as much as those who live in the worst city slums.

Dr. Hurty, speaking of a farm family indifferent to health, says: "They neglect the bathtub, and overwork the frying pan. Their bread is overfermented and under-

baked. They eat too much of smoked, pickled, and salted pork. There is as little fruit and vegetables as if they had no space for an orchard or garden. If the appetite for delicious fried chicken and seven kinds of jelly palls, they arouse it with a large dose of pickles. These things, with polluted drinking water, explain why such a farmer

Courtesy of Indiana Board of Health.

A typhoid well, Gibson Co., Ind., that caused many cases and 10 deaths.

is a large buyer of patent medicines. This farmer is sure to locate his cesspool so that the vault contents will drain into his well." Luckily such farmers are uncommon.

What did you learn in the chapter on Insect Carriers that applies to the farm?

Many farm wells get infected from hands and mouths that touch the well bucket. To touch the rim of a well bucket with your hand is the same as putting your hand into the water that others are to drink. A self-tilting well

bucket should be used, and the well platform should be water-tight.

A farmhouse that lacks water pipes and water pressure need not lack *a shower bath in summer;* a space in the back yard four by six feet may be walled in with planks, and a flower sprinkler filled with water may be used to spray one's own body until it is cool, clean, and refreshed after a hard day's labor in the field. Instead of the sprinkler a can with many small holes punched in the bottom may be used.

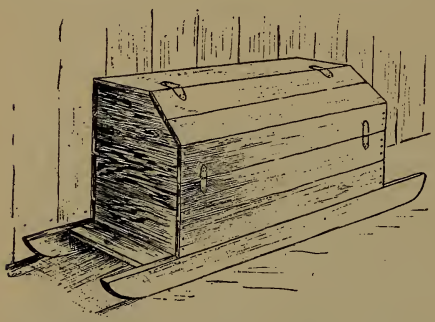
An ideal farm is easy to have, if it is *arranged on the right plan.* The dwelling house is near the top of the hill with trees near enough to break the wind in winter and keep off the glare of summer, and yet not so close as to prevent sunshine from falling on the house. The house is not so built as to be hot in summer and cold in winter, but with the opposite plan. Neither barn nor outdoor closet is south of the dwelling where the wind would take odors into the house. The well is above the house, and the barns and stable yard below it, at least 100 feet distant. The kitchen and bedrooms for the family are the most comfortable rooms in the house. The porches are wide enough for family gathering or for open-air sleepers.

Courtesy of Indiana Board of Health.

Two left out of a family of four. Cause, a typhoid well. Such results will be impossible when an aroused public conscience will demand that all wells be made safe and kept safe.

No stagnant water is allowed in the neighborhood, and

the pest of mosquitoes does not exist. There are few flies, for *manure sheds* and outdoor closets are screened and made fly tight. The *stable yard* is well ditched or drained, and manure is not allowed to accumulate, but is scattered on the field on a certain day each week, to prevent flies from breeding; for the *house fly* is most dangerous in rural communities, because there the disposal of infected household wastes is most difficult.



MANURE BIN with fly-tight lid and on skids, to be drawn by horse once a week and manure spread on fields.

If there is a *cistern*, it is elevated so that for convenience the water may be drawn at the open window or from the edge of the porch. Carefully fitted *screens* protect the kitchen and dining room,

Courtesy of Mississippi Board of Health.

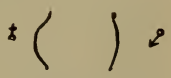
The fly hatches in the manure pile, lunches in the closet, and dines in the dwelling.

if not the rest of the house. If there is not a septic tank (page 256) for all sewage, the slop pail and *garbage can* are kept constantly covered. The members of the household

work for shorter hours, but more efficiently, have time for recreation, and life is not drudgery.

Such a farm does not poison the city by sending impure milk and butter, and the summer visitor does not have to fight insects and boil the drinking water. The young people of this family do not migrate to the city, for they can see that the cramped life of towns is not as wholesome as pleasant country life, and that wage slavery is often the lot of the city dweller.

Hookworm Disease is very common in warm countries. During the past few years it has been found in nearly all of the warm countries of the world. All persons who live in such countries should know about the disease in order that they may protect themselves against it and be cured if they should chance to have it.



Hookworm, male and female, natural size.

The disease is caused by a tiny worm, called the hookworm, which gets into the body and lives in the intestine or bowel. The worm is about as big as ordinary cotton sewing thread and about half an inch long. Its mouth is provided with hooks by means of which it fastens itself to the soft lining of the intestine, and there it lives and feeds on the soft lining of the wall and on the blood of the person who harbors it. *The worms get into the body* through the skin. When persons who have hookworm disease pollute the soil, the tiny eggs hatch, and from them come very small undeveloped worms, or embryos. These live in the top soil and in a few days are ready to enter a human body. When the sun is hot, they burrow down out of sight, but on cloudy days and in the early morning when the dew is on the ground they live in the very topmost layers of the soil. When a person with bare feet walks over such soil, the little hook-

worm embryos catch hold of the skin and burrow into it until they reach the blood. They are then carried into the heart and lungs, and go on from there to the stomach and bowels.

As they burrow into the skin they make sores which are called dew sores or *dew itch*, sometimes ground itch or toe itch. This is one of the first signs of the disease. Treat ground itch promptly. Never go with bare feet through

Courtesy of Hon. Wickliffe Rose, Sec'y Rockefeller Sanitary Commission.

At left, home of a worm-sick family in 1910. They hardly worked at all, and no child had gone to school for three generations. *At right*, home of same family in 1912, built by the family 14 months after cure. Children now go to school and family are hard workers.

muddy places, or even on damp ground, or before the sun has dried the dew. Always be examined for hookworms within three months after having the ground itch.

What are the Signs of the Disease?—If a person has only a few worms living inside him, he may show very few signs of the disease. He will probably have slight indigestion, feel weak and disinclined to work. Many persons who have the disease get the reputation of being very lazy. If persons have many of the worms, the signs are much worse. They are pale and weak, suffer from headache, indigestion, shortness of breath, and fluttering of the heart. Some of them have dropsy, a condition in which the limbs swell up

and the face and other parts of the body become swollen and puffy. The hair is dry and rough and the skin rough and of the color of tallow.

The Cure of the Disease. — It is fortunate that the disease is easy to cure; a drug called thymol, when properly given, will cure the disease in almost every case in a very short time.

The disease may be prevented by wearing good tight shoes all the time[1] and by not letting polluted soil come

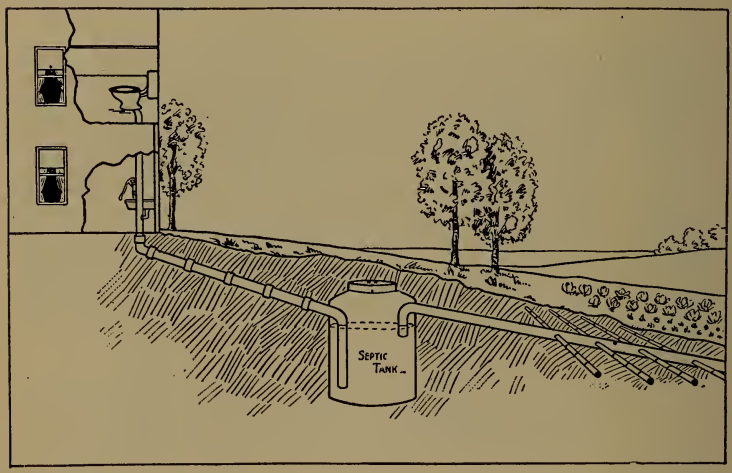
Typical pained expression about the eyes of two PORTO RICAN HOOKWORM VICTIMS. U. S. health officers cured thousands of worm-sick people on the island. (Cost, 60 c. each.)

into contact with the skin. The best way is to prevent the pollution of the soil by the use of the sanitary outdoor closet so that the eggs cannot get on the ground to develop. *The eggs cannot develop in the body,* and if we prevent them from developing outside the body the disease cannot spread. Two things are necessary to eradicate hookworm from a community: (1) Stop soil pollution; (2) Cure

[1] Hookworm experts in the U. S. teach this, yet Dr. Ashford found that more than half of a company of soldiers in Porto Rico became infected on one march although they were wearing stout army shoes.

every sufferer from the disease. Such a task is the work of years.

How the Disease is Recognized.—The disease can sometimes be recognized by looking at the patient, but the sure way is to examine the discharge of the patient under the microscope to see if it contains the eggs of the hookworm. The State Board of Health will make this examination



Courtesy of Indiana Board of Health.

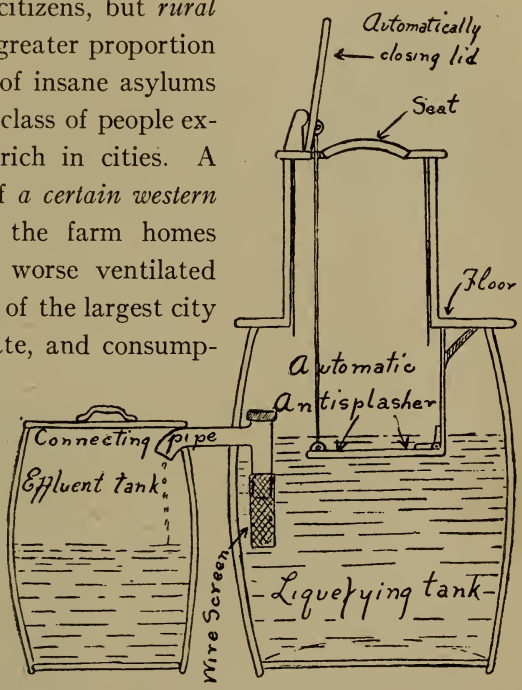
The contents of a septic tank are purified by standing, as fermentation destroys all disease germs and liquefies the solids, and the contents are siphoned off and spread upon the field.

free and will send you a mailing case for sending a specimen if you will write them and ask for it.

Country Slums.—Although one half of the people of the United States live in the country, *more efforts have been made for sanitation in cities* than in the country. This is because the crowded condition of cities compels attention to public health. There are slums in the country as well as in the city, and they, like city slums, are breeding places of infection dangerous to the whole people. Country-

sides where ignorant, shiftless inhabitants settle and neglect the conditions of health form the rural slums.

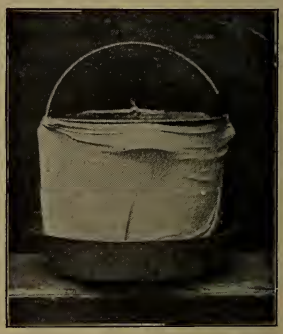
Intelligent rural neighborhoods give to our country its most vigorous citizens, but *rural slums* supply a greater proportion of the inmates of insane asylums than any other class of people except the very rich in cities. A health survey of *a certain western county* showed the farm homes within it were worse ventilated than the homes of the largest city in the same state, and consumption was as frequent in this county as in the largest city. An examination of the stock of the country stores *in villages in malarial districts of two different states* showed that two fifths of the shelf room were taken up with patent medicines. Attempts to keep in health by the aid of patent medicines give a fair measure of the lack of sensible efforts toward the same purpose.



The L. R. S. Sanitary Closet (compare with septic tank, p. 255). The vault consists of two barrels connected by a pipe or a cement trough (cost $12) with a partition. The liquefying tank is filled with water to level of connecting pipe. The fecal matter ferments in the water and liquefies, disease germs being destroyed by the fermentation. Additions of excreta raise the level of the liquid, and the excess flows into the effluent tank. Because of evaporation it requires emptying only about once in two years. After disinfecting effluent tank, contents may be siphoned off for fertilizing. An old closet may be changed to a Sanitary Closet if roof admits of raising floor.

In the country the annual death rate for each 100,000 people is as follows for several diseases: Tuberculosis, 136; intestinal diseases, 121; bronchitis and grip, 90; pneumonia, 83; diphtheria, 17; whooping cough, 12; scarlet fever, 8; measles, 8. The country death rate is increased and the city death rate is lowered because so many sound, healthy people move from the country to the city.

Because so little community of interest is felt in the country, *greater personal responsibility* rests upon the head of each household. Public sanitary control is hindered by the isolation and independent mental habits of the farmer. In country slums, a farmer sometimes even gets angry because his child with the whooping cough is excluded from school. Progress is best gained by appeals to the intelligence of educated citizens, and by the spread of education.



HOME WATER COOLER. Cistern water is more healthful than water from dug wells. To cool it fill a large metal bucket or tin vessel in evening. Tie around it a wet cotton cloth which dips into a pan of water. A wooden cover should be kept on the bucket during the day.

Official supervision of public health is needed everywhere. Sanitary districts should not be laid out according to settlement unless the population is sparse, but according to watersheds and drainage. The people of the districts may elect district health officers who pledge themselves to carry out the orders of the county health officer. The district officers in convention choose for county health officer one who has passed

the examination required by the State Board of Health, or one who has a diploma in public health or preventive medicine.

NOTE. — The citizens of each community should hold an annual meeting not only to elect a local guardian of health but to assign other duties which should be divided in an orderly community. No community can prosper where the citizens live in selfish loneliness, jealous of each other's success. Scientific farming by individuals, and coöperation and combination by the whole community are essential to health and happiness in rural life. Farming is more suitable for the basis of ideal living than for quick profits. Fairs at the county town drain and weaken the country, but a neighborhood fair helps and stimulates. There should be quarterly and monthly market days in each country district.

According to the "Coleman Plan," at the annual community meeting, the following coöperative workers may be elected: 1. Barber. (Unlike the town barber, his chair and tools will not bring the risk of infection by persons from the whole town and county.) 2. Blacksmith. 3. Butcher. (See Farmers' Bulletin No. 183. The farmers will take animals in turn to him for butchering and will not have to eat rancid salt meat.) 4. Buyer and seller. (He will soon become expert and will get discounts for his neighbors by buying in large quantities.) 5. Cobbler. 6. Carpenter and lumberman. 7. Carrier, to distribute meat, bread, and supplies, and collect things to be sold. 8. Health guardian (against infection, breeding of flies and mosquitoes). 9. Freighter (to town once a week). 10. Referee, a wise and just-minded man. 11. Road foreman. 12. Sports manager, who will plan a good ball ground, swimming hole, recreation grove, and arrange holiday celebrations, match games, athletic meets. 13. Junker, to buy and sell second-hand articles. 14. Seedsman, to develop and save the best seed. 15. Chairman of meetings at Neighborhood Center (the schoolhouse?). 16. Storekeeper. 17. Teacher. 18. Tinker, for tinware, sewing machines, clocks, etc. 19. Trustees for school. Of course all remain farmers. The storekeeper, for example, opens the store for only one hour each day.

The community work of the women may be divided as follows: 1. Baker. 2. Butter and cheese maker. 3. Manager girls' canning club. 4. Manager of school or neighborhood fair. 5. Merrymaker, to arrange parties, play picnics, and merrymakings. 6. Postmistress.

7. Reading club manager. 8. Referee. 9. Song and glee leader. 10. Seamstress and tailor. 11. Teacher. 12. Trained nurse. She, like many of the other workers, should miss no opportunity for study and training in her special work.

TEST QUESTIONS. — What are the advantages of farm life to health? Why do young men go from the farm to the city? What is a country slum? Why is public sanitation in the country difficult? What is said of tuberculosis in the country? Give the shortcomings of an ignorant farmer as described by a state health officer. Describe different ways in which members of a farmer's family may coöperate for healthy, happy living. Describe the location and arrangement of a healthy farm home. What is said of visiting a family where there is a contagious disease?

To what is the hookworm disease due? Describe the worm. What are the symptoms of the disease? How is the disease spread? Give the life history of the hookworm from the time the egg is laid until the egg is laid again. Can the disease be cured? Which is better, prevention or cure? How can it be prevented? What can school children do to help eradicate the disease?

What proportion of the people live in the country? Why is more attention paid to sanitation in cities? What causes rural slums? The greatest proportion of insanity comes from what two sources? What is said of patent medicines in the country? How is a home-made shower bath provided in summer? Give the death rates of several diseases in the country? What is said of personal responsibility and health in the country? What plan is suggested for organizing the public health service? Give an outline of the author's plan for organizing a country community (see note).

CHAPTER XVI

INDUSTRIAL HYGIENE

Courtesy of National Child Labor Committee.

GIRL SPINNING COTTON. In this mill children of widows may legally work until 9 P.M. Other children quit at 8 P.M. The roaring, buzzing, and jerky noise of the machinery is deafening and nerve racking.

MAN spends more of his time sitting down or standing still than he has ever done before. When he moves from place to place, he usually rides. With the use of sulky plows and reapers even farming tends to become a sedentary, or sitting, occupation.

Man's body is adapted to outdoor life of hunting, fishing, and farming. Persons who do their daily work in close, warm places, holding the body in an almost fixed posture,

have departed far from the life which the body has been used to through the ages. Hence there are many broken-down men and women among those who have adopted indoor life. Farmers are the healthiest class of people and liquor dealers the shortest lived.

This chapter discusses the ill effects upon the health which may come from following different industries, and what employers and laborers can do to prevent or lessen those effects and prevent diseases of occupation.

A Factory Girl. Hair confined, apron strings short, sleeves short, she is safer among the whirling bands and wheels.

With the exception of firemen and their horses whose lives are shortened by sudden, violent exercise between times of complete rest, most *modern work is too monotonous.* The sameness of modern factory work is trying to the nerves. On the farm or in the old-fashioned shop, the work is constantly varied. There is nothing so wearing on the human body as months and years of monotonous toil. When men are turned into mere human machines, their spirits become depressed; many injure themselves still farther by seeking excitement in drinking and gambling.

Excessive hours of labor are contrary to public welfare. The ceaseless toil in factories where the hands are never still, the constant watching of machinery, the all-day standing, cannot safely be endured for a great length of time. Shorter hours prove to be better both for the worker and for the work done.

When the worker is reduced by overwork to *a state of constant fatigue,* the heart, lungs, and kidneys fail to work

Courtesy of Survey Associates, Inc.

A SWEATER and two sweat shop workers making stogies.

Courtesy of National Cash Register Co.

A factory need not have a dismal, dirty, dusty yard.

Courtesy of National Child Labor Committee.

CHILDREN SEWING after school until 9 or 10 P.M.

From "The Bitter Cry of the Children."

These children (except the baby) work in a sweat shop. They were called from the photographer to return to work. Protection of children is the highest patriotism.

properly in removing impurities. Then *rheumatism*, a disease hard to shake off, settles upon the worker.

President Woodrow Wilson says: "Did you ever think that men are cheap and machinery is dear; and many a superintendent will be dismissed for overdriving a delicate machine who wouldn't be dismissed for overdriving an overworked man?"

"*Speeding-up*" machines to increase the work done, speeds up the men and shortens the lives of the workers. Men and women come to hospitals who at forty or forty-five years, are simply worn out human machines, thrown on the scrap heap. This is waste of human life. Even in slavery times, slaves lived under as good conditions for health as their masters. A wise employer knows that his interest and the interest of the laborer are mutual. A wise people realize that the energy and *the health of the working men are the greatest source of strength and wealth;* that a nation of weak men with money piled up is weaker than a nation of strong men with little money.

Working men will be more healthy and efficient in *a factory that stands in well-kept grounds* made attractive by green lawns and shrubbery than in a dingy factory with bare and dusty surroundings. There is a money value in pleasant surroundings. Many factories are moving to the suburbs. It is hoped to plan new factory towns better than the old. It is best for city workmen to live in the suburbs among trees and fields. Trolley cars make this possible.

The *successful manufacturer looks after* proper lighting, pure air and water, and safe plumbing. In the best modern factory, the light falls through spacious windows, the walls are white or soft-tinted and clean. Any factory owner

who permits men to work with gas jets burning because of bad lighting, is wasting his money and the men's health. More windows should be cut in the walls. It pays to provide for the comfort of workmen, but if it did not pay, there ought to be no difference. It is our duty to protect the health of our fellowman whether it pays or not.

