HEALTH STUDIES

HOAG

A City Playground.

Fresh air and sunshine and outdoor exercise promote health and diminish disease.

HEALTH STUDIES

APPLIED PHYSIOLOGY AND HYGIENE

BY

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PREFATORY NOTE

This little book of Health Studies is the work of a wise and earnest man who is also a successful physician. Doctor Hoag has tried to tell young people, in plain and direct language, how to take care of themselves and thus to take the ordinary course of their lives out of the hands of himself and other physicians. For the most that the doctor is called on to do, in our day, is to relieve his patients from the necessary results of carelessness or ignorance, on their part or on the part of others. When carelessness and ignorance can be avoided, we call it criminal not to do so. It was long ago said about other forms of wickedness, "It is their condemnation that light is come into the world." Much light as to sickness and health has come of late years through the advance of scientific research. It is nowadays the "condemnation" of ignorance that truth is so easy of access. Men and women who "ought to know better" than to do unwholesome things must be taught to do better. To help the young people in our schools, who will be men and women before very long, to know the truth about common living and to act on such knowledge is the purpose of this book. And having read the book in manuscript, and having known the author as one of my own students, I feel sure that it is well fitted to fulfill its purpose.

David Starr Jordan

Stanford University.

PREFACE

Anatomy and physiology, except in their simple elements, are of doubtful value for young pupils. But the study of how to keep well, or hygiene, is something that every boy and girl, man and woman, must learn or else must suffer for his ignorance. Hygiene, properly presented, deals with things of everyday life. No pupil in the schools is too young to begin to learn how to adjust himself successfully to his surroundings. This learning how to meet our environment, as Professor Huxley long ago said, constitutes a liberal education.

Many of the school texts have been based too exclusively on physiology, or have dealt largely with elementary anatomy, and have been difficult of comprehension to the pupils. Health Studies differs materially from such books. It makes hygiene the primary study, and introduces only a sufficient amount of physiology to form a sound basis for the study of health principles.

If this small book succeeds in helping its readers to think for themselves; if it encourages them in making their own definitions; if it leads them to realize that it is not ignorance but knowledge which leads to health, and therefore happiness; and finally, if it helps to prepare them to meet practical life as they will find it, — then its appearance will have been justified.

These studies are not intended for memorizing. They are meant to encourage thought and a little original work on the part of the pupil. The text, to be successful, must be taken as a basis for simple discussions about the things which the pupils find around them every day, and not merely as lessons to be learned. The lessons should be made a pleasure rather than a duty. Any pupil can be interested in the things of real life.

The criticism will perhaps be made by some that the lessons are not presented in the usual way, and that many things are introduced which are difficult for young students. The writer believes that this subject is no more difficult than arithmetic, much less difficult than grammar, and considerably more important in life than either of these subjects.

The topics on each chapter (pages 181–198) are intended as an outline for discussion, but not as demands upon the pupil to be rigidly insisted upon. If the pupils, after reviewing these topics, will make out from them a written outline of each chapter, it will prove a helpful exercise.

The suggestions for teachers, which are found in the appendix (page 205), present many topics for class discussion, give ideas of how to start pupils on a little original observation, and furnish a bibliography of interesting articles on health subjects which are available in almost every community.

Suggestions and criticisms from teachers who are really interested in health work and in trying to make hygiene and physiology teaching something more than lessons to be finished by the pupil will be greatly appreciated by the writer, who has here ventured into a comparatively new field.

Many friends in the medical and educational world have given useful suggestions during the preparation of the manuscript. Cordial thanks are due Dr. David Starr Jordan, President of Stanford University; Professor D. R. Jones of the San Francisco Normal School; Dr. N. K. Foster, Secretary of the California State Board of Health, Sacramento; Dr. G. F. Reinhardt, Professor of Hygiene, University of

California; Dr. Ernest A. Sweet of the Public Health and Marine Hospital Service, San Diego; Dr. D. D. Whedon, San Diego; Mr. Edward Hyatt, Superintendent of Public Instruction, Sacramento; Dr. William F. Snow, Professor of Hygiene, Stanford University; Miss M. Henderson of the State Laboratory of Hygiene, Berkeley; Miss Grace Fisher, head of the Department of Domestic Economy, Manual Training School, Menomonee, Wisconsin; Mr. A. L. Hamilton, Superintendent of Schools, Mr. W. H. Holland, Principal of the Garfield School, and Miss Virginia Pease, Principal of the Elementary Polytechnic School, — all of Pasadena.