Any man who loves his country will oppose conditions that weaken the workers. One of the worst sources of weakness is *child labor*. There are hundreds of thousands of children working in the factories of our land. What are the legal limits of the age and hours for child labor in your state? Children with bones still soft and tissues tender and growing are stunted by being put to work in factories, sweatshops, or mines.

Little children not only work in factories, but they work twelve hours a day in some instances. Once, in a country needing soldiers, it was proposed to enlist boys in the army. Then a statesman said, "We must not grind the seed corn." Every one of the six cities having the highest death rate for children are mill cities.

Modern Civilization threatens to destroy the Home. — Competition for wages makes it impossible for some men to marry and support a home. A married couple are much better off if the wife takes care of the home and the man works. If they both work, they earn more money, but their expenses are greater, the home is not so clean, the food so well prepared, nor their conditions of life so healthful. *If a married woman works* she does not have to demand wages large enough to live on and she thus forces other women to take less than living wages. A married woman who works is the enemy of her home, her health, and of women who work and have no husbands to help support

These women have brought their children to a caretaker before going to the factory. It is a great loss to national health that some women have less chance than the lower animals to care for their offspring. The mother who goes out to work and changes the method of feeding the baby cuts its chance of life in half.

Courtesy of National Cash Register Co.

Suction fans carry away particles of dust and brass from the N. C. R. Polishing Room.

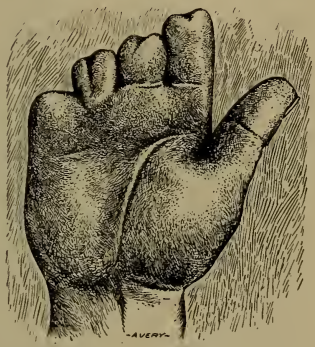
Where the dust is collected.

Courtesy of Mr. Jacob Riis.

Children playing on a Recreation Pier, New York City.

them. When women work in unsanitary factories for long hours, the evil effects are seen in their children and grandchildren.

Idle boys are usually dull compared to boys who work part of the time. Farm work is educative, but boys on the farm should not be overworked or kept out of school. Of several hundred thousand children in the United States who cannot read or write, a large part live in the country. Boys should avoid going into "*blind-alley*" jobs like selling newspapers, blacking boots, or carrying messages. These impart no skill and prepare for no better paid work.



DONE WITH A SQUARE HEAD PLANER. Finger guards on the machines would prevent such injuries.

The *chief sources of danger* to the health in factories are fumes, dust, machinery, and too great heat and moisture. The belts, saws, pulleys, and wheels, if without screens, may cut or crush the workman who falls against them. Much depends upon the workman himself: Nothing can protect a very careless man from injury. Workmen should get "the safety habit" and so work as to avoid risks. The machinery in cotton gins and sawmills is largely unguarded, and maiming and crippling occur daily. The author has gone to European sources for several pictures of safety devices for woodworking machines. Dr. Stresemann of Germany who had just visited many factories in the United States said in 1913, "The conditions in most American factories in respect to safety are horrible."

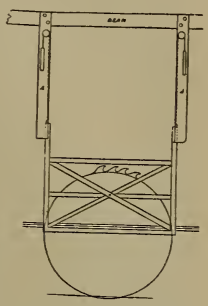
Fumes (from brass, lead, phosphorus, arsenic, quicksilver) shorten life. Workmen in such factories should breath through a strainer until they find work at factories with fume and dust removers. Painters and other workers in lead should keep the hands clean.

Courtesy of Mr. S. C. Close, Welfare Bureau, U. S. Steel Co.

Guards around belts, guard over safety head in planer, self-locking belt shifter.

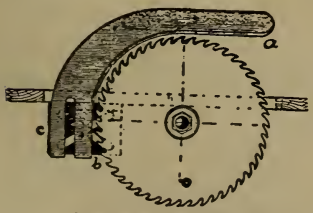
Irritating dusts, vegetable, animal, or mineral, are formed in manufacturing cotton and woolen goods, brooms, ropes, matting, wooden ware, horn and celluloid articles, felt hats, and in stone and metal working. Stone workers and metal polishers lead in the consumptive death rate. *Cigar workers* were next to them; but since the cigar-makers'

union has encouraged care for cleanliness, fresh air, and prevention of dust, they have reduced the rate very much. *Pearl button making* is a very dusty trade and one third of the workers die of consumption. *Laundry workers* are very liable to consumption because of the overmoist air in laundries. Employees in glass works and foundries encounter destructive heat.



Extended splitter. Protecting frame may be raised and lowered.

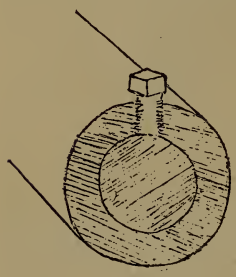
Workers in dusty trades should breathe through an *air filter* tied to the nose. Stone workers and grinders of tools should protect the eyes with *goggles*. Dust should be sucked off through a tube by power-driven blowers. Excessive muscular work and overconfinement in dusty factories are fruitful sources of consumption. What is the use of the state spending millions of dollars on sanatoria and hospitals for consumptives if we are to allow the conditions to continue which prepare the people for the disease and keep up the chances for infection? Smoke and coal dust are believed to cause pneumonia.



Courtesy of British Factory Dept.
Guard for circular saw.

Insurance companies save money by employing physicians to examine the insured, not only before insuring, but frequently thereafter. They discover the beginnings of disease and warn against the incorrect way of living that is bringing it on. Some companies employ visiting nurses to advise and help those who fall ill.

A number of American factories (in Boston, Pittsburgh, Dayton, Chicago, and other cities) are using every possible means to protect their workmen, and to educate them into habits of protecting themselves. The greatest source of danger in factories provided with safeguards is the wrong point of view that many workmen have. They think it is heroic to take risks, but it is merely foolhardy. It shows lack of self regard and of respect for the duty owed to one's family. A man who tries to be a hero by taking useless risks has a false idea of heroism. This false heroism comes from moral cowardice. A man may thrust his arm through a whirling belt to reach an oil can or a monkey wrench for fear that if he steps around the machine for it others will say he has weak nerves. Hence safety training must be partly training in common sense and self regard which forbids the risking of life and limb by taking chances or "showing off." To the successful, self protection and caution become second nature. Those who are reckless usually fail and many of them shorten their lives or go through life crippled and weakened.



Projecting set screws should not be allowed; they have caused many fatal accidents.

References. — American Museum of Safety, 29 West 39th St., New York. Van Schaack's Wood-working Safeguards, Ætna Life Insurance, Hartford, Conn. L. C. Close, Welfare Dept. U. S. Steel Co., New York. Metropolitan Life Insurance Co., New York. National Cash Register Co., Dayton. International Harvester Co., Chicago.

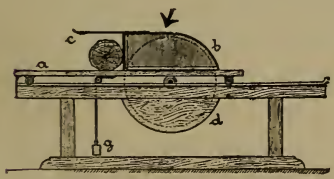
Applying for Work. — A healthy applicant is usually chosen before an unhealthy one. Good health shows itself

Courtesy of New York City Dept. of Child Hygiene.

APPLYING FOR CERTIFICATES OF HEALTH AND FITNESS. This they must do in New York City if they wish to stop school and go to work under 16 years of age.

in clear eyes, fresh skin, prompt attention, resonant voice, and in the way one sits, stands, and moves.

A youth with his hair parted in the middle, his teeth decayed and breath bad, or a youth with his finger nails unclean and fingers stained with cigarettes, and his clothes smelling of them, may have to hunt long for a job. A girl chewing gum, or with high-heeled shoes, small waist, and uncomfortable clothes which are showy, instead of neat, her hair frizzled and her complexion artificial, has less chance of being chosen for work than others of more agreeable and healthy looks.

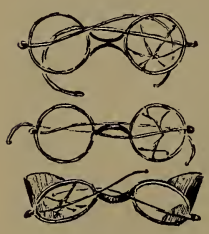


Courtesy of North German Woodworkers Association.

Guard on a cut-off saw.

One who is pale, thin, and nervous from ill health, or one with the vacant adenoid look, is at a disadvantage. To

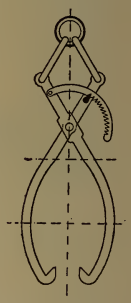
have worked at many places may make an employer suspect that you are unreliable; but if you start into a "blind-alley" job, the quicker you change the better, that is, if you change to work that trains you and leads to more skillful employment.



Each pair of goggles has saved the loss of an eye from a flying bit of steel.

Selecting an Occupation. — A man who has no physical endurance, is not fond of seeing things grow, and likes to be much in crowds, should not try to be a *farmer*. One with bad hearing or weak throat and who is not fond of children, should not become a *school teacher*. One with a delicate frame and little strength will not make a good *blacksmith*.

One who has *weak lungs* should not do work requiring a fixed, bent posture, and should not become a tailor, shoemaker, watchmaker, seamstress, bookkeeper, typesetter, or stenographer. In such work bend at the hips, not at the shoulders. Those with weak lungs and delicate health should not become janitors, stonecutters, nor follow any other dusty trade. In fact, any one who, tempted by high wages, does such work where the employer has not installed fans and other necessary preventives of dust and fumes, and who does not use a protector to breathe through, is making a fatal mistake. Trades which expose one to the fumes of poisonous chemicals, to sharp metallic dust, and those which endanger life or limb, should be shunned. A person with weak lungs should prefer outdoor work.



Safety tongs.

A man of halting speech should not become a *lawyer or preacher*. A *physician* should love natural science, a *carpenter* should be quick in arithmetic and skillful with his hands, a *merchant* should be orderly and of pleasant address.

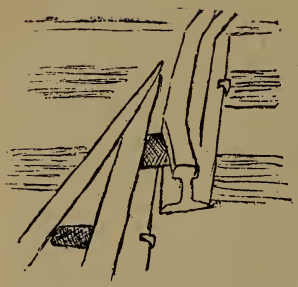
If *the hands perspire freely*, the relaxed condition of the skin should be overcome by means of cold baths, an open-air sleeping porch and simpler, more digestible food;

Courtesy of National Child Labor Committee.

A messenger boy at 10 P.M. This is a "blind-alley" job. See page 267.

otherwise such persons should not apprentice themselves to learn watchmaking, bookbinding, leather working, millinery, dressmaking, or dentistry. One with varicose veins should not become a clerk nor stand long at work.

One whose *skin is very thin or tends easily to eruptions* should not follow bricklaying, plastering, or tanning. A tendency to eczema, or skin eruptions, also unfits one to become a laundress, butcher, baker, painter, lacquerer,



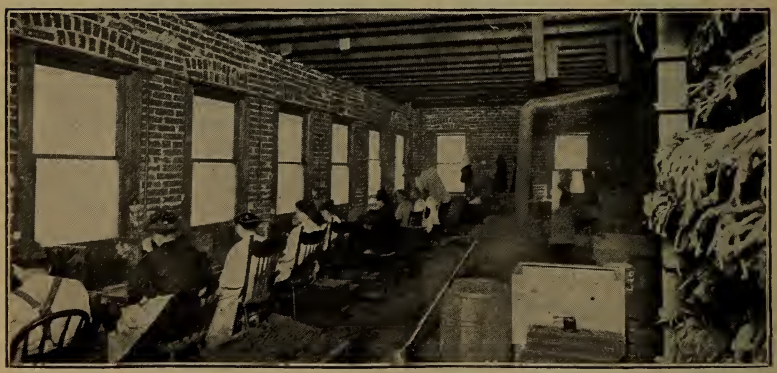
Part of a Railroad Frog. Showing blocks to prevent switchmen's feet from getting caught. Injury to one is the concern of all.

polisher, or cook, for the worker may be often disabled and lose much time.

One who has had a *heat stroke* should not fire a furnace or work under ground, in laundries, or in very hot places. Those who are *color blind* or have weak vision should not be locomotive engineers or trainmen.

Think of these things before applying for work, or you may find yourself doing work that you cannot do well or that puts you out of health. You will not want to keep on, but when you change, you will have to begin at the bottom again.

TEST QUESTIONS. — What is the healthiest life for man? What is the effect of confinement and monotonous work? What are the effects of too long a working day? What is one cause of rheumatism?



Courtesy of Survey Associates, Inc.

A CIGAR FACTORY, Pittsburgh. Cigar makers suffer much from consumption. Notice the leaf tobacco stored in the workroom. This makes much dust, and is against the law. Are the factory laws enforced in your town? The person who took this picture has already died of consumption contracted from cigar makers. This factory is well lighted.

What did President Wilson say about overdriving a factory workman? What is "speeding up"? What is the greatest source of a nation's wealth? What is the effect of pleasant surroundings upon workmen? What is said of imperfect light in the factory? Of child labor? What may be the effect upon the home of competition for wages? What may be the effect of married women working? What evidence is there of improper child labor on the farm? Should a child be reared in idleness?

What are the chief sources of injury to health in factories? What is said of careless workmen? Foolhardy workmen? Give sources of injurious fumes. Of hurtful dust. What do some insurance companies do for health? What are some American factories doing for health? Why do some men take useless risks?

CHAPTER XVII

A SOUND BODY CONQUERS DISEASE

You have no doubt wondered at those magical little warriors, the *white blood cells*, whose activity was described in the first chapter. This is only one of the many wonders of the body. The *nerve cells* are another of the many kinds of interesting cells that make up the bodily community or city. Like judges and teachers and officers, the nerve cells show the other cells when to act, for the bodily city, like our own people, is self-governing.

The heart is the most tireless and wonderful pump that exists. When there is a *great battle* on against a multitude of hostile germs, it is necessary to send the white cells in a hurry against the enemy, and bring up fresh ones for reënforcements; so the nerve captains stir up the heart to beat fast, and command the road workmen to widen those wonderful roads, the blood tubes, along which the warriors are to march. This state of activity of the body is called a *fever*. If you were to put your hand over the heart or your finger on the wrist of a person with fever, you would find the heart and pulse beating fast; you would see the skin flushed because of the opening of the roadways for the blood. *If the fever becomes too high* and the body too hot, then the nerve cells call for water, and order the sweat cells in the skin to deposit water and cool the body as it dries off the skin, and so take away the fever.

The wise physician does not interfere with the efforts of

the body to cure itself, and he tries to keep others from meddling. The more ignorant a person is, the more he wants to meddle with his body, and the more ready he is to tell others how to cure themselves. He is sure that the drug advertised in the newspaper is the magic potion needed. The wise physician knows that in a body which has not been

From "The Bitter Cry of the Children." (The Macmillan Co.)

NIGHT SHIFT IN A GLASS FACTORY. These boys walk 20 miles in 8 hours carrying hot bottles from work benches to the cooling ovens. Work builds up, overwork tears down. These boys cannot hope to develop bodies strongly resistant to disease.

greatly abused, most diseases are self-limited; they tend to get well of themselves if not made worse by blind meddling.

It is better not *to check the symptoms* (or signs of the struggle) of disease. A *cough* is only Nature's way of blowing dust or phlegm out of the throat or lungs; the stupidest thing to do is to take a patent "cough cure," and dry up the cough with the opium or other poisonous dope

which it contains. If it is to do its purifying work, the cough must loosen instead of dry up. At the same time strive to avoid breathing dust, or inflaming the throat by sudden chilling of the skin. When you begin to injure your lungs, Nature usually warns you by making you *sneeze.* If you do not take the warning, and get away from the dust or the cold, the friendly sneeze may not warn you again. The lungs were made for air, not for dust, although the lining cells of the windpipe have waving hairs, called cilia, which serve as chimney-sweeps to safeguard the lungs against a certain amount of dust.

The vapor bath is used to refresh the skin after the weakening effect of much clothing.

If you *lose appetite* the stomach is needing a rest; do not eat until you are hungry again; those who think themselves wiser than Nature will try to arouse appetite with dainties, or with mustard, pepper, and vinegar. The natural flavors of wholesome food will awaken the desires of the body cells when food is needed. If there is *a rash* on the skin, let it alone. Do not try to "cure" the rash, but try to purify the body by living differently. *If you are sleepy,* go to sleep, do not try to keep awake with strong coffee or tea. We can gain nothing by scorning the well-proved laws of health. Nature tries to keep us well, why not permit it? Wise physicians do not allow patients to be waked up to take medicine.

If *a pain* comes, do not dope it with cocaine or something else. Remove the cause, and live so as not to bring it back again. If *a corn* forms on the foot to protect the ten-

der nerves and blood vessels beneath from an ill-chosen shoe, do not put a corn ring on it; this will only force it to stand out more. Listen to Nature and throw away the shoe: or, if the shoe is too small, cut a hole in the leather. If too large, have an insole put in. Otherwise walking will become punishment and you may acquire a stumbling or strutting gait as well as a permanent corn. Ill-fitting shoes are not the only cause of deformed feet; "flat-foot" may come from flabby habits of life. Sound, strong feet do not get corns quickly, or cause a cold every time they are wet, or remain cold while the body is warm.

SOUTHERN HOME with wall of slats and shutters to keep out sun and admit gulf breeze. A home without an open air sleeping place is as lacking as a home without a bathroom.

If you are thirsty, drink water. If not thirsty enough to relish cool water, do without drink. *If perspiration* comes, let it stay; to wipe it off would only hinder the effort of the body to cool itself. But do not rush out into cold air when perspiring; the body would not have started to perspire if the cells could have foreseen that.

If you are tired, rest; do not arouse yourself with a stimulant drink. When you feel bad, you may not want to work, and there will be a good reason. For example, if a cold is beginning and you take a rest, perhaps go to bed for a day, the cold may stop or be a very slight one; but by

keeping at hard work, the strain of fighting the germs of the cold, plus the strain of work, may prove too much for the cells, and the cold may run into influenza.

It is best to follow *natural ways; that is, the ways most closely like those which the race followed as the body was developed to its present state.* Living naturally is the only way to insure health. Most people believe there is some short cut to health. There are many rascals, as you have learned, ready to take advantage of this *belief in a cure-all.* Other people that want to cheat Nature make *a fad* of one thing after another, each of which may have a little good in it. One year it is the water of a certain spring, another year it is hot water to be drunk in immense quantities; they keep at this until the stomach is relaxed by the heat and stretched by the load. The next year the fad is sour milk; another year it is a certain kind of undergarments; the next year the fad will be a serum; and so it goes. It is as sensible as Ponce de Leon's belief in a fountain of youth. If a man breaks down his health drinking alcohol, a drug cannot cure him even if it has gold in it. Drunkards are now sent for treatment to farm colonies where they work out of doors and return to more natural ways of living. Dogs that live in the city often have the mange. Dairy cows take tuberculosis; cows on the range do not. Domestic fowls die readily, while quail do not. Our horses have many diseases which wild horses are free from.

When *an overworked city man* sees that he must break off, or break down, taking tonics and beer will be useless. The constant tired feeling shows that the cells are using more energy during the day than is replaced during sleep, and nothing can prevent bankruptcy except a change in his home or business conditions. He has been undermining

his general health. An acre of ground in the suburbs for his garden or orchard or chickens, to keep him at work out of doors a part of his time, will do more for his health than a sanatorium or hospital. At the same time, his orchard, garden, and poultry will supply more wholesome food than he could buy in a market. But if he waits too long, he will have to go to a hospital with little chance of ever being sound again. A "preventorium" is better than a sanatorium.

One should not be stubborn when Nature warns him. Giddiness upon suddenly rising shows that the body is not in good condition. Constipation warns not to sit continually (one can stand even while writing), but to walk more, and perhaps to drink more water, and to eat rougher food. Cold feet show sluggish blood flow, usually from lack of lively exercise or from too warm clothing or house.

If one's hair begins to fall out and dandruff is abundant, this proves he has been starving, smothering, and overheating the scalp. His hair needs the fresh-air cure. He should not wear a hat in cloudy weather or on the street car, or when working in the garden, or on the street at night except during a cold wave. Frequent and thorough washing of the scalp may restore its vigor. This is better than to insult the cells in the scalp with a dirty "hair restorer."

Fat is the savings bank of the body, but too much of it is a danger signal, a sign to change one's habits (eat less and work more), or the fat will become oppressive and shorten life. *Headaches* or a bitter taste in the mouth may be a sign of indigestion. This does not mean to begin fussing about diet, starving, taking drugs or beef pepsin, but to mend the ways of living. It may be the part of wisdom to seek more open-air life and natural surroundings. But if a

man continues a slave to business, as if money were the only thing in the world, he may find at fifty that by the deposit of earthy salts in his arteries, they have become as

An overworked city man at the first sign of weakened health should move to the suburbs where there is fresh air, quiet, and plenty of room out doors.

stiff and weak as a piece of old rubber hose; there is no elasticity and soundness left; a man with hard arteries or a bad heart cannot climb stairs or run a hundred yards without half smothering.[1] The idler is at the other extreme. A "short life and a merry one" usually means headaches and rheumatic pains, a "sour stomach and sourer thoughts." Some people who do not work are tired most of the time and keep trying to guess what it is they eat that harms them. Idleness is the heaviest of all oppression.

Girls in New York city schools taking gymnastic drill in open air. This is better than indoor exercise.

Young people should lead a simple life. A mother may expect *a daughter* to lose her rosy cheeks and freshness if, besides going to a high school with a crowded course of study, the daughter devotes strength to music, art, and parties. This is the road to becoming a chronic invalid instead of a home maker.

Girls, the future women of the nation, should have every advantage of health that boys have, and chief of these is

[1] Hardening of the arteries means hardening and loss of elasticity in the tissues in general. The body has been so inactive that it has not purified itself, and Nature had to use this material, the best she could get, for repairs.

loose clothing. A baby hampered by uncomfortable clothes will kick and scream and become frantic with rage, but a young miss will peg along demurely on high heels with toes pinched, head top-heavy, arms restricted, and waist cramped. Only a few are silly enough to believe the absurd beauty hints in the Sunday newspapers. Health is the only secret of beauty. Beauty and grace must be earned; powder and paint, tight shoes and tight clothes, only bring more ugliness and awkwardness to the beauty seeker. She fails because she follows artificial instead of natural ways.

The body tends so strongly to health that wrong living must be persisted in for a long time before health can be destroyed. There is a certain *amount of reserve force* natural to every healthy animal body. Man is able to use up this reserve force when he is under the influence of alcohol, drugs, or excitement. A person may be very tired; if alcohol or excitement drives off this feeling for half an hour, he will then feel more tired than ever.

You have learned of *the body's many defenses against*

FAT MAN AND THIN MAN. The "bay window" of the fat man is a sign of decay, and that he will not reach three score and ten. He has very little endurance, yet the "work cure" is all that will help him except eating less, for he has fed too often and too well.

The thin man seems to be trying to "lean on his liver." He stands so as to squeeze his lungs.

Photographs from Dr. Louis J. Cooke's Manual of Personal Hygiene. Used by courtesy of author.

disease germs — of the outer barrier, or skin; of the inner barrier, or mucous membrane; of the germ-killing mucus, saliva, and gastric juice; and of those two great defenses in the blood, the serum and the white cells. You recall how the white cells slowly change shape, flow around disease germs, engulf, and digest them; in other words, they eat them. Thus the body escapes disease. But this does not always happen. The cells may have been paralyzed by alcohol or other poison. The germs may destroy the cells, live, multiply, and form toxins. The body, from overwork or strain, may not manufacture the antitoxin needed fast enough to conquer the disease promptly. The disease is more likely to be severe when the body receives a large dose of the germs at one time, or when the germs are a kind the body cells have never fought before.

The body is usually supplied with *a stock of various antitoxins* for all the toxins it has encountered, and is ready to manufacture more when needed. The white cells know how to combat all the germs they have experienced. The body can be prepared thus because a few of the germs of each disease have occasionally reached it and trained it to defend itself. When a person goes to Porto Rico or the Philippines or some other place with climate and germs such as the body has not been used to, the body has for a while a harder time defending itself. The strange new germs strike it down with illness. This means that the body has given up all other work except that of acquiring power to defend itself against its new enemies.

Sometimes the body recovers from the disease without killing all the germs; it merely learns how to keep down their numbers and prevent their multiplying. This is the case, for example, with typhoid and diphtheria "car-

riers." *Disease is the process the body goes through with in adapting itself to new conditions.* Americans that go to the Philippines usually become "acclimated" (that is they become used to the climate and germs), within a few months. If they drink alcohol the white cells may never conquer the germs of the new country.

The *adaptation of the body to new disease germs* is believed to take place in this way: At first the devourer cells, or white cells, do not like the strange germs and will not eat them rapidly; so the body learns *to form a sauce* (*opso'nin*) which either weakens the germs so that they do not multiply rapidly, or causes the white cells to relish them and eat them up quickly. The devourer cells, it seems, will not eat all kinds of raw bacteria, but want them prepared with a sauce, and they want each kind of bacteria to have its own proper sauce (or opsonin).

Persons are not all alike in their power to resist different diseases. When diphtheria or scarlet fever spreads, only a few acquire the disease. Those who escape have greater resisting power; their army of defense seizes the germs and destroys them, instead of allowing them to increase in numbers and make poison. If the disease gets a start, some persons, because the body is able promptly to manufacture antitoxin, and the blood cells quickly devour the germs, suffer very little and recover quickly. There seem to be different strains of the same kind of germ, as you have already learned. At one time a mild form of the disease spreads; at another time, a severe form spreads. Some think that the germs are made more poisonous[1] by living in very vile human bodies, and that if one must catch a disease, it is better to take it from those whose robust bodies have

[1] Experiments on guinea pigs indicate this.

weakened the germs and lessened their power to multiply.

At times a craze for health sweeps over the country, and every one is ready to do almost anything for health in a public way, provided most of the burden falls on public health officers. They are ready to do anything for health

Campfire girls seek nature's ways.

except the *things which count the most*, such as stopping useless self-indulgence, and following simple, natural ways.

Public sanitation, by preventing sources of infection, is none the less necessary because a vigorous body conquers disease. One can hardly keep his body vigorous all the time, and the condition of the body affects the fighting power of the devourer cells and the power of the tissues to form antitoxin. It is the duty of each to avoid causes of weakness so that he may resist disease, not only for his own sake, but for the sake of the community. For a diseased citizen is not a good citizen, and is often a dangerous one.

TEST QUESTIONS. — What are the fighting cells in the body? What is the duty of the nerve cells? Tell things that happen in the body during a fever. What is said of meddling with the body? What is done for the body by a cough? What should one do if the appetite

is lost? If one becomes sleepy? If a corn begins to form? If one is tired? What are natural ways? What is said of fads? What are the proofs that natural ways are best? What course is advised for an overworked city man who is losing his health? What do cold feet show? What is shown by falling hair? Excessive fat? What happens to the arteries after years of wrong living? What is said of the health of girls? What is said of the reserve force in the body, and how it may be used up?

What are the defenses of the body? When does the body have its hardest battles with germs? What is said of germs which are entirely strange to the body? What has happened when one remains a carrier of disease germs? What is disease? What is an opsonin? What is said of different strains or races of the same disease germ? What is it that counts the most for health? Why will the public prevention of infection never cease to be necessary? Why is health necessary if one wishes to be a safe citizen?

Illustrated Studies. I. Draw on blackboard and explain figures, pages: 205, 208, 220, 221, 223, 228, 231, 248, 252, 253, 256, 257, 262, 269, 271, 272, 274, 276, 286, 291.

II. *Questions on pictures:* Describe the adenoid face. Just where do adenoids grow? How do pupils at flat desks lean? State two ways to get a proper slope: p. 213. Name the four cities with highest, and four with lowest, death rates. Describe a sterilizing plant. How is a room made ready for fumigation? Do the sixteen flats of the open-stair house all have bathrooms? Outdoor entrances? Can the 7-cent lodging house be kept sanitary? Describe the three ways of cleaning Washington's streets. How may a well be made a typhoid well? Describe a tubercular country home. Where do flies hatch and visit? Describe facial expression of a hookworm victim. How long is a hookworm? How may health and dwelling house affect each other? p. 254. Describe iceless coolers: p. 178, 258. What kind of windows has the factory with green lawn and flowers? What is safe clothing for a factory girl? Describe sweatshops. What mothers cannot treat their babies fairly? How may dust be removed from factories? How prevent accidents from belts? Circular saws? Splitters? Revolving shafts? Cut-off saws? Flying particles? Log tongs? Railroad frogs? What change of position should be made by the workers in the cigar factory?

The layers of the skin that germs cannot pass.

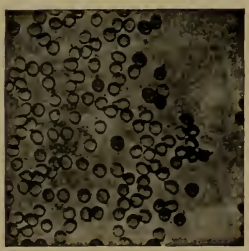
The mucous lining stops and the mucus kills germs.

The serum of the blood (shown separated from the clot) that forms antitoxins and opsonins.

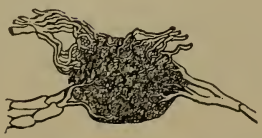
Cells of the liver that destroy poisons.

Cells which form saliva that kills germs.

Gastric glands which form a juice that kills germs.



Blood cells. A white cell (larger than the red) is seen to the right.

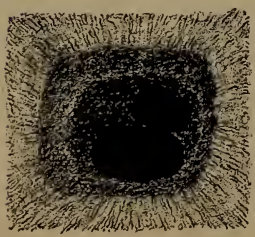


A lymph gland which filters the tissue juice, or lymph, before it reaches the blood. These glands are the favorite dwelling place of the white cells which act as sentries and capture and feed upon germs before they reach the blood.

These figures are from "The Hygienic Physiology," a book devoted to personal hygiene.

THE MANY DEFENSES OF A HEALTHY BODY

By courtesy of the Rockefeller Institute of Medical Research.



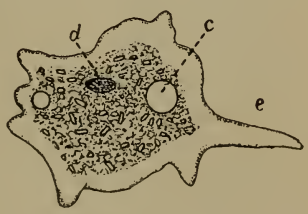
TWO PHOTOGRAPHS (through microscope), taken 48 hours apart, of the same bit of TISSUE REMOVED FROM THE HEART OF A CHICK and kept suitably warmed and nourished. This marked growth of cells and their fibers shows that cells have a vitality of their own; hence the body will keep itself sound if our cells are allowed the simple conditions of life which they need. (Part of the larger photo is not shown.)

CHAPTER XVIII

CELLS AND TISSUES

GLADSTONE said, "It is the first duty of a statesman to care for the people's health"; it is the first duty of the citizen to care for his own health. If *personal hygiene* be neglected, efforts for public health will be in vain. To care for the body intelligently its structure or *anatomy* must be learned and its mode of action, or *physiology*, understood.

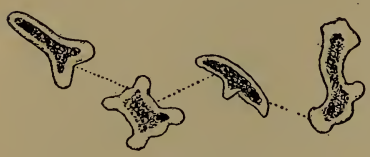
The small units of which the large unit, called the body, is made, are called *cells*. The cell is a particle of living substance containing a *nucleus*, or center of activity. A bodily cell resembles a one-celled animal. You learned that a disease germ is a one-celled vegetable. One-celled animals and vegetables and bodily cells can be seen only with a microscope.



THE AMEBA (magnified). It moves by pushing out a false foot, *e*, and flowing into it. See figure on next page.

The figure on this page shows a microscopic view of a one-celled animal called the *ame'ba*. It contains a nucleus, or active center, *d*, a contractile bubble, *c*, which swells and shrinks. At times the ameba sends out finger-like projections, *e*. Like other one-celled animals it does not die of old age; it is immortal. Later in life, instead of dying it will divide into two smaller cells. A portion of the nucleus goes into each cell and they soon become as big as the first one was.

Any animal large enough to be seen with the unaided eye is made up of many simple cells living side by side and helping each other in a brotherly way. We shall learn that large animals have many advantages over one-celled animals. They also have a disadvantage, which finally results in death: — The ameba takes oxygen from the water with the whole surface of its body. It swallows a food particle that touches it anywhere simply by engulfing it or wrapping itself around it. Any undigested portion is easily thrown out. The cells of the larger animals interfere with each other since all cannot be on the surface where they can reach food and easily rid themselves of waste material.



The path of a crawling ameba and its four shapes after each half minute. (Magnified.)

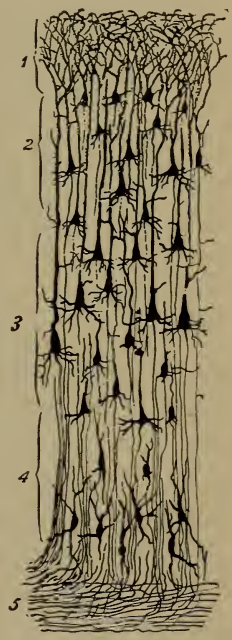
Venice, you know, has streets of water. We could hardly imagine a city without streets or roads and without ditches or sewers to drain away waste. So in *the community of cells forming the human body* certain cells make liquid roadways called blood tubes (see figure, page 315) to serve these purposes; other cells form muscles which are admirable for movement; the nerve cells become teachers and governors. The skull is the governor's palace, and the cells in the nerve centers there send out messages on long branches which serve as telegraph wires for this wonderful community. The cells lining the digestive tube are like farmers and turn crude material into food ready for use by the cell-citizens. See the figure on page 10; it shows five kinds of cell-citizens.

Some of the cells, most wonderful of all, are like soldiers and policemen, to protect from public enemies. These are the *white blood cells* which destroy bacteria and other dangerous enemies by simply swallowing them whole and digesting them. There is no graveyard in the community; dead or injured cells are disposed of by white cells in the same way. A place that is sore and swollen usually means that the white cells have crowded to a bruised or injured spot or a point of infection, that they may devour the dead cells or the

invading germs. This is also called an inflammation. After the dead cells are removed, other cells called plasma cells subdivide and turn their own bodies into new tissue to replace the tissue removed by the white cells. Have you ever seen how the white cells remove a splinter from your finger? Thus the cells work together and help each other to keep the body sound and strong. No change in any cell in the body is a matter of indifference to any other cell in the body.

Do any of the cells, like naughty citizens, ever become selfish or quarrel? In a healthy body every cell works for the common good and for itself; but cancer cells only eat, they will not work. They are criminals who rob and poison neighboring cells. Death of the body follows cancerous growth unless it is promptly removed by a surgeon.

To the Teacher. — To make sure that the pupils get a definite idea of each tissue it will be well to appoint several pupils to draw on the blackboard, ready for use in recitation, the six figures of tissues referred to below. This plan will prove helpful in other lessons.

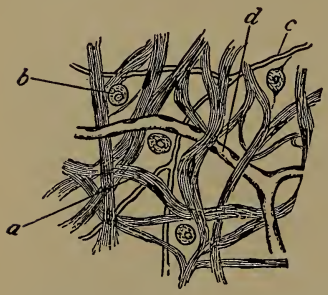


NERVE TISSUE from the brain. Note the delicate arms by which nerve cells keep in touch with one another.

Similar cells, side by side, doing the same kind of work are said to form a *tissue*. The cells in a tissue look alike and act together. To understand the structure of the body it is first necessary to know the different tissues and their work.

Nerve tissue is composed of cells with many branches; these cells are capable of receiving and transmitting messages. See figure on this page. *Muscular tissue* is made of long cells that have the power of shortening and lengthening, spoken of as contracting and relaxing. (See figure, page 318.) The nerve and muscular tissues are sometimes called the master tissues, while the other tissues are called the supporting tissues.

The cells in *connective tissue* have formed a great abundance of long *fibers* which help to make the organs, or the working parts of the body, by holding the other tissues in place in each organ. See figure on this page.



CONNECTIVE TISSUE. Notice cells (dark) among fibers, free cells, *b*, and a tiny blood tube, *d*, to bring food.

The outer layer of the skin and the lining of the mouth and digestive tube are made of *epithelial tissue.* See first two figures on page 291. It has no fibers, and its cells are packed closely together, like bricks or tiles in a pavement. Germs may infest the skin but they are harmless unless they penetrate the epithelial tissue. These cells protect, but other epithelial cells form pocket-like or tubular organs called *glands*, with tubes, called *ducts*, to empty them. Glands secrete, or form and deposit, useful fluids called *secretions.* Secretion of wastes to be cast out is called *excretion.*

Fatty tissue is soft, for it is composed of round cells filled with oil and of connective tissue fibers which hold the cells together.

Bony tissue is a hard, stiff tissue, for its cells deposit enough lime to take up most of the room. In bony tissue there are many small cavities filled with a red marrow (see figure, page 297), and some long bones have large hollows containing yellow marrow which is chiefly fatty tissue.

Cartilage tissue, or gristle, is very tough, for it has more fibers than cells.

Fibers are thread-like. *Membranes* are skin-like sheets. The *mucous* membrane is seen on the lips. It lines many

inner organs and keeps itself supple by secreting a slimy fluid called *mucus*.

TEST QUESTIONS. — Define anatomy, physiology, cell, nucleus. What does a cell resemble? Sketch an ameba and name its parts. What becomes of amebas that are not killed? What advantages has a one-celled animal? What disadvantage in a many-celled animal leads to its death? Of what are the smallest blood tubes made up (figure, page 315)? Compare the body's cells with members of a community.

Describe what happens at sores and swollen spots.

What is a tissue? Describe the parts making up each of the following tissues: nerve, muscular, connective, epithelial, fatty, bony, cartilage tissue. Define gland, duct, secretion, excretion, fiber, membrane.

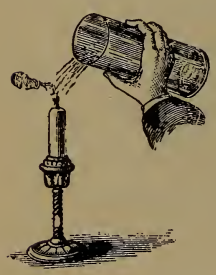
Microscope view of BONY TISSUE, showing the holes for the blood tubes and the encircling cavities where the bone cells lie.

CHAPTER XIX

SOURCE OF THE BODY'S ENERGY

LIGHT, sound, electricity, heat, motion, chemical action, are all forms of energy. The total amount of energy in the world is always the same. *No energy is ever destroyed*, but *energy in one form can be changed* to energy in another form. For example, the energy of motion is changed into heat if you rub a button on your sleeve for several minutes (try it).

Heat and motion are being constantly produced in our bodies by a chemical action resembling combustion or slow burning. (*Chemical action* binds two or more substances together into a compound or breaks up a compound body into two or more simpler ones.) The heat produced in the body is about equal to the heat from the continuous burning of two candles. The amount of work which the body can do in one day would lift 900 tons one foot high.



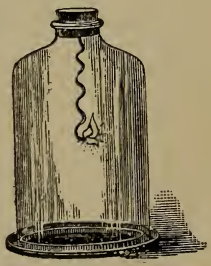
Carbon dioxid, a heavy invisible gas, can be poured down in the direction of the lines and will smother out a candle.

What supports this burning in the body? The breath supplies the air to the fire, and the food we eat supplies the fuel. As in a stove or furnace fire, the chief part of the air used is *oxygen* gas and the fuel is chiefly *carbon*. Just as *carbon dioxid* gas is the chief substance resulting from coal (carbon) in a furnace, so it is the chief waste product of the life process. Carbon dioxid is heavy (see figure

on page 298); it gets its name because it is composed of carbon and oxygen. The process of uniting is called *oxidation*. Very rapid oxidation is called burning. One fifth of the air is oxygen. Oxygen is so active a gas that iron will burn in pure oxygen. See figure on this page.

About one eightieth of the body's weight is consumed daily; at this rate *the fasting body* would consume itself in 80 days. Records of starvation show that death occurs when about one half of the body has been consumed, or in about 45 days. The life process keeps the body at a temperature of $98\frac{1}{2}°$. A few degrees above or below this temperature, consciousness is lost.

Heat is a product of life; it also supports life. Heat makes the egg to hatch and the seed to sprout. The living body supplies the proper conditions for the slow gradual union of food and oxygen. The heavy inactive gas, carbon dioxid, results, and leaves the body in the breath and is carried through the air to the plants.



An iron spring burning in pure oxygen gas.

The chemical energy of the food and oxygen is given up to the body, but *where did the food and oxygen get their chemical energy?* They got it from the plants and the plants got it from the sunlight. The sunlight falls upon the green leaf of the plant and enables the leaf which has absorbed carbon dioxid from the air to split the inactive gas into two parts, carbon and oxygen. The gas oxygen is sent out into the air ready to be breathed; the carbon is stored up by the plant in sugar, starch, oil, or other food. See figure on next page. Carbon dioxid is sometimes called carbonic acid gas.

Every fruit, every seed is a little bundle of solar energy ready to make a new plant or to give its energy to animals that eat it. So you see, *the plant gathers energy from the sunlight, the animal uses that energy in the body.*

The more energy you expend in work, the more you must eat,

and the faster and deeper you must breathe. The colder the weather or the thinner the clothes you wear, the more heat the body must make in order to keep warm. So in cold weather we must eat more and breathe more, just as we put more fuel in the stove and turn on the draft a little more to keep the house at its usual temperature.

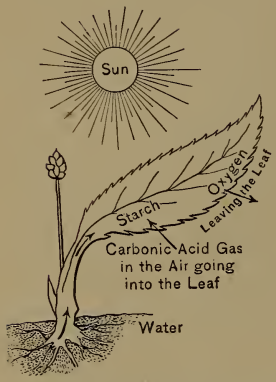


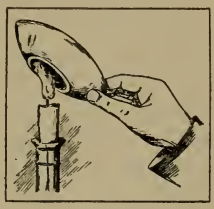
Diagram to illustrate that the plant, helped by the sun, stores up carbon in starch and gives out oxygen gas.

The body stores up part of the food as sugar in the blood and as animal starch in the muscles and liver ready for instant use; this is like the coal already in the hot furnace of the locomotive. Some of our food we store up as fat in fatty tissue to be used only in an emergency after the sugar and starch are exhausted. This is more like the coal in the tender of the locomotive. Food is also used to repair the cells and tissues. This corresponds to the iron and brass with which the locomotive is repaired. But we should not think the body is a mere machine. No mere machine could care for and regulate itself as the human body does.

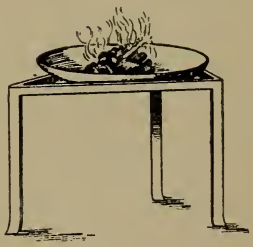
The food used for growth and repair is called protein. Protein is always made partly of nitrogen. The food we eat is of *three kinds;* — coal foods (or fats and oils, sugars and starches), proteins, minerals. When sugars and starches are burned in the body, *muscular work* is chiefly produced; when fats and oils are burned, *heat* is the chief result. Do not think that fats produce heat merely, sugars produce work merely, and that proteins only *repair tissue;* protein produces heat and energy also. Hard workers feed the furnace of life plenty of sugar to prevent the muscles from wasting away. Surplus sugar is turned into fatty tissue.

The *energy in any food* is measured by finding the amount of heat and motion set free by it on complete burning in

oxygen. The *calorie*, or heat unit, is also used as a food unit. It gives an exact measure of the heating power of food, a less exact measure of its energy power, and a still less exact measure of its tissue-building power. Fats and oils, sugars and starches, are called *carbon foods*, or *coal foods*, because they contain much carbon. See the two figures on this page.



Soot (carbon) from half-burnt tallow blackens the saucer.



Heat sugar on a stove. Notice that it is charcoal (carbon) when half burned.

Mineral foods help the proteins to build tissue. The chief mineral substances used as food are water and common salt. We need iron for our blood and lime for our bones, but we cannot use iron filings or lumps of lime as food. Iron and lime must be *prepared for us by the sun and the plant*, and we eat them in plants or in the flesh of animals that got them from plants. Tomatoes and beef are both red because of the iron in them (iron rust, you know, is red). Milk contains more lime than lime water. Our bones cannot use the lime in lime water, for it is in the mineral state; it would not help us and might even hinder digestion. We must get lime for our bones from milk, grains, and other foods.

THOUGHT QUESTIONS ON THIS CHAPTER. — Why should there be a balance between the income and outgo of the body? If one eats less food each day than the body needs, what happens? What happens if one eats more than the body needs? A boy from 9 to 13 years needs as much food as a man. Why? Between 14 and 19 years he needs more. Why? What are the years of fastest growth? A girl older than 11 years requires as much food as a woman, though she works

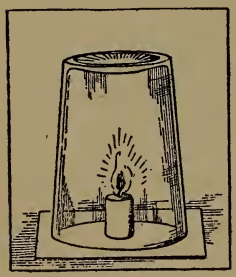
less. Explain. Who will need a larger proportion of tissue-maker in his food, a child or a grown-up? Why? One who begins to train for a contest, should increase the proportion of protein. Why?

Beginning about 50 years of age the food, especially the protein, should be diminished about one tenth during each decade. Explain why. At about what age are men and women most likely to acquire a double chin and grow fat? At about what age are old people apt to become lean and wrinkled?

The strength increases during sleep. Why? Does sleep change the looks? Why is the last hour of sleep called the beauty sleep? What balance has been lost if one gets very fat or very thin? If one eats less than is needed for the day's work, why must there be a loss of weight? What is then consumed in place of food? Will loss or will gain in weight probably result from increased sleep? Shorter sleep? Cold baths? Warmer clothing? Long walks? Cold weather? Idleness? Increase in amount of coal foods? Draw up a plan of living to reduce weight. To increase weight.

Test Questions. — Name several kinds of energy. Is energy indestructible? Give examples of change from one form of energy to another. Name two kinds of energy produced by the body. What is their source? What is said of oxygen? Carbon dioxid? Define oxidation. Why does doing without food result in death? What is the normal temperature?

What becomes of the carbon dioxid given off in the breath? Where does the plant get energy with which to split the oxygen from the carbon? What does it do with the carbon? What becomes of the oxygen? Why do we have keener appetites in cold weather? Compare food in the body and coal in the engine. Why is the body not a mere machine?



If a glass is placed over a candle, it will burn only until the oxygen is used up.

What element does protein food always contain? What are the three kinds of foods?

What do the several kinds of foods do for us? Name the four coal foodstuffs. How prove by experiment that two of these contain carbon? Why can we not eat iron and lime as food?

CHAPTER XX

THE CONTROL OF THE BODY

THE cells of the body work in harmony with each other largely because of *chemical substances* given off by each cell *which act as messengers* between them. An example of this is when the white cells are attracted to dead or injured tissue by the substances such tissue sends into the bloodstream. Germs are found and attacked because they make their presence known in the same way. A hunting dog is drawn to a rabbit by the odor it gives off.

The nerves also help the various parts of the body to know each other's needs and work in harmony. If the nervous system is like the telegraph system with its wires, the system of chemical messengers is like the post office system with its letters.

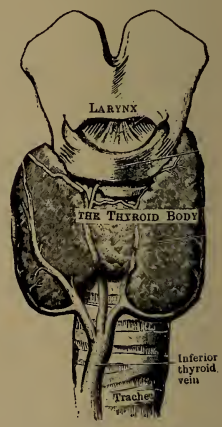
The chemical messengers of the body are called *hor'-mones.* A hormone must be able to pass quickly through the walls of blood vessels so as to reach the parts to be stimulated, and it must be easily destroyed by oxidation or otherwise so that its action may come to an end promptly. The organs in the body called *ductless glands* have as their only known function to form chemical messengers, or hormones. These glands have no ducts; they form internal secretions which pass directly into the blood that is always flowing through them.

There are two small ductless glands, called the *adrenals*, lying one on the upper end of each kidney. See figure on

ADRENAL GLAND, sliced through. It grows on kidney but is not related to it. *v*, vein.

this page. The cells composing these glands are remarkable for the large amount of granules they contain. It is believed that these granules readily change into a hormone called *adrenalin.* When this occurs the adrenalin passes into the bloodstream, causes a tightening of the blood vessels, and *raises the pressure* at which the blood is flowing. When a drop of adrenalin is put under the skin, the spot becomes perfectly bloodless.

When a man or beast sees *a sudden danger*, the adrenals at once secrete adrenalin, anger rises, sugar flows from the blood to the muscles, the muscles become stronger, the blood pressure rises, and the heart becomes stronger, fatigue and exhaustion disappear, and the man or beast is thus made ready to conquer the enemy or overcome the danger. Most remarkable of all, under such conditions the blood clots more quickly, so that if a wound is received in the contest it is less liable to prove fatal.

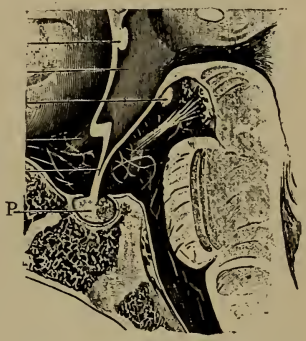


THE THYROID BODY, or gland, on front of windpipe.

The *thyroid gland* is a soft lump in the neck. It can be felt on the sides of the windpipe below the Adam's apple. It consists of two oval bodies connected by a narrow band. See figure on this page. *If extract of a sheep's thyroid* is given, the pulse is quickened, appetite is increased, output of protein rises above the intake, fat is diminished. *If the thyroid shrinks* or loses its

function, mental activity is blunted, connective tissue beneath the skin thickens, hands and face appear swollen and puffy, pulse is slowed, and the temperature falls below normal.

In the bone forming the floor of the skull there is a deep depression dipping down nearly to the nose. Lying snugly at the bottom there is a small onion-shaped body, the *pitu'-itary* (see figure on this page). It stimulates growth, especially of the bones. If its *front half is removed* or becomes diseased, *a dwarf* results, for the bones of the animal do not grow. If *it becomes enlarged*, there follows an abnormal growth of the hands and feet and lower jaw. If the disease occurs during childhood, then, in response to the pituitary hormone, the bones of the trunk and limbs attain great length and *a giant* is the result.



THE PITUITARY BODY, *P*, in a deep pit at base of brain.

Thus you see the ductless glands are both important and powerful.

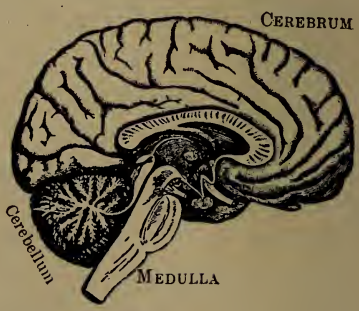
The Nervous System. — Chemical messages must be carried by the bloodstream. *Nerve messages* travel much more quickly, for they pass along nerve fibers. The nature of the nerve message is not known. Some physiologists hold that it is electrical. Others think it is a wave of chemical change like that which travels along a train of powder when one end is lighted. The hormone messages about which you have already studied travel only between the inner parts of the body, but many of the nerve currents start at the surface of the body and guide us in our relations with the outside world.

As you have learned, nerve cells have much longer branches than other cells. These branches, or nerve fibers, bring all parts of the body in close communication with one another. A complete nerve cell is called a *neuron*. It consists of a gray *cell-body*, many short branching *fibers*, and one long fiber, *the axon*. See figure, page 295. The axon has a white fatty covering. The nerves which carry messages between various parts of the body consist of many axons bound together (see figure on this page). A cluster of cell-bodies is called a *ganglion*.

A NERVE cut across and enlarged to show its fibers.

Nerve fibers are of two kinds: sensory, by which impressions are received, and *motor*, by which impulses are sent. The sensory nerves come from the skin, mucous membrane, and other organs whose condition must be reported. The motor fibers go to the muscles, glands, and other organs which are to be excited to action.

The brain is in the hard skull and looks not unlike a beef's brains. It is divided into right and left halves by a deep trench. The largest part, the part with which we think, is called the *cerebrum* (see figure on this page). The portion beneath the hinder part of the cerebrum is called the *cerebellum*, or little brain. It serves to harmonize action when several muscles act at once.



THE HUMAN BRAIN, showing its folds, or convolution.

The brain is gray on the outside because the gray cells lie on the surface in a layer called the cortex ("bark").

See figure on page 306. The brain is mainly white beneath the cortex because of the white fibers which connect all parts of the brain and pass down to the spinal cord.

SPINAL CORD and roots of a pair of spinal nerves.

The *spinal cord* is in the spinal column. Like the brain it is divided into right and left halves; but, unlike the brain, its gray matter is within and its surface is white, for its fibers run near the surface. See figure on this page. Nerves pass out to all parts of the body through openings between the vertebræ.

Movements are of two kinds, voluntary and involuntary. The involuntary, or *reflex movements*, follow quickly the exciting cause; for instance, when the finger touches a hot stove, or something touches the eyelids, or when the mouth waters at the sight of food.

SYMPATHETIC SYSTEM, its nerves and ganglia (one of the two chains).

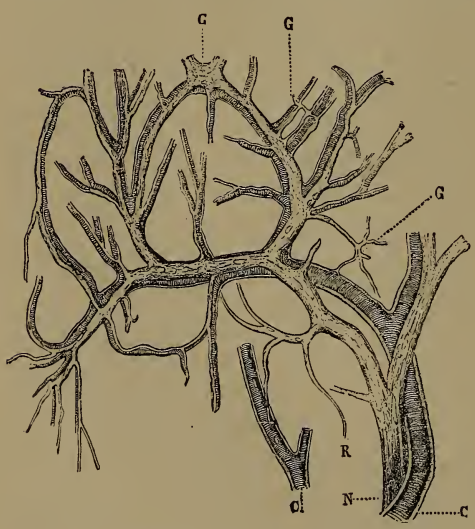
A voluntary act, after many repetitions, *may be transformed into a reflex act.* Walking without thinking of it is an example. A person playing dance music has been seen to fall asleep over the piano and yet continue to play correctly.

A *nerve center* is a group of nerve cells having one definite work to do. The part of the spinal cord within the skull is called the *medulla* (figure, page 306). It contains many nerve centers. Among them are the centers for sweating, blushing, blanching, swallowing, vomiting, coughing, and the center for breathing, called the vital knot.

The nerve impulses which regulate the heart and other internal organs do not come directly from the brain and spinal cord, or *central*

nervous system. They come through the *sympathetic system.* This system consists of many nerve fibers and two chains of ganglia near the spinal column. See figure on page 307. The sympathetic system relieves our minds from superintending the organs inside the trunk; we cannot control them by will power, but the sympathetic system keeps them in harmony with each other.

Hygiene. — As it takes two reins to control a horse, so it takes *two sets of nerves to control most of our activities.* The heart's beat is kept up by the salts in the blood, but there is one set of nerve fibers (from the sympathetic system) tending always to increase the heart beat and another set (from the medulla) tending to block (inhibit) their influence and slow the heart beat; the two together keep the rate right. *Vasomotor nerves* control the size of the blood vessels. There is one set of vasomotor nerves (the *constrictors*) tending to tighten the blood vessels and another set (the *dilators*) that tend to block (inhibit) their influence and allow the vessels to swell. Between the two sets they are kept at about the right size. See figure of vasomotor nerves on this page.



VASOMOTOR NERVES and blood vessels controlled by them. *G, G,* ganglia.

A stimulus or stimulant is anything which arouses nerve action; that which benumbs nerves and weakens nerve

action is called *a narcotic.* Alcohol is a narcotic; yet a drink of alcohol sometimes increases the heart beat and flushes the face. This seeming contradiction is explained by the following facts: Alcohol benumbs and weakens the nerves which hold back the heart beat. This removes the check upon the nerves which tend to hasten the heart; alcohol also weakens the constrictor nerves that tighten the blood vessels and the pressure of the heart then dilates the vessels and flushes the skin. Perhaps you have seen some drinkers with a "rum blossom" on the nose or the whole face a fiery red. Alcohol gives heat to the body but causes it to be lost by the rush of blood to the skin.

The *first alcoholic drink* taken is repulsive unless its true taste is concealed by sugar, fruit, or other means. One drink is a danger. After a few drinks Nature ceases to warn; a desire for it may even arise. If the habit is not stopped, the desire soon becomes a craving, and the habit may never be broken. The drink craving usually takes several months, in some cases, years, to become a man's master; the *habit of taking morphine* or cocaine may overmaster a victim in two weeks. He who when ill and in pain insists on a physician giving morphine is doing a reckless thing.

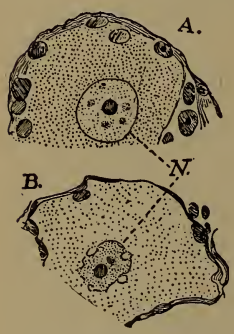
Cold is a natural stimulus, but *heat*, unless too great, is soothing to the nerves. *Oxygen* is a natural stimulus, *carbon dioxid* is a natural narcotic. Alcohol, tobacco, tea, coffee, drugs, are artificial stimulants and narcotics, for they are new to the race and the body has not learned sure and reliable reaction toward them. As a stimulus a short, brisk, cold bath is preferable to a cup of tea, for it leaves no burden of poison for the body to get rid of. Morphine will narcotize and bring sleep, but hard work or play will cause enough carbon dioxid to form in the tissues to soothe the nerves and bring a delicious drowsy feeling at bedtime.

Stimulants supply little or no energy to the body; they arouse the

body to use its own energy. An artificial stimulant causes the body to use a wasteful amount of energy. An habitual stimulant is sometimes called a *tonic*.

Fresh air, sunlight, foods of pleasant flavor, laughter, and merriment are better tonics than strychnine or whiskey or bitters, as every one will admit. A poisonous *coal-tar drug* (acetanelid, antipyrin, antifebrin) may stop a headache by benumbing the brain or depressing the heart, but these remedies weaken the heart. Their use is believed to be one cause of the great increase of heart disease in recent years. The best way to cure headaches is to cure the cause.

The hands of *a cigarette slave* are often trembly because of overstimulated nerves. His skin is usually pale, because tobacco stimulates the constrictor nerves.



A fresh nerve cell, *A*, granules plentiful, nucleus round; an exhausted nerve cell, *B*, fewer granules, nucleus shrunken.

Neuritis is inflamed, painful nerves; it is sometimes wrongly called rheumatism. The *principal cause* of neuritis is confining the diet to overcooked food, polished rice, wheat flour not made of the whole grain, canned goods. Oranges and lemons take the place of fresh vegetables in winter and help to prevent neuritis. Beriberi is one form of the disease. See pages 104 and 105.

Neurasthenia, or nervous exhaustion, brings with it self-consciousness, self-pity, loss of confidence, indecision, exaggeration, a dread that something untoward will happen, habitual worry over trifles, and general weakening of health. *It is caused by* bad mental habits, close confinement indoors with little hard work for the muscles, overwork, idleness, loss of sleep. It is cured by removing the cause and changing the mental habits.

The false thinking and *bad mental habits* usually found in neurasthenia may start from some mental shock or nervous strain. A child has sometimes become a nervous wreck because an exaggerated importance is attached to his passing in school. The mind *represses the unpleasant memory* of a shock or strain and will not look at it frankly and calmly. The repression causes the nervousness. The cure is to bring it clearly into consciousness and no longer be afraid of the dark memory. Sometimes such nervous shocks leave a bad habit, or muscle spasm, such as a jerky motion of the head or foot,

twitching of the eye, a grimace, or stuttering. The first step in curing the habit is to bring clearly into consciousness how it was caused. To cure stuttering requires long practice on the offending words.

Nerve specialists nowadays give few if any drugs, but try to instill into the patient sounder and clearer *mental habits*. *A fixed idea* may take possession of the mind, such as that one has heart disease, is mistreated or persecuted, or that some matter of small import is so disagreeable that it cannot be borne. A better mental habit is the best remedy, together with fresh interests and keeping busy at work that is worth while. Few persons are entirely free from *fixed notions*, or *obsessions*. A nervous person is generally one who has had bad nervous training or has associated with nervous persons.

To the Teacher. — It will be well to call for volunteers to recite on "Mental Hygiene," the chapter (page 164) on hygiene of nerves already studied.

TEST QUESTIONS. — What is the use of chemical messengers in the body? Give an example. What qualities are needed by a hormone, or chemical messenger? Where are hormones formed? Where are the adrenals? What is the effect of adrenalin? How does it prepare the body for a contest? Where is the thyroid gland? What happens if it shrinks? Where is the pituitary? What causes giants? Dwarfs?

Compare chemical messengers and nerve currents. What is a neuron? Name its parts. What are the two kind of nerves? What is the cerebrum? Cerebellum? Medulla? Explain why the brain is gray without and white within. Why is the reverse true of the spinal cord? Compare voluntary and involuntary movements. A reflex act requires how many neurons? What is a nerve center? Name nerve centers in the medulla. What is the structure and function of the sympathetic system? What are vasomotor nerves? What are the two kinds?

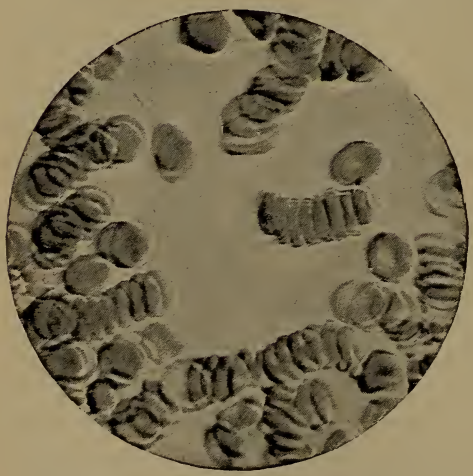
Define stimulant. Narcotic. Explain the effect of alcohol upon the heart. What is said of forming the alcohol habit? Drug habits? What is a natural stimulus? An artificial stimulant? Give examples of each. What is the advantage of one over the other? Name a natural narcotic. Do stimulants supply energy? What is a tonic? Give one cause of the increase in heart disease.

What is neuritis? Beriberi? The cause of neuritis? Its cure? What is neurasthenia? Signs? Cause? Cure? What is an obsession? Examples? How removed?

CHAPTER XXI

THE CIRCULATION

The cells would die in a short time if the blood stopped flowing, for no food or oxygen would reach them nor waste material be carried away. A person faints if his heart stops beating for only a few seconds. The blood, which may be called *a liquid tissue,* is slightly alkaline and equals about one twentieth of the body weight.



HUMAN RED BLOOD CELLS (magnified 840 diameters). Notice they are thinnest at the center. Most of them cling together in rolls. There are millions in one drop of blood. (From Handbook of Physiology by Austin Flint, M.D.)

The *cells in the blood* are of two kinds, red and white. The liquid part of the blood is called *plasma.* It carries food to the tissues and carbon dioxid away. The *red blood* cells carry oxygen to the tissues. These cells are round, flat, and thinner towards the center. See figure on this page. The *white blood* cells, as you have learned, defend the body. They do not have to remain in the bloodstream, but, because of their remarkable power of self-motion, they visit various tissues.

Soon *after blood is drawn* from the body fine strings of a protein called *fibrin* form in the plasma, entangle the corpuscles, and cause clotting. (See third figure, page 291.)

The *red blood cells are formed in the red marrow* of the bones. See figure on this page. The white blood cells are formed *in lymph glands*. See figure, p. 37; also last figure, page 291.

WHERE THE RED BLOOD CELLS ARE BORN. Cavities containing red marrow (two wrist bones, part of thigh bone).

The *heart* moves the blood; it is a double pump made of active muscle. The blood leaves the heart by blood tubes called *arteries*. These keep subdividing until they become fine tubes called *cap'illaries*, which lead to the return tubes called *veins*. The circulation of the blood is almost *a closed circuit*, since there are no openings, except in the spleen, from blood vessels to tissues. The *capillaries are so small* that not more than two red cells can float through side by side, and sometimes they go single file. These cells are elastic and bend out of shape in a narrow place. See figure on page 350. With a microscope the circulation in the web of a frog's foot or the tail of a fish may be studied.

The Heart.

The *capillary* wall is made of only one layer of cells with branches that interlock. See figure on page 315. If we except the cells that form the walls of the blood tubes, the blood does not anywhere come in contact with the living cells of the tissues. A middleman is needed between the blood and the cells. This middleman is the tissue juice, or lymph filling the spaces between the cells (you have seen it come out of a broken blister). Sugar, salt, oxygen,

hormones, and other things readily soak *through the thin walls of the capillaries* into the lymph and the lymph gives them to the cells. Carbon dioxid formed in the tissues passes through the lymph spaces and capillary walls into the blood.

Lymph is slightly yellowish except that after a meal the lymph bringing fat from the small intestine is white. Since the plasma soaks through the capillaries, there would soon be too much lymph if it were not drained off. This is done by tubes called *lymphatics.* They begin with open ends in the lymph spaces and unite into two large lymphatics which empty into the large veins found beneath each collar bone. Thus the lymph becomes blood plasma again and dropsy is prevented. Every time the body is moved, jolted, or shaken, the lymph is moved along and valves with tubes allow it to move in only one direction. Study the lymphatics in the palm and near the surface of the trunk as shown in the figure on page 37.

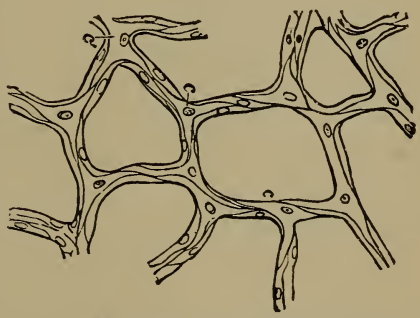
The one exception to the circulation being closed is in the *spleen.* There are many gaps in the walls of the blood vessels passing through it. This structure makes the speen a great *blood filter.* The splenic cells take up from the blood particles of foreign matter and worn-out red cells. The spleen is purplish; it has involuntary muscle fibers and beats once a minute.

The Pulse. — The blood vessels are elastic and the arteries expand as the blood is squeezed into them by the heartbeat. This wave of expansion is felt as a beat, or *pulse,* and it is noticeable in the arteries as far from the heart as those in the wrists. The kidneys and most organs expand slightly, or beat, as the pulse passes through them. The pulse does not reach to the veins.

Every contracting muscle squeezes the blood forward in the veins that flow through it or beneath it. The muscles cannot squeeze the blood backward in the veins because of the many small *valves* which open only toward the heart; in the arteries the back flow is prevented by the pressure from the heart.

There are two pumps in the heart; each pump has a

receiving chamber, or *auricle*, and an expelling chamber, or *ventricle*. The right auricle receives impure blood from the veins of the body and passes it down to the right ventricle, which sends it to the lung capillaries for oxygen. It comes back pure to the left auricle, goes down to the left ventricle, which expels it into the arteries. Passing next through the capillaries, it becomes impure and goes back through the veins to the right auricle and so repeats its ceaseless rounds. In the figure on next page color all the vessels red that carry pure blood and color those blue that carry impure blood (blackboard or notebook).



CAPILLARIES are built by exceedingly thin, flat cells. Notice their interlocking strands; also their nuclei.

Hygiene. — As you know what the blood does for the cells it is easy to see that the question of the *disease or health of any organ is largely a question of whether it gets a bountiful supply of fresh, good blood.* If the blood flows freely through the organ, it will be warm, sound, well nourished, and keep free of wastes. If because of pressure from other organs or because of impure blood the supply of good fresh blood for an organ is lessened, the resistance of that organ is lowered and it becomes the ready prey of disease. Soon the starved cells degenerate.

Helps to the Blood Flow. — The expansion of the chest when a breath is drawn helps to suck the blood of the veins into the chest and on toward the heart. Muscular activity of any kind helps to move the blood in the veins.

In fact it is not the heart that moves the blood back from the feet and legs when one is standing; the contractions of the leg muscles squeeze the blood upward in the veins. This explains why it is so painful to stand for any length of time without moving. Fainting would soon bring relief.

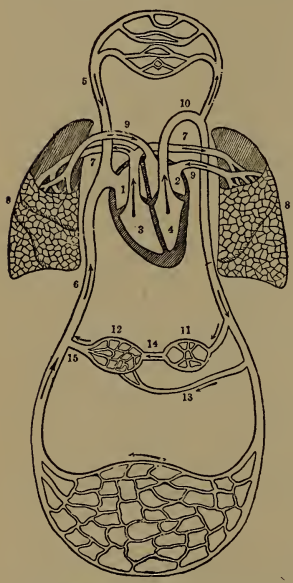


DIAGRAM OF CIRCULATION through heart, lungs, and body. With pencil shade the vessels carrying impure blood.

Any organ needs more blood when it is working than when it is resting. Arteries have a muscular coat in their walls. The dilator nerves dilate the arteries of a working organ and more blood flows through it. At the same time the arteries in other parts contract, just as if, when water is needed in the bathroom, it should be shut off in the kitchen. Do not study hard right after eating and draw the blood from the digestive organs. Mark Twain usually wrote lying down or half reclining so the blood flowed more freely through his brain. Reckless persons have been known to drive the blood to their brains by studying with the feet in cold water. Why is one inclined to be drowsy after a heavy meal?

Smoking *tobacco*, especially in the form of *cigarettes*, often causes what is called "tobacco heart"; the heart thumps alarmingly for a while, then flutters weakly, then thumps again, and so on.

Summer complaint (see page 59), is often caused by the blood with its protecting power being withdrawn from the

intestinal walls to the skin. This allows bacteria to multiply in the digestive tube. It is treated by cool baths, light clothing, and keeping the child in a cool place.

Lack of energy in hot weather is due to want of blood in brain and muscles. It has been sent to the skin to cool off. Energy is regained by eating less so as to make less heat and by wearing very thin clothes. Women are usually more sensible than men in both these respects.

The quantity of blood is important; its quality is still more so. Anemic persons have not enough red cells in their blood. *What will cure ane'mia* and bring roses to the cheeks? Living much out of doors and eating plenty of green vegetables and fruit. See photographs, pages 22, 23, 31, 35, 153, 279, 283, 292. An open-air sleeping porch or a bedroom with all windows open during the hours of sleep is the best blood purifier.

TEST QUESTIONS. — Why is the blood essential to the life of the tissues? What is the use of plasma? Red cells? White cells? What is fibrin? Clotting? Where are red cells formed? White cells? Describe the heart. What are arteries? Veins? Capillaries? What is the structure of the capillary wall? What goes out of and what into the bloodstream through the capillary walls? Explain how the lymph is a middleman between the blood and the cells.

What is lymph? Its color? Its course? What is remarkable in the spleen's structure? What is its color? Location? Functions? How does blood leaving the spleen differ from that entering it?

What is the pulse? What causes the blood to flow in the veins? What prevents its being squeezed backward? What is an auricle? A ventricle? Where does the blood become pure? Describe one complete round trip, or circuit. What is the common cause of disease in an organ? How does breathing aid the blood flow? How does muscular activity aid it? Why is standing still so painful? When an organ becomes active, what happens to the bloodstream in it? What is often the cause of summer complaint of children? Of lack of energy in summer? What is anemia? How is it overcome? What is the best blood purifier? How do cigarettes affect the heart?

CHAPTER XXII

THE MUSCLES

Anatomy. — *The muscles weigh* nearly as much as all the rest of the body. The red flesh of animals is muscle. A piece of boiled beef may be easily separated into *strands* the size of cords. Each strand is a bundle of fibers inclosed in a thin sheath of connective tissue. A fiber picked to pieces under a microscope with the aid of needles is found to consist of still smaller fibers called *fibrils*. These last are the true muscle cells. They are crossed by fine dark lines; and the muscle is called *striped muscles*. See the figure on this page. The striped muscles move the bones; they can act quickly and are called *voluntary muscles*, though they sometimes act reflexly.

Sketch of eight fibrils of a voluntary or striped muscle (enlarged).

There are also *unstriped involuntary muscles* which are pale and act more slowly; they are never under the control of the will. They are made up of spindle-shaped cells without cross stripes. See figure on next page. They are not attached to bones, but are tubular, or hollow. *The walls of the blood vessels and of the digestive tube* are made of involuntary muscles. We cannot blush at will nor control the heartbeat, nor stop anything after starting to swallow it.

The glistening sheets of connective tissue which bind the fibers of voluntary muscles into bundles extend beyond the muscles and form tough unstretchable cords called leaders, or *tendons*, which lie in a small space and connect the muscles with the bones. Bend the elbow or knee forcibly and feel the tendons; if drawn tight they feel not like flesh, but almost as hard as wires.

Physiology. — Voluntary muscles are arranged *in pairs*. A muscle which bends, or flexes, a joint is called a *flexor;* it has as its *antagonist* an *extensor*, which extends, or straightens, the same joint.

When a muscle contracts it changes in shape but not in size. As it becomes shorter and thicker it exerts a pull and can do work. *By use* a muscle grows larger, firmer, and redder; *by disuse* it becomes small, flabby, and pale.

Six spindle-like fibrils of unstriped muscles (enlarged).

Where does muscular energy come from? To move the clapper of an electric bell the wires take electric energy from battery cells to the bell when the button is pressed. The nerves do not carry the energy with which the muscles contract. The muscle cells have already absorbed food and oxygen from the blood and thus stored up energy; the nerve merely stimulates them to action. When a gun is fired, the energy already stored up in the powder of the cartridge is set free by pulling the trigger. The contraction of muscles produces not only motion but also heat. (When have you noticed this in your own experience?)

The protein and fat eaten supply very little energy to the muscles. Their energy usually comes from the *oxidation of sugar*. Muscles get sugar from the starch and

sugar we eat. Beef tastes sweetish because of sugar stored in it. Candy is good food for a football player, a farmer, or any one who does hard work with muscles. A very active child who plays in the fresh air can have pure candy, but candy will make an inactive child fretful; for he has no use for it and it may turn into an acid or, at best, will only form fat.

Hygiene. — They do not look like it, but *many fat people* are poorly nourished. Their muscles are flabby and weak, including the muscles that work the lungs, so they easily get out of breath. Another surprising thing is that *many lazy men* eat more than hard workers; but it is the overeating that makes them lazy. They eat more food than is needed; it ferments, or spoils, in the digestive tube and *forms toxins which weaken their nerves and cause a tired feeling*. Since they are always tired they are said to have been "born tired" by those who do not know the physiology of it. In other cases the energy is sapped by the *hookworm* in the intestine which consumes the blood of the poor victim (page 253), or by the *tapeworm* which feeds upon the food of its victim. The man who hires a hookworm victim or takes him as a partner will probably lose money.

In *natural healthy fatigue* the energy in the muscles is not exhausted, but the activity of the muscles gives rise to *carbon dioxid which weakens the junction between the nerve fibrils and the muscle fibrils* so that the stimulus can hardly pass into the muscle. A bath may relieve the fatigue by aiding the blood flow so that the carbon dioxid is washed out. Sleep also allows this to be done and repairs to be made. Sleep is as necessary as food in keeping up the energy. *After middle age* the nerves report fatigue less promptly and old people are apt to overwork.

Fatigue is as much a result of nerve exhaustion as of muscle exhaustion. Hence *the more numerous the nerves and muscles employed and the finer, more delicate the work, the quicker exhaustion comes.* For this reason writing with the finger movement is more exhausting than writing with the forearm movement.

Those whose *regular work* is done mainly with small muscles should, *in hours of recreation*, choose exercise which uses the large muscles, and the other way about. An artist can refresh himself by chopping wood; a wood-chopper might find recreation in learning to draw.

A round-shouldered boy sketched from above.

While a muscle is contracting it is receiving many nerve impulses each second. Even when it is not contracting it is receiving a slight nerve stimulus which keeps it in *tone*, so that healthy muscles constantly exert a slight pull on the bones and keep ready for instant action. Some people waste energy by keeping their *muscles too tight* and they look stiff, do not move with grace, nor talk in mellow tones. They should learn to *relax.*

Constant contraction of the same muscles causes them to become "bound" so that they will hardly stretch, or relax, at all. In many people with *flat chest* the upper part of the chest has become *muscle-bound*, the shoulders being round and bound forward by tight, hard muscles. See figure on this page. People who wear high heels and walk without a springy step often have the *calf of the leg become so muscle-bound* that a free springy step is painful. The feet may be gradually set free by the use of

canvas shoes or other flexible low-heeled shoes, by practicing dancing in the bare feet, and by learning to step off on the ball of the foot.

On the other hand, the muscles of some people have so *lost their tone* that they are slack and flabby. Such persons are likely to shuffle and slouch. Dr. Murphy of the Navy says that the majority of American men and boys have good tone and strength in the leg muscles but are muscularly weak from the waist line up. The signs of this are round shoulders and protruding abdomens. See photographs, page 286. *Flabby abdominal muscles* as a result of belts, corsets, or tight clothing are almost the rule with grown-ups whose occupation does not require vigorous, muscular work.

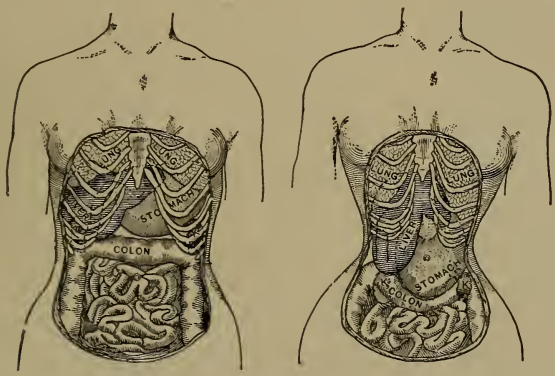
The waist of a natural woman (Greek).

Constant changes of style between high and low heels, large and small waists, high and low waists, with too much indoor life and too little exercise, accounts for the general flabbiness and poor state of health so common with women. *Flabby abdominal muscles may bring a train of serious evils.* The stomach, spleen, liver, the intestines, and even the kidneys sag down and cause the abdomen to bulge out (see figures on next page). When an organ is out of position it will not do its work well. The weight of the organs pulls upon the sympathetic nerves, which tug at their connections with the spinal nerves, hence backache and headache result. The only way to return to health is to strengthen by special exercises the abdominal walls so that they will hold the organs back in position. Then an active body, sensibly clothed, will soon regain health and retain it. Headaches are suffered by women who take up general gymnastics while their trunk muscles are still flabby.

Most work to-day tends to a one-sided life with overuse of the nerves and disuse of most of the muscles. This is true not only in offices, but in factories. Yet many in addition wear tight shoes and clothes and thus forbid themselves free exercise. They invite years of suffer-

ing, great expense, and a shortened life. If awakened to the evil of their ways they can soon acquire firm muscles, steady nerves, a free flow of the bloodstream, and the bearing and color of health.

What is called "*muscular rheumatism*" may be a bacterial infection of the muscles and joints. The germs may enter the body at broken gums, decayed teeth, catarrhal nose, or diseased tonsil. When the happy hunting ground of bacteria is cleaned up and healed up, the "rheumatic" pains cease.



One figure shows the organs of the trunk in their normal places; the other shows them after a snug-fitting corset has been worn for a few years.

To the Teacher.— It may be well to call for volunteers to recite on "Hygiene of Work and Play," the chapter (IX) on muscle hygiene already studied.

Test Questions. — Name a fact which proves the amount of work to be done by the muscles. Do people live as if they believed it? Describe structure of striped and unstriped muscles. Other differences. Of what is a tendon formed? How are voluntary muscles arranged? What occurs when a muscle contracts? What are the effects of use and disuse? What is the source of muscular energy? What food is of especial use in great muscular activity?

What are causes of laziness? Where is the cause of fatigue located? How does rest overcome fatigue? Is it more tiring to use many small muscles or a few large ones? Why? What kind of exercise should be chosen for recreation? What is muscle tone? What does the term "muscle bound" mean? Give examples. The muscles in which region are most liable to flabbiness? What evils may result? Why do people nowadays usually get so little exercise? To what may "rheumatism" in muscles and joints be due?

CHAPTER XXIII

THE SKELETON

Anatomy and Physiology. — The *skeleton*, or hard framework supporting the body, is made up of a little more than 200 bones. There are *flat bones* like the shoulder-blades and skull bones, there are *long bones* such as those in the legs and arms, and there are *irregular bones* like those which form the wrists, ankles, and spine. See figure on next page.

The many *joints* between the bones allow of varied motion. The ends of the bones are covered with gristle, or *cartilage*, to lessen friction and the effect of sudden jars. The surface of the cartilages is very slick and supplied with a slimy liquid that the joints may move freely. Tough sinews, or *ligaments*, hold the bones together at the joints and set limits to their movements.

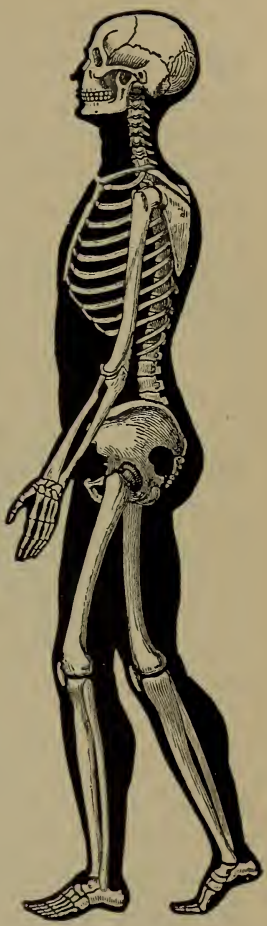
The arms and legs revolve on the trunk by means of ball-and-socket joints at the shoulders and hips. Hinge joints at the elbows and knees allow motion to and fro. In the hand there is one ball-and-socket joint (where?) and many hinge joints (where?). The bones of the skull are united by immovable joints.

The back "bone" or *vertebral column* is made of small bones called vertebræ joined together by thick pads of gristle, or cartilage. The column rests on a wedge-shaped bone which with the curved hip bones make up the hip girdle, or pelvis.

The twenty-four *ribs* are attached to twelve vertebræ behind. The front end of the upper seven pairs of ribs join to the flat breast bone in front. Each of the next three pairs is attached by long cartilages to the pair next above. See figure on this page. The front ends of the last two pairs of ribs are free ("floating"). Thus the region of the five lowest pairs of ribs is not a firm cage like the upper part of the chest, or thorax, and the portion of the chest near the waist is more useful in breathing.

The shoulder blades and collar bones together make up the *shoulder girdle*, which rests upon the chest. Thus the entire weight of the shoulders and the arms which hang from them is supported by the chest. If the shoulders slip forward, they weigh down the chest in front.

The *thigh* bones are the largest bones. They fit into deep sockets in the hip bones. Because of the depth of these sockets and the narrowness of the hips, the legs do not have as free movement as the arms. There



THE HUMAN SKELETON.

In this figure locate the following (do not, unless required, learn the Latin names): skull (cranium), upper and lower jaw (superior and inferior maxilla), cheek bone (malar), bones of spine (vertebræ), collar bone (clavicle), shoulder blade (scapula), breast bone (sternum), ribs (costæ), upper arm (humerus), fore arm (radius and ulna), wrist (carpus), palm (metacarpus), fingers (phalanges), hips (sacrum and innominata), tail bone(coccyx), thigh (femur), knee cap (patella), shin bone (tibia), splint bone (fibula), ankle (tarsus), instep (metatarsus), toes (digiti pedis). Mark L after names of long bones, F after flat, and I after irregular bones.

is a *knee cap* to protect each knee joint. (Straighten your knee and move the knee cap with your hand. Its shape?) The lower leg, or *calf*, has two bones, the splint bone which is buried in the muscles, and the shin bone which can be felt just beneath the skin. The many small bones of the *foot* are bound together by ligaments and form an elastic arch which is higher on the side of the foot next to the other foot.

You have noticed that *when a bone is burnt* most of it is left and is white and brittle. This part is *limy;* the part that burns up is gelatin-like, or *gluey.* In childhood,

The bones and cartilages of small children are very tender. At the left is shown the unsafe, and at the right, the safe, way to lift a young child into a bath.

there is more of this gelatin and the bones are not so easily broken, but deformity is more easily acquired. If deformities are not corrected in youth, they are hardly ever corrected later. Explain why.

Hygiene. — Persons in delicate health are more liable to acquire deformity. *Ill-nourished bones* are soft and readily undergo alteration in shape. Weak muscles bring a tendency to lapse into a heap; strong muscles keep the body balanced and the bones in shape. Sound bones are not easily fractured by a fall or strain. When the bones of a drunkard are broken, there are sometimes cases of delayed union, showing that alcohol has weakened the vitality (or vigor of the cells).

Correct postures while sitting, standing, or walking are essential to the development of a normal figure. It is hardly possible even to breathe well if one sits or stands improperly. The clothing should allow freedom to the body to stretch and readjust itself at will; the body of a savage has the pliancy and grace of a cat or tiger.

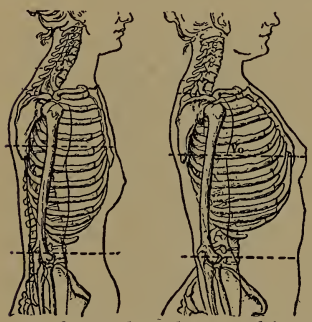
The bones of the foot form a beautiful elastic arch.

If tight shoes or a deep respect for corns and bunions has led one to walk flat-footed or with stiff ankles, and he would *learn to walk well*, he must learn to sway the whole body forward from the ankle and to remove the weight largely from the heel and carry it lightly upon the ball of the foot. Walking with the weight upon the heel is an advantage only in soft or plowed ground where a springy step is impossible. The weight should not be thrust down upon the heel through rigid joints as if too lazy to use the muscles of the calf and thigh. With a springing step, the chest expands, the head is carried easily, and a fine poise is attained which makes every motion a pleasure and gratifies the eye of the beholder. The Greeks, as shown by their statues, walked with the whole body even to the tips of their toes. The body is so perfect a unit that even an easy carriage of the head depends upon having the feet well shod and well used.

A foot covering with room for the big toe.

Applications. — The boys should inspect the heels of each other's shoes and the girls the heels of the girls. If the heel is worn most at the back edge, what fault of gait is shown? If it is worn at the outer side?

Hump back, round shoulders, and flat chest are usually parts of one deformity. The cartilages of the spine, from uneven pressure continued for weeks, become wedge-shaped, with the thin part of the wedge in front. Habits which tend to produce this deformity are: 1, *bending at the shoulders* and neck *instead of at the hips* when the work is hard to see or low in front, as in hoeing, or on a low work-bench or desk (see photographs, pages 158, 186); 2, weak *muscles*, especially at the back (see figure, page 335), and failure to keep erect (see photograph, page 163); 3, carrying *the hands in the pockets* (the habit may be overcome by swinging the arms while walking); 4, sleeping *curled up in bed* (to keep warm); 5, *sitting slipped down* in the seat or chair; 6, *clothing too tight at waist or chest* (see figure, page 329), or with a coat collar that is too tight over the back of the neck and pulls the head forward; 7, *adenoids*, though more often adenoids and flat chest both result from general weakness; 8, *bicycle-riding* (see photograph, page 154) with low handle bars.



The figures show the natural form of the trunk and (at left) round shoulders from wearing tight corsets.

Lateral curvature of the spine (see photographs on page 162) may be caused by: 1, writing at a *desk that is too high;* 2, habitually carrying a book-satchel or other *weight in the same hand;* 3, standing too much *on one foot;* 4, sleeping on the side *without a pillow* after early childhood; 5, a certain defect of vision (astigmatism) leading to the habit of *holding the head to one side.*

Applications. — 1. Count those in your class who have flat chests and round shoulders and reckon the percentage of the deformed. 2. Examine your chest and shoulders at home unclothed before a mirror. Does your head protrude? Do the shoulder blades lie flat? (A fine back is flat across the shoulders.)

Several Defects in School Seating must be guarded against. Nine tenths of spinal deformities begin during school years. The curves children get are apt to stay with them. The following is a list of possible *defects* with their possible *results:* 1, *desk too low* (stoop shoulders, flat chest, congestion of eyes, nearsight); 2, *desk too high* (right shoulder too high, lateral curvature of spine); 3, *seat too far to rear of desk* (for results see 1, the rear edge of the desk should be exactly above the front edge of the seat); 4, *too high a seat* (feet dangle, pressure on nerves and blood vessels, foot goes to sleep); 5, *too low a seat* (a crouching attitude with results as in 1); 6, *desk nearly flat* (flat chest, round shoulders, injured eyes; the slope should be about 40°; see figures, p. 213); 7, *seat with straight back* (restlessness, slipping down). The back of the seat should be curved to fit the back and partly support it below shoulder blades. If not adjustable, the seats for each grade should be in three sizes.

The mother said the child's dress was large enough, but see how it gaped when unbuttoned and she drew a full breath.

Application.—1. Let half of pupils, accompanied by the teacher, inspect the seating of the other half, testing the seven points above. Teacher may record credits for the pupils finding and proving defects. 2. To test lateral curvature of spine test whether one shoulder is higher than the other by tacking a strip to a post with one nail; bring end of strip down until it touches one shoulder, turn and see if it will touch the other shoulder.

Clothing, though needful for warmth, is probably the greatest single cause of human deformity and weakness. Its effects are plain from the bald head to the crooked toes with their corns, bunions, and ingrown nails. The most serious evil effects of clothing are to weaken the skin, displace the vital organs, and deform the skeleton.

From love of neatness, mothers usually buy clothing barely large enough for the active child, and *the growth of the child leaves the clothing far too small* before it is worn out. See picture on this page. If the clothing is tight over the chest or across the shoulders, it is useless constantly to remind the child to sit up, as it does so only for a moment. If a child gets a flat chest, there is little hope of stopping the frequent coughs and colds which follow unless and until the flat chest is corrected.

If *suspenders* are not of the right kind, they flatten the chest. The further out suspenders pass over the shoulders, the more they pull the shoulders down and depress the chest. They should lie close to the neck behind and pass obliquely to the sides in front to allow the chest to expand between them. At the back the suspenders should either cross without rigid connection or be attached to the arms of a short lever (see figure on this page); one end of this lever goes up with the shoulder that is raised, while the other goes down with the other shoulder. *Knickers* are more easily supported than trousers. They should be supported not by a tight belt around the waist, but by a loose belt resting on the hips.

Home-made lever suspenders. When the spine bends to side, one shoulder needs more space, the other needs less, and the lever transfers the slack.

A sprain means that sinews (ligaments) have been stretched or torn from the bone. The sprained joint should be kept in hot water for an hour or two, then wrapped so as to keep the joint immovable. After a day or two the joint should be used, though cautiously; for if not used, it may become stiff.

Applications. — 1. Study the working of a properly made suspender (made by a pupil, see figure on this page).

2. Make a test of those who have most frequent colds and coughs. Are their chests flat, or shoulders round?

3. Call for volunteers to come before the class that their posture and gait may be studied, and, if necessary, corrected. Is the head well balanced? Is the chest flat, swelled out like a bantam, or just right? Is the weight lifted on the ball of the foot?

4. Practice chair carry, and four other ways of carrying injured (see Appendix).

5. Practice the triangular bandage (Fig. 8, Appendix).

TEST QUESTIONS. — How many bones in the skeleton? Three shapes of bones, with examples? Locate ball-and-socket and hinge joints. Use of cartilage? Use of ligaments? What makes up the vertebral column? The hip girdle? How many ribs? How attached in front? What makes up the shoulder girdle? Locate thigh bone, kneecap, splint bone, shin bone. How are the bones arranged in foot? What chemical stuffs are found in bone?

Result to skeleton if muscles are weak? What is necessary to the growth of a normal figure? Discuss faulty gaits and their causes. Describe a correct gait. How did the ancient Greeks walk? What did your study of heels show?

Give six causes for round shoulders and humpback. Give five causes of lateral curvature of spine. State the seven ways in which school seating may be wrong and the bad effect of each defect. Are any pupils in your school seated wrong? What three evil effects from clothing? Why are the shoes and clothing of children usually too tight? Discuss suspenders. Is there a connection between posture and frequency of colds or coughs? How must a sprain be treated? What ways do you know of carrying the injured?

CHAPTER XXIV

THE LUNGS AND BREATHING

Anatomy. — The *nostrils* and mouth open into the upper part of the throat passage (pharynx). From the lower end of the *throat* the fleshy *gullet* leads to the stomach and the gristly *windpipe* (trachea) leads to the lungs. The windpipe is in front of the gullet; it begins as the *voice box* (larynx), the gristly front of which you can feel as the Adam's apple. Rings of gristle or cartilage (feel them) have the very important duty (why important?) of keeping the windpipe open. About four inches below the voice box the windpipe divides into two tubes, the *bronchi.* One bronchus enters each lung (see figure on this page) and then divides and subdivides again and again; the smallest tubes end in clusters of tiny air chambers with thin walls surrounded by a network of capillaries. See figure on next page.

The right lung (3 lobes) and left lung (2 lobes). The space between them held the heart, large arteries and veins, windpipe, and bronchi.

The windpipe can be felt to enter the *chest* (or *thorax*) behind the top of the breastbone (feel it). The chest is a cone, its walls are of muscle and bone (ribs, breastbone,

backbone). The floor of the chest is a sheet of thin tendon and muscle called the *midriff*, or diaphragm (see figure, page 334), which also forms the roof of the abdomen. It rounds up into the chest somewhat like two low domes (see same figure). Under the right dome is the liver and under the left is the spleen and stomach.

The two *lungs* hang freely in the chest. Being attached only where the windpipe and large blood tubes enter them, *they are free to move as the chest expands.* To insure still better against painful friction there is a double lining (the pleura) between lungs and chest.

Tiny air chambers at ends of smallest air tubes in lungs.

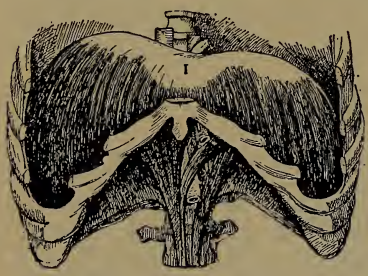
Physiology. — The work of the lungs is to supply oxygen and rid the body of carbon dioxid. As the thorax expands, air rushes in, stretches the lungs, and makes them fill the enlarged space. This inbreathing is called *inspiration.* The thorax expands because the muscles contract, lifting the ribs and swinging them out, and the muscular diaphragm flattens and sinks. Thus the thorax becomes broader and longer. When the muscles relax, the chest walls sink, the stretched lungs draw together, and outbreathing or expiration occurs. There is a short pause or rest before the next inspiration. (Watch yourself during several breaths.) Expiration may continue beyond the position of rest by forcibly drawing the chest walls down and in and by forcing the diaphragm up. A thin sheet like the diaphragm cannot force itself up, but the muscles forming the front and side walls of the abdomen draw in and press up the abdominal organs against the diaphragm. This presses the air out. (Try it.)

The expired air contains less oxygen and more carbon

dioxid than the inspired air. It also contains more of the vapor of water. (For proof of this, breathe against a cold window pane.)

The blood as it passes through the capillaries in various parts of the body *takes up carbon dioxid* from the tissues and *gives up oxygen* to them.

There is a constant flow of oxygen into and carbon dioxid away from the tissues because oxygen is continually uniting with carbon in the cells and forming carbon dioxid. The carbon used up in the cells is replaced by the foodstuffs eaten. A compound of iron (hemoglobin) in the red cells absorbs oxygen as the blood passes through the capillaries of the lungs; the blood becomes a brighter red and carries the oxygen to the tissues.



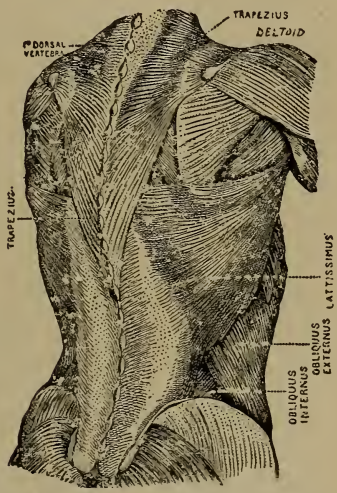
DIAPHRAGM. Lower portion of chest with parts of ribs cut away to show the dome-like diaphragm (of red muscle, except in the middle where it is white tendon).

When we breathe too slowly there is a feeling of *air hunger* and we reflexly heave a sigh or a yawn. If the tissues can not get rid of carbon dioxid fast enough, as during rapid exercise, panting and a feeling of breathlessness come on.

Hygiene. — The throat is the crossroads from mouth, nose, ears, lungs, and stomach.

A tonsil is on guard on each side of the throat behind the mouth to halt dirt and germs. The adenoid is a smaller tonsil further back. See figure on page 208. (Draw it on blackboard.) Tonsils and adenoid are a growth of round lymph cells in connective tissue. They enlarge because dirty air or unclean mouth and nose give them

more work to do. If the air and nose are kept clean and the air cool and moist, they would not swell. A tonsil should not be removed merely because it is enlarged unless there is pus formed in it. A small diseased tonsil may be more in need of treatment or removal than a large one. Diseased tonsils may be cleaned and squeezed and kneaded. A tonsil may be so badly diseased that instead of killing germs it may be a gateway of germs for acute rheumatism and other diseases. Decayed teeth, raw spots on the gums or in nose, may also admit infection to the blood.



MUSCLES OF NECK, SHOULDERS, AND BACK. These muscles, if strong, prevent humpback; they lift the shoulders up and lessen the weight upon the chest and lungs.

The lungs must be free to work and they must be stimulated by vigorous exercise, without which we seldom draw a deep breath. *The air breathed must be pure, moving, cool, and not too dry nor too moist.* Perfectly still air is "dead." The race led an outdoor life for ages, and the nerves need the accustomed natural stimulus of moving, cool air. Those deprived of it become weak; no wonder they feel depressed and seek an artificial stimulus.

Ventilation should be so arranged as to keep the air moving, pleasantly cool and comfortably moist, as well as pure. Because of the moisture from many lungs and the heat from many bodies, the air of schools, churches, and other assembly rooms may become too moist and too warm. On the contrary, the air of dwellings is usually

too dry. *Mustiness* of rooms closed for several weeks is caused by a growth of molds.

A person exercising actively vitiates the air about *five times as fast* as a person at rest. A room becomes unpleasantly *stuffy* when the carbon dioxid has reached one per cent. This stuffiness is believed to be due to *animal particles* from the skin, lungs, and digestive tube which poison us, give rise to headaches and sleepiness, and lower the vital resistance to infection.

Germs in many theaters and churches are warmed up and served fresh night after night or Sunday after Sunday. Delicate children who enter *overheated* and *poorly ventilated schools* risk their health. Even the strongest may be weakened. If children are dressed especially for warmth, cheesecloth (not white because of glare) may be tacked over frames of right size and set into the windows of schoolrooms to keep out rain, snow, and strong winds. Open-window schools, if the pupils dress warm, have many of the advantages of outdoor schools. A city was forced to build some temporary wooden schoolrooms beside the large brick schoolhouses. The pupils in the wooden houses had better health and did better work than those in the brick houses.

Gardeners and clergymen have the best chance for a long life because of much time spent out of doors. The two greatest Americans, Washington and Lincoln, were both surveyors in youth and early manhood and lived an outdoor life. Farmers should live longer than professional men, but they do not live as long. This is because they work 16 hours a day during the crop season and have anxieties for crop failures when the weather is not right. A farmer who goes in debt will not probably have as sound nerves nor live as long as one who tries to raise everything he needs at home, sells and buys as little as possible in town, and keeps out of debt.

Applications. — (1) With a 36-inch tape measure the teacher may measure the circumference of the chest when most expanded and most contracted; difference of two measurements is called chest expansion. Find which pupil of each sex has the largest chest expansion in school. (2) Send several pupils outdoors to remain for ten minutes; let them come in and note whether the schoolroom smells stuffy to them. (3) If pupils become inattentive, increase the

ventilation and note effect. (4) Have the pupils who sleep with open windows raise their hands. Compare the color of their faces with the color of those who sleep with closed windows. (5) How much chalk dust gets into your lungs daily? More than on the coat because the lungs suck in air. Examine coats. (6) At home test whether clothing at chest gapes when unbuttoned and a full breath is drawn. If so, it is dangerously small. (7) Practice the movements of resuscitation upon volunteers (appendix).

TEST QUESTIONS. — Name three openings into the throat from above; two from below. What is the structure of the trachea? The lungs? Describe the thorax. The diaphragm. What is the relation of the lungs and the chest wall?

What is the function of the lungs? Describe how inbreathing and outbreathing are brought about. How does expired air differ from inspired air? Where does carbon dioxid enter the blood and leave it? Where does oxygen enter the blood and leave it? What is panting a sign of?

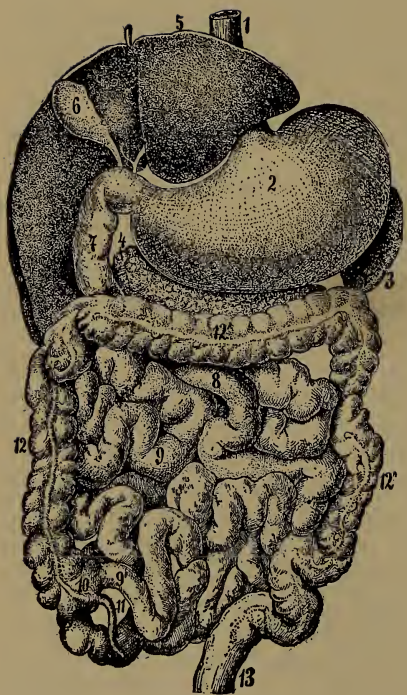
What and where are the tonsils? Adenoids? What is the function of tonsils? Why do they swell? When should a tonsil be removed? How may adenoid growths and mouth breathing cause each other?

What condition do the lungs require to do good work? Name the two best stimuli to deep breathing? What are the qualities of air which is suitable for breathing? Discuss indoor air. What is most likely to be wrong in the air of assembly rooms? Of dwellings? What is the cause of mustiness? Stuffiness? What arrangements may be made for an open-window school? Who have the best chance for a long life? Which boy in school has the greatest chest expansion? Which girl? How is stuffiness tested? How many by test at home found chest free for full expansion in spite of clothing?

What did you learn in Chapter II about fresh air? Ventilation? Tuberculosis as a house disease? Why are water- and steam-heated houses so often the worst ventilated?

CHAPTER XXV

THE DIGESTION



DIGESTIVE ORGANS from the front. 1, gullet, leading into broad portion of stomach; 2, stomach, its narrow portion opening into duodenum, 7; 8, 9, small intestine; 9′, junction of small intestine with colon; 10, blind end of colon with 11, appendix; 12, 12′, 12″, ascending, transverse, and descending colon; 13, rectum. The S-shaped curve is midway between 12″ and 13. The liver has been turned up to show the gall bladder, 6, in which bile is stored until needed. 3, spleen; 4, pancreas.

Anatomy.—The digestive tube is about thirty feet long. Its parts are: the mouth, gullet, stomach, small and large intestine. Its walls are mainly unstriped muscle and it is lined throughout with mucous membrane. The *mouth* contains thirty-two teeth for dividing the food and receives the ducts of six glands which secrete saliva. The *gullet* is a tube nearly as large as the forefinger and nine inches long.

The stomach (see figure on this page) lies crosswise, like a bag lying on its side. The gullet enters it at about the center of the waist and the intestine leaves it at

the right side. It is about ten inches long, but draws together when empty. When filled it has a diameter of about six inches. This is the largest expansion of the digestive tube; in its walls are many small tubelike glands which secrete gastric juice.

The small intestine (figure, page 338) is over twenty feet long and a little larger than the gullet. The opening into it from the stomach is usually closed, being guarded by a strong ringlike, or sphincter, muscle called the *pylorus*. The first loop of the small intestine is called the *duode'num*, and into this is the opening of the duct from the large glands called the pancreas and liver. The small intestine takes many turns and loops throughout its course of more than twenty feet. Just above the right groin it opens by a valve into the large intestine, or colon. See figure, page 340.

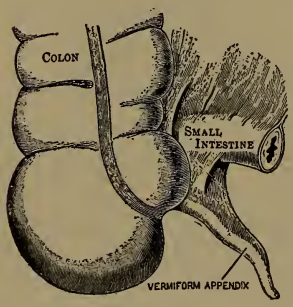
The colon (figure, page 338) is about the size of the wrist, six feet in length, with regular bulges in its walls. It first goes up as the *ascending colon* nearly to the waist, crosses over to the left as the *transverse colon;* the *descending colon* then leads down to the S-shaped, or *sigmoid, bend;* the next and last part, the *rectum*, is short and straight.

In the market you may have seen sold for food the stomach of a beef, which is called tripe, the pancreas, called sweetbread, and the liver; the lining of the small intestines of hogs is also eaten when it is used to hold sausage.

Physiology. — Foods as we take them will hardly dissolve; yet they will not pass across the wall of the food tube into the circulation unless changed so as to dissolve readily. This change, called digestion, is brought about

in the tube itself by the action of secretions from glands. These secretions, or cell juices, contain alkali or acid and substances called ferments that help to change the food. *By digestion each foodstuff is broken up into simpler, more soluble substances.*

Ferments are very wonderful and mysterious particles; they accomplish tasks wholly out of proportion to their size and quantity. It is due to a ferment in the yeast plant that a tiny quantity of yeast is able to raise a very large quantity of dough. A ferment produces changes without itself changing or being used up, for it does not supply energy for the change. It is like a ladder which enables many men to pass over a wall, yet is unchanged. It is like gravel which keeps a soil from being tight and lets down air and water to plant roots, adding to the crop grown, yet the gravel does not change.



Junction of small intestine and colon. Showing appendix, which may become inflamed if colon is not well trained. For training see footnotes, pages 108 and 343.

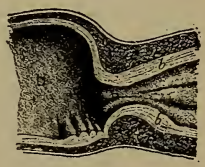
The salivary glands are in the floor of the mouth and in the cheeks. The slimy *saliva* moistens the food and makes it slippery. It *changes starch into malt sugar.* Boiled starch is changed in a few seconds; unboiled starch changes very slowly. Starch may also be malted by toasting bread or baking it to a brown crust. Saliva and mucus kill disease germs.

When the food enters the stomach, rhythmic waves, or beats, of contraction begin; the stomach beats only about one tenth as fast as the heart. (See X-ray pictures, page 107.) The saliva, which is alkaline, continues to act for

half an hour after the food reaches the stomach. By that time the gastric juice becomes strong enough to neutralize it; for of course an acid and alkali cannot both act on the food at the same time; they would neutralize each other. (See page 93, Exp. 2 and 3.)

The gastric juice contains *hydrochloric acid* and a ferment called *pepsin.* The acid kills germs, dissolves mineral salts, and changes *cane sugar into grape sugar.* The pepsin, aided by the acid, breaks up *protein into peptones.*

The pylorus (see figure on this page) opens for liquids. Water or other liquid taken with the meal is promptly sent by the rhythmic contractions into the intestine to be absorbed. The solid food moves around close to the walls of the stomach; as it is gradually reduced to a half fluid called chyme it moves to the center and is passed into the duodenum by the pylorus from time to time. From two to four hours after the meal the stomach is empty.



PYLORUS, the gate between stomach and small intestine, *D.*

When the acid chyme passes the pylorus, the intestinal cells notify the pancreas to begin secreting. This message is brought to the pancreas not only by nerves but also by *a hormone called secretin* which the intestinal cells send to the pancreas in the bloodstream.

The pancreas (figure, page 338) looks somewhat like a flattened banana, and is reddish yellow in color. It lies behind the lower border of the stomach. Its secretion, the *pancreatic juice, contains three ferments:* one changes starch to grape sugar, another changes proteid to peptones, and the third acts upon fats. Thus the digestion of *starch,* begun in the mouth, and the digestion of *proteid,* begun in

the stomach, are completed in the small intestine.[1] The protein envelopes of the fat cells were digested in the stomach and fat globules set free. Fat globules are digested in the small intestine, being divided into fine particles to form *an emulsion.* The fat in milk, before it collects as cream, is an emulsion and makes the milk white.

There are many small tabular *intestinal glands* in the mucous layer lining the small intestine; their secretion, the *intestinal juice*, contains a ferment which changes *cane sugar* and *malt sugar* to grape sugar, the only kind of sugar which can enter the blood.

The bile duct and pancreatic duct unite and enter the duodenum by a common duct. *The liver* is the largest gland in the body and it secretes a large quantity of *bile* which it makes from worn-out red cells of the blood. *What is the bile for?* This greenish yellow liquid doubles the power of the pancreatic juice to digest starch and proteid and trebles its power to digest fat. After the bile has done its work its salts are carried by the blood back to the liver to be made into bile again. Bile salts excite the secretion of the liver; calomel and other drugs do not.

Summary of digestion: Mouth, for *starch;* stomach, *proteid;* small intestine, *all;* colon, *none.*

There is no *absorption* from the mouth and very little from the stomach. *Nearly all the absorption of food takes place from the small intestine.* Its lining has many folds and fine velvety projections to increase the absorbing surface.

The large intestine, or colon, is chiefly an *excreting* organ.

[1] In the intestinal wall and perhaps in the liver peptones are broken into still simpler substances called *amino-acids;* in this form proteid food is carried to the tissue cells.

The cells in its walls excrete lime, salts, iron, and phosphates. A part of its contents consists of bacterial growth and indigestible parts of the food such as cellulose (woody fiber).[1]

The bean-shaped *kidneys* are against the back of the abdomen. From each kidney a white tube — the ureter — conducts its secretion to the bladder. This is a muscular bag lined with mucous membrane and lying in the pelvis (page 324). The kidneys purify the blood by filtering from it, mineral salts, urea, uric acid, water, and poisons.

Hygiene. — You have already studied two chapters on the hygiene of food: "Pure Food" (page 74); "Food Values" (page 93). *Most writers lay too much stress upon digestion.* One who takes plenty of exercise, breathes fresh air, and eats pure food freely and regularly will not be troubled with indigestion. Beware of *food faddists* and *diet cranks*.

[1] This waste material collects in the sigmoid bend of the colon (figure, page 338) and once or twice a day rhythmic contractions carry it into the rectum. This gives a sense of fullness and uneasiness. This important instinct, or "call of Nature," should be promptly obeyed. If it is disregarded, the rectum soon relaxes and may become pouched and constipated. This is a condition which should be shunned by all refined and cleanly people. Metchnikoff holds that the growth of the colon bacillus (see page 54) and other bacteria in a sluggish colon and the toxins they give off cause hardening of the arteries and old age.

Foods that prevent constipation: Fibrous vegetables, green vegetables, fruits and potatoes eaten unpeeled, oily nuts (pecan, walnut), olive oil, dates, raisins, prunes, stone-rolled whole wheat, mush from the same flour, wheat bran (buy it at feed store) used in bread, breakfast food, pancakes, or puddings. Drink plenty of water.

Constipating foods are: White bread and pastries, blackberries and raspberries, hard-boiled eggs, milk with meals.

Foods which tend to form gas, if eaten too freely, are: White bread and pastries, sugar except for sweetening, baked beans, sweet potatoes, white potatoes, except when baked, polished rice, tapioca, raw apples and grapes, meat if eaten three times a day. Remember there are exceptions in these lists differing for each individual.

Signs of gas are: Belching, rumbling, palpitation of heart, colicky pains.

One tells us to eat no salt, another says no meat, a third shuns sugar and starch. One eats no breakfast, the second no supper, the third eats one meal a day, the fourth eats six meals a day and between meals. One drinks no fluid at meals, another munches for an hour. One says eat everything raw, the next says eat everything cooked. One says eat very little, the latest crank says eat whatever you want whenever you want it.

Nutrient fraction of six foods (black).

Avoid extremes. — No one way can be right for all. Each should follow the way that experience has shown to be best for him. The Germans eat six times a day and tend to corpulence, yet one who eats only twice a day tends to overload his stomach. The city man is away from home at noon, he rightly eats dinner in the evening; the country man is near home and has the advantage of eating the heavy meal at noon.

Each country should prefer *home-grown food* because of its freshness. Arizona *dates* are as fine as African dates and better than the usual imported ones which have been soaked in molasses. Solidified *cottonseed oil* is much prized abroad for making margarine, which is better than inferior butter sold in America at a higher price. *Cottonseed meal* is bright yellow, free from rancidity, and has a pleasant odor. It has twice the fuel value of eggs and one half more than beef or mutton. If it prove after refining and trial to be a healthful food for man, it would supply the place, not of bread, but of meat. A pound of

protein costs as cottonseed meal 5 cents; as beefsteak about 85 cents; as eggs about $1.06.

With the protein of beans, peanuts, cowpeas, milk, or eggs at hand, none need suffer from pellagra because of a one-sided diet of carbon foods. Pellagrins can thus add protein to their diet as suggested by the United States Public Health Service.

Applications. — 1. Let pupils hand in actual menus of their lunches or other meals, without signing them. The teacher and class will discuss them.

2. *About 2500 food units* (calories) are needed daily. If, to balance the diet, $\frac{6}{10}$ of the 2500 should be sugar or starch, $\frac{3}{10}$ fat, and $\frac{1}{10}$ protein, how many units of each kind are needed? Select three meals for one day (2500 units) from the following list, with the food units after each food (see also lists on pages 96, 99) and bring the menu to class. To balance your ration roughly, select one proteid food (lean bacon, peanuts, cheese, steak, chops, eggs) for each meal and about half as much of fat as of sugar and starch (carbohydrate); but consult your taste as well. Water and salt are to be used, but are not on the list with calories, for neither will burn even if put into a fire.

Bread (1 oz.), 1 slice,	80	Round steak, ½ lb.,	200	Cheese, 1 oz.,	120
Corn bread, 1 oz.,	80	Potato, usual size,	140	Sugar, heaped teaspoon,	40
Lean bacon, 1 slice,	80	Sweet potato, usual size,	200	Butter, 1 inch cube,	40
Peanuts, 1 oz.,	150	Milk, ½ pint,	140	Egg, 70;	Banana, 50
One pork chop, ⅓ lb.,	150	Buttermilk, ½ pint,	100	Apple, 60;	Orange, 50

3. Have the pupils examine labels on packages in pantries and kitchens, bottles, tin cans, pasteboard boxes, wrappers. Collect and bring to school all labels containing the words: artificially colored or flavored, coal-tar preservative, salicylic, sulphite, borax, alum, etc. (See page 74.) Look especially for small, dim print.

He who weakens his digestion by selecting only the most digestible foods will be made sick when those foods are not within reach. One who eats only soft foods or foods from which mineral salts have been removed by milling (page 104) or boiling will have unsound teeth; and cleaning them three times a day will not keep them sound. The greatest need of the modern table is something to chew. Bread made without hog grease (water bread) is tough; it gives the teeth something to do, nor does it become stale quickly. Since lard hinders the action of saliva upon starch, water bread is more nourishing than shortened bread. One raw food should be eaten at each meal.

Those who eat too fast eat too much; those who munch too long or worry with diet foods do not eat enough. In cases of chronic invalidism the patient must be encouraged to eat. In acute illness the wise physician usually finds it best to give no food for a week or more except plenty of water. A fever patient loses by lungs, skin, and kidneys 4 or 5 quarts instead of the usual 3 quarts of water a day. Water washes out the toxins.

Foods have degrees of digestibility: (1) Liquid foods are most quickly digested; (2) next come foods that liquify at body temperature; (3) those already broken into fine particles — as mashed potatoes, baked potatoes, crumbs, pieces of vegetables, nut butters; (4) those easily broken up — as boiled potatoes, bread; (5) those somewhat harder to divide — as meats, raw fruits; (6) those toughest of all or with most refuse fiber — as fat meats, salads, raw vegetables, hard-boiled eggs, cheese. He who has good teeth and uses them will change the order of digestibility of some of these foods.

Test Questions. — Digestive tube; its parts, length, walls, lining? What is said of the mouth? Gullet? Stomach (size, position, glands)? Small intestine (dimensions, pylorus, duodenum, pancreas)? Liver? Colon (size, structure, function)? Define digestion; ferment. Give location of salivary glands. Effect of saliva? Changes that take place while food is in stomach? In small intestine? Name the secretions in stomach and small intestine and their effects. Describe action of pylorus. Describe digestion of fat. What is the bile? Its use? Where is the food absorbed?

Name some food fads. What is said of time for dinner? The number of meals? Arizona dates? Cottonseed oil and meal? How many calories of food are needed daily? What proportion of the three foodstuffs is needed? Have you made out a menu totalling about 2500 food units? Is food taken during illness? What two warnings are added? Discuss chewing. Water bread. Name six classes of foods according to digestibility.

CHAPTER XXVI

THE SKIN

THE skin protects, purifies, and cools the body. It has *two layers*, the epidermis, or outer skin, and the dermis, or true skin. The epidermis is a sheet of epithelial cells and would soon go to pieces but for the fibrous dermis supporting it; the dermis would soon dry out but for the scaly mat of epidermis covering it.

The lowest cells of the *epidermis* contain *pigment* (see first figure on page 291) which gives complexion and color. The deep cells of the epidermis are young and round (see same figure); they multiply and displace the older cells outward. When the cells reach the surface, they are dry and flat. The epidermis is epithelial tissue.

Some cells of the epidermis grow down into the dermis and form pits from which the *hairs* grow. The hairs lessen the heat loss and help the nerves of feeling in the dermis. The epidermis and hair are made supple and partly protected from drying out by an oily secretion. This is supplied by *oil glands* with mouths opening into the hair pits. See figure on next page. The *skin oil* also protects against infection since it covers the skin and does not nourish germs. Too much oil in the scalp holds the scaly cells together in flakes and they are shed as *dandruff*. Sometimes in a warm bath the epidermis is rubbed off in rolls. Great heat may raise the epidermis in a *blister*, with lymph beneath. A blow also may do this and break

capillaries so that the blood leaks in and forms a *blood blister*.

The soles and palms are without hairs; hence they are also without oil glands; but their *sweat glands* are especially numerous. A sweat gland is a simple tube lying coiled in the dermis (see figure on this page); after a spiral course it reaches the surface as a pore. These glands regulate the heat of the body and remove impurities. Perspiration is usually insensible, but at times it collects in drops.

SECTION OF SKIN (for blackboard). *a*, *b*, epidermis (*a*, dry cells, *b*, soft round cells); *c*, dermis; *f*, loop of capillary in a papilla; *e*, nerve ending in papilla; *i*, sweat gland; *m*, oil gland opening into hair pit; *g*, *g*, nerve fibers; *h*, *h*, capillaries; *d*, *d*, fat cells.

That the *bulk of the dermis is connective* tissue may be known from the fact that leather is the connective tissue of an animal's hide from which the epidermis, nerves, and blood vessels have been removed by tanning. The dermis projects in hillocks into the epidermis. Each hillock, or *papilla*, contains a *nerve ending* or the *loop of a capillary*. On the palm where they are in rows, you notice they raise the epidermis and distinct ridges. A *wart* is rough because it consists of several papillæ grown through the epidermis.

The skin absorbs. Wash your hands with strong soap as soon as you come home if you have touched poison ivy, to remove the poisonous oil before it soaks in. If not, you may have to use a wash made of sugar of lead.

Hygiene. — A *healthy complexion* is indispensable to

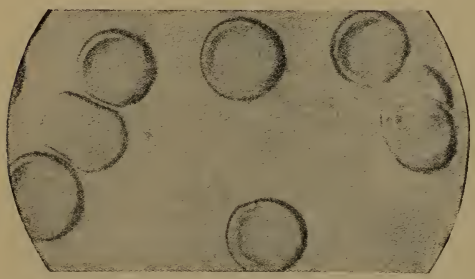
good looks. This is because the race is instinctively attracted by tokens of good health and repelled by signs of bad health. The quality of *the complexion depends* largely upon the manner in which the lungs, stomach, liver, brain, nerves, and blood are treated and the way in which they do their work. But many act as if they think the skin of the face is independent of the rest of the body. See picture on next page.

A weak, unsound skin is not resistant to infection. Pus germs and other germs reach the hair pits and oil glands, multiply, and cause *pimples. To become free of pimples* live wholesomely, keep the face clean by thorough washing with soap and tepid water; rinse the soap off and finish with cold water. Never touch the face with the fingers at other times unless they have just been washed. Some boys and girls have pimples (acne) at the age of fastest growth because the nourishment cannot quite keep pace with the growth. Overeating of course would not help, for this would not increase but interfere with the powers of digestion. Never use *soap* strong enough to make the tongue smart if you taste it.

A *sallow skin may be made fresh and rosy* by outdoor activities, sleeping with open windows, eating more fresh vegetables and fruit and less meat, and shunning overheated rooms.

Regulation of the temperature of the body is the most important duty of the skin. All of the heat loss of the body takes place by the skin except the heat carried off in warm breath and bodily wastes. The skin loses heat by *contact* with the air and cold objects, and it gives up heat to change perspiration *from its liquid state into water vapor.* This takes up as much heat as is required to boil away an equal amount of water on the stove. The bodily temperature is controlled not so much by regulating the heat production in muscles, liver, and other heat-making organs as by regulating the perspiration and the amount of blood in the skin.

Clothing helps to protect from heat loss because air is a poor conductor of heat; air is inclosed in the meshes of the fabric and between the layers of clothing. *Wet clothing* does not prevent but aids the passage of heat from the body. *We should dress for indoor temperature.* Since this is nearly as high in winter as in summer, *cotton is most suitable for undergarments.* It is then easy to change the outer garments or add to them when going out, according to the severity of the weather. The body's heat regulating power is limited. This we might conclude from the constant talk about the weather.



THE COMPLEXION AND THE RED BLOOD CELLS: These tiny hollow disks are very tender and easily injured by heat, cold, drugs, or chemicals. If broken, their red stuff and other life stuff pours out into the plasma and the empty "shadow cells" float on to the blood filter, or spleen. If much stuff is set free, it makes the skin sallow, bluish, or ashy; practically all headache remedies, coal-tar drugs, tablets, etc., discolor the complexion and destroy millions of good red cells.

The body will become a poor heat-maker and heat-saver if one lives in a needlessly warm dwelling or wears heavy flannels. The condition overtakes one who habitually hugs a stove or radiator, or sits over a hot-air register. He easily gets the shivers, has cold hands and feet, and cannot bear a draft. This preference of too great comfort to vigor will weaken his whole body. Daily cold baths, lighter clothing, a couple of hours daily in the open air, and sitting away from the stove *will train him to become a better heat-maker.* Which food makes most heat? (See last chapter.)

Infants are poor heat-makers and should be carefully

protected. Active children are good heat-makers unless overclothed and weakened by hothouse life. *The skin, like any other part of the body, must be trained to work.* Kindness, tenderness, and indulgence, more often than hardship, are the assassins of health and life. If you fear heat prostration in summer, give your skin a chance to work. If you would insure against pneumonia, train your skin with cool baths. If colds are about and you escape them, thank your skin.

If your *throat* becomes tender because of high collars, dash cold water on it whenever you wash your face and cease to muffle it up. A *cold air bath* in the morning, during a few minutes of bedroom gymnastics, is invigorating. *If your skin fails to react* and glow after a cold water bath with vigorous rubbing, see that the bathroom is warmer next time or heat your body by rapid exercise before the bath. *If inclined to be nervous*, do not take cold baths, but take a cold shower or a dash of cold water for a few seconds at the end of warm baths. Why should a cold bath be long in summer and short in winter?

Cold feet may be due to the use of foot warmers or to obstructed circulation from tight shoes or garters, or to general inability to make heat; or cold, sweaty feet may come from wearing rubbers when not walking; the cells in the sweat glands degenerate and the skin relaxes. Such feet should be washed in cold water morning and evening and rubbed until they are red and warm; wear light, well-ventilated shoes; to exercise feet, rise and sink on the toes, repeating for five minutes; become a good heat-maker in general.

House air. — Cool air that has sufficient moisture will no longer have enough when it is heated and expanded without moisture being added to it. Therefore heated house air is generally too dry. Passing to and fro between such house air and the outdoor air is a great strain upon the cells of the mucous membrane. If the lining of any of the air passages becomes dried out, it cracks; frequent or chronic colds and catarrh may follow. Our mucous membranes were not

developed for furnace-heated houses. The only instances of *injurious dampness indoors* in heated buildings are: laundries, textile mills, and sometimes crowded assembly rooms. House temperature should be below 70° and humidity over 50.

Dry air may crack the mucous membrane and cause chapped lips and colds, *dry the scalp* and increase baldness, *dry the skin* and cause winter itch, chapped hands, and bad complexions. Damp air adds to the sultriness of a summer day because the air being already filled with moisture cannot take more from the skin. A dry atmosphere cools the body by hastening evaporation. Dry air leads to a demand for overheating because dry air at 70° feels as cold as normally humid air at 60°.[1]

[1] *For all systems of heating* there are easy methods of humidifying the air. *Fireplaces* draw in outdoor air so plentifully that the air is humid enough.

For stove heat, place a broad pan or vessel on the stove and *keep water in it all the time.*

For hot-air heat, place a pail or deep pan in each register; fill daily; for wicks stand many thicknesses of newspapers in the pans and the thirsty air will drink there instead of from your skin or air passages; or use cloth wicks, letting them hang from a pan down into the pipe. Water pans at the base of furnaces are useless. A curved trough or pan made to fit around the dome of the furnace, holding 15 gallons and filled daily, is another way to solve the problem.

For hot-water heat, have long pans or trays made and set under radiators and insert wicks made of blotting paper or newspapers.

For steam heat, have a stop cock fitted to a radiator in each room on the side at which steam enters; let steam escape into the room.

A gallon of water should evaporate in each room daily. You will not look so dried out or mummified when winter is over, will have had fewer colds, and will have paid fewer doctor's bills.

Tests. — If air has to be heated to 70° to be comfortable, it is too dry. On very cold days, if no moisture is condensed on window panes, the air is too dry.

Fortunately for the Gulf States and states on the Mexican border, simple methods of heating are best, and, whatever selling agents may say, any kind of furnace or central heating with its attendant risks to health is needless.

TEST QUESTIONS. — Why are both dermis and epidermis needed? What is each made of? Is there a difference between the cells in the epidermis? Where is the root of a hair? What is the origin and use of the natural skin oil? Explain dandruff; blisters.

Describe a sweat-gland. What makes up most of the dermis?

What is leather? A papilla? Where are oil glands absent? Explain the presence of lines in palms and soles.

Why is a healthy skin essential to good looks? Upon what does a good complexion depend? What are causes of pimples? Sallowness? The cure? What is the most important function of the skin? In what two ways does the skin give up heat? How is the heat loss increased? Diminished? What is the body's normal temperature? How does clothing keep us warm? Rule for amount of clothing. What material is most suitable for underwear? How does one become a poor heat-maker and saver? How reform? Infants and children as heat-makers? Why needful to exercise the skin? What is to be done if the throat is delicate? Effect of cold-air baths? What three ways to aid reaction after a cold bath? Causes of cold feet? Cure?

Why is heated house air liable to be too dry? Effect of too dry air on mucous membrane? Hair? Skin? Why does dry air feel cooler than moist air of same temperature? How is moisture added to air when heat is from stoves? Hot-air registers? Hot-water pipes? Steam pipes? How much water per room should evaporate daily? Give two rough tests for proper humidity. What is said of heating houses in border states from Florida to California?

DEGENERATIVE DISEASES. Combined death rate (per 10,000 pop.) from apoplexy, paralysis, and diseases of the kidneys, heart, and circulatory system. Note that the rate has nearly doubled in the U. S. Registration area within 30 years. Those saved from infectious diseases by public hygiene died of degeneration from lack of personal hygiene.

CHAPTER XXVII

THE SENSES

The muscular sense comes from sensory fibers in the muscles. It allows us with our eyes closed to know the position of our limbs. By means of this sense the muscles and nerves of a baseball pitcher coöperate to put the ball over the plate.

The sense of touch reports changes of pressure and temperature in the skin. There are special fibers for heat, for cold, and for pressure. When a sharp point is pressed on the skin, the pressure becomes painful just before it is strong enough to pierce the skin.

The nerve endings for *taste* are in the papillæ of the tongue. Notice the tongue has a velvety look because of its many papillæ. Sour and sweet tastes are reported by the edges of the tongue, salty and bitter tastes by the back of the tongue.

The nerve of smell.

The nerve endings for *smell* are spread over the upper part of the nasal chambers. We sniff to draw the odor higher in the nose. We smell gases only; solids and liquids do not affect the nerve of smell. Flavors reside in odors; foods lose their flavor but not their taste when there is a severe cold in the head.

Hearing. — In the wrinkled cartilage called the *ear* you notice the opening of a canal. This leads to the *drumskin* (commonly called the "eardrum") which sepa-

rates the *outer ear* from the drum chamber or *middle ear*. There is a tube leading from the throat into the drum chamber which keeps the air pressure equal on both sides of the drumskin. Artillerymen hold the mouth open when they fire a cannon. Why? Sound waves set the drumskin to quivering. Three tiny bones, the hammer, anvil, and stirrup (see picture on this page), carry the sound from the drumskin across the middle ear to the labyrinth, or *inner ear*. There it reaches the ends of the *auditory nerve*. The inner ear is filled with fluid. It also contains the nerve endings of the *balancing sense* whose nerve fibers go to the brain in the auditory nerve. When you whirl for several minutes and stir up the liquid of the labyrinth, what happens to the balancing sense?

The three bonelets of the middle ear.

Sight. — The eyeballs are in deep, bony sockets. The *optic nerve* and other nerves pass to the brain through holes in the walls of the sockets. The lids and tears are perfect dust removers; the lashes are eye shades. You will see from the figure on this page and by studying your own eye that the eye is much like a camera. The curtain or iris adjusts the round window or pupil to the amount of light; the *lens* is just behind it and throws the images on the rear wall. Copy the figure in your notebook or on the blackboard and write the names of each part.

The two humors fill the ball and keep it round. The *sclerotic* coat, or white of the eye, makes the eyeball tough and strong. Its transparent front is called the *cornea*. The *choroid*, or middle coat, absorbs light which may pass through the *retina*. The retinal coat contains the sensitive

endings of the *optic nerve.* Twelve muscles have the important duty of moving the eyeballs.

Hygiene. — Squinting is due to lack of balance of the eye muscles. Squinters to prevent seeing double disregard the images in one eye, and it may become blind if not treated promptly with glasses. *Sties* are due to infection of the lid because of lowered vital resistance and lack of cleanliness.

Astigmatism means that the lens is ill-shaped, the curvature not being equally strong all around. In *farsightedness* the eyeball is too shallow and the image falls beyond the retina. In *nearsightedness* (myopia) the eyeball is too deep and the image falls short. In both cases the image is blurred. These three defects can be corrected by glasses. Headaches following study indicate astigmatism.

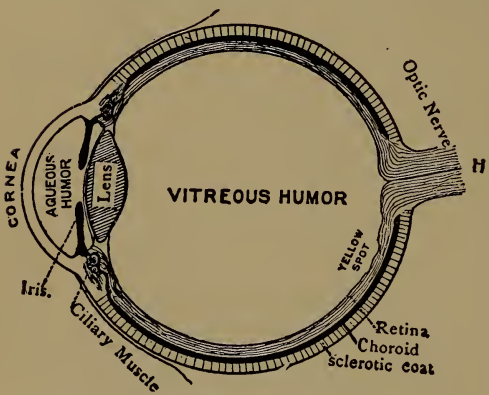


DIAGRAM OF THE EYEBALL (for blackboard).

If your eyes feel gritty, winky, watery, or achy, look to your *light.* It should not be too dim nor too bright, and above all it should not flicker. Do not sit near moving picture screens, do not look at flickering pictures. Light that comes from the front or from low down is very trying. Nearsighted pupils should have front seats. A blackboard should not be placed between windows. *Windows* of schoolhouses should, according to the site, take up one fourth to one sixth of the wall space.

Nearsightedness is caused and made worse by *bending the head over the work.* This makes the eye adjust itself for short distance; and, still worse, it makes the blood congest in the eye. If the desk has not a slope of 40°, the hand holds up the book but soon gets tired; the book lies flat on the desk, the spine is bent, the head drops, and the eyes are injured. See pictures, page 213.

Weak eyes are due to use when weak from illness, bad lighting, print or work too fine, and above all to bad habits of posture, as just explained.

The *normal ear* should hear a watch tick several feet away and a whisper 18 or 20 feet. Test it, trying each ear separately. You learned that the throat is the meeting place for many roads. (Which?) The tube that leads from it to the middle ear, or drum chamber, may be closed by a chronic cold and inflammation and the ear on that side may become deaf. *Earache* may be caused by risings in the outer canal or in the drum chamber. Never use laudanum to relieve it if you value your hearing; a bag of hot salt will probably serve the purpose. Blowing the nose very forcibly may injure the drumskin. A cold that settles in the middle ear may stiffen the hinge joints between the three bonelets. This may cause whispering sounds and even deafness.

Every *noise* gives a nervous shock like the blow of a tiny hammer disturbing the cerebral mass. Railway mail clerks, typewriters, printers, show symptoms of chronic fatigue because they work under tension and heightened blood pressure due to the shocks from noise. A depression comes when reaction sets in. As the eyes need rest, so the ears need silence. Most people who live in the noisy parts of cities are in a state of constant nervous fatigue and unfit

for sustained effort. Just as some people come to dislike fresh air, others learn to like noise; either is a proof of an abnormal condition.

TEST QUESTIONS. — Where do the fibers end that report the muscular sense?

Name the special senses. When is pain felt in the skin? What is said of the sense of taste? The sense of smell? How far in does the outer ear extend? What is the middle ear? How is the air pressure kept equal in outer and middle ear? What is the function of the bonelets? Where are the endings of the nerve for balancing? Its fibers are bound up with what nerve?

Locate and give the use of: orbits, lids, tears, lashes, iris, pupil, lens, aqueous and vitreous humors, sclerotic coat, cornea, choroid coat, retina, optic nerve.

State the facts which control the hygiene of squinting, sties, astigmatism, farsightedness, nearsightedness, lighting, and posture in relation to the eyes.

Why are textbooks with large, clear pictures more desirable than those with small pictures or none at all?

What is a test for normal hearing? What two results from colds in the head may lead to deafness? Explain earaches. What injury may result from blowing the nose too forcibly? Explain fully how habitual noise is an injury.

APPENDIX

By permission of the University of Wisconsin.

Exercises for strengthening the walls of the abdomen (see appendix).

APPENDIX

PREVENTION OF ACCIDENTS; EXERCISES FOR PRACTICE IN FIRST AID

FIG. 1

As in all matters concerning health, so with accidents, *prevention is better than cure*. Preventable diseases number one half, but preventable accidents number two thirds of all.

Poisons should be labeled with skull and crossbones and placed out of reach (Fig. 2). (Obtain labels from any druggist.)

Burns. Children should not stand near open fire in chimney or field, as the draft may draw the skirt or clothing into it. In case of *burns*, apply common soda in a thin paste twice a day.

How to Avoid Street Accidents

Do not cross streets except at crossing. You have right of way there, but nowhere else. Look both ways before starting; do not turn back, as hesitation will confuse drivers.

In using a knife, cut from, not towards, your face. In case of a cut artery, press it on the side nearer the heart (Fig. 7). Figure 11 shows

FIG. 2.

tourniquet on the leg. Practice on the arm. Find artery near the armpit or in the wrist by its throbbing. Make tourniquet with a handkerchief, and use a smooth stone over artery. Do a cut up in the blood. Blood is a good antiseptic and salve.

Carrying the Injured

Let one boy lie on the ground; three others stand side by side, slipping their hands under him and lifting together at word of command (Fig. 13.) All of the methods here illustrated should be practiced in class. Fireman's lift (Fig. 3). Two-man carry for helpless (Fig. 4). Chair-carry with chair (Fig. 5). Chair-carry without chair (Fig. 6 and page 302). Chair-carry with support to back (Fig. 14). Three-man carry (Fig. 13).

Giving way of abdominal wall beneath the skin (rupture, or hernia) is very common. It is believed to occur with five out of a hundred men and boys. It is difficult for surgeons to remedy even with an operation, for it only occurs when the wall is thin and weak. Sometimes a loop of the intestine is pushed under the skin and may become strangulated, threatening death. In this case lift the boy by his feet (Fig. 12) and hold him a few seconds with the head down, and the loop will return to its place. It is important to practice exercises to develop the wall of the abdomen. Two of these (figures loaned by University of Wisconsin) are shown on a preceding page. A pillow may be kicked instead of a football. Instead of raising the legs, the legs may be held down, while the person rises to the sitting posture twenty times. The feet may be held while the person lying on his back tries to kick his feet free. All such exercises strengthen the walls of the abdomen and prevent this disabling accident.

To sterilize a knife or needle for picking out a splinter. See Fig. 9.

To make a sling for broken arm with a triangular bandage. Fig. 8.

To bind up a deep cut in the palm (Fig. 10). Place in the middle of the palm a pad of sterilized cotton which the patient is to grasp tightly. With a bandage bind the fingers firmly over the pad, passing the bandage round the hand and wrist.

Peroxide of hydrogen is best for *sterilizing wounds* and sores. It becomes useless if it is very old. Foaming is a sign that it has not lost its strength and that it has found work to do.

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 9.

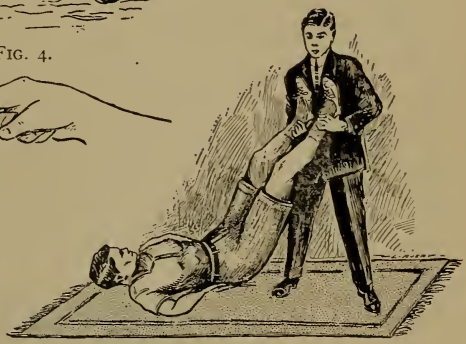


FIG. 12.

FIG. 7.

FIG. 10.

FIG. 13. Three-man Lift.

FIG. 8.

FIG. 11.

FIG. 14. Chair-carry with support to back.

First Position

Second Position

Resuscitation

Let every pupil in class practice this important exercise so he will not hesitate if he ever need to use it. Lay the patient face down, the face a little to one side. Place hands as shown in Position 1, with thumbs extended toward each other. Lean forward and put the weight of your body straight over the lower ribs (Position 2) and count three slowly. For two seconds release pressure (Position 1) by squatting backward. Alternate thus about 12 times a minute until breathing is restored.

"WE WILL NEVER DESERT A SUFFERING COMRADE." (*Page* 1.)

INDEX

Figures in italics refer to definitions. References include the illustrations and legends as well as the text. The index may be used as a guide for final review, one column for one lesson. It may also furnish subjects for essays and guide in writing them; examples: White Blood Cells, Citizens (and health), Woman's Health, Death Rates, Dust, Factories (and health), Resistance to Disease, Clothing, Schools (and health).

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