Particular thanks are due Dr. Winfield Scott Hall, Professor of Physiology in Northwestern University Medical College, who wrote the chapter on Stimulants and Narcotics and furnished much of the material for the chapter on Food; and to Dr. Arthur R. Reynolds, formerly Commissioner of Health, Chicago, who supplied some of the facts for the chapter on Public Health.

ERNEST BRYANT HOAG

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HEALTH STUDIES

THE OBJECT OF HEALTH STUDY

It rarely occurs to people that most kinds of sickness are *preventable accidents*. The greatest teacher of science that England ever had, Professor Huxley, once said that we should look upon most cases of illness as *criminal*. What he meant was that people have no right to treat their bodies recklessly, or to expose others to disease by their own carelessness. Such carelessness may be a crime. Every one who becomes sick puts a burden on somebody else. Every one's usefulness is decreased by sickness.

Another great Englishman, many years ago, said that no other thing has detracted so much from happy living as our sins against health, and those of our forefathers.

Man has always been most afraid of those things which he does not understand. One need fear disease far less when one really understands its nature and how easily it can often be avoided.

We are all ashamed of most kinds of ignorance. We wish to be well educated in order to succeed in the world, and because it makes us happier. In spite of this fact, few people feel any shame in their ignorance of how to care for their own bodies. Boys and girls often pass through the schools knowing almost nothing of how the body does its work. Many men and women are graduated from college just as deficient in this kind of knowledge. Teachers, lawyers, ministers, and business men, whom we all respect, sometimes do the most foolish things imaginable in neglecting the care of their health.

Knowledge is desirable only when it can make us happier or more useful. Nothing else in the world has so much to do with happiness and usefulness as *good health.* It is the duty of every one to learn something of how his body does its work and how that work can be made most efficient. It is not essential that young students, or even most older people, should know a great deal about the structure of the body. This is what is called *anatomy.* But we all need to know something about how the work of the body is done. This is *physiology.* We ought to learn even more about the things that interfere with its best action, and how to avoid them. This is *hygiene.*

The complete study of the human body is one of the most difficult of all subjects. No piece of machinery, however complicated it may be, can compare with the body in this respect. But without trying to study all the details of its structure and all the complicated kinds of work which it does, we can understand enough about this human machine of ours to learn how to take the best care of it. This is health study, for *hygiene* is a word which means simply *health.*

PART I

GENERAL PHYSIOLOGY

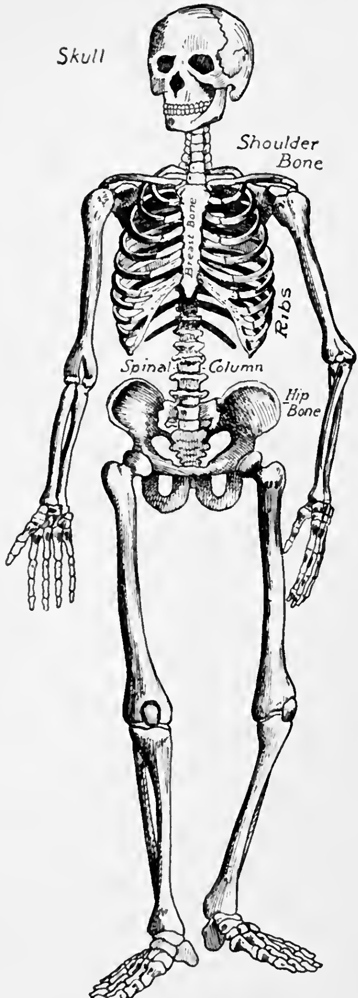


FIG. 1.—THE HUMAN SKELETON.

CHAPTER I

THE GENERAL PLAN OF THE BODY

To make the best use of the house in which we live, we examine first the general plan on which it is built. We must know how many rooms it has, what is the shape of the rooms, and how they are arranged and connected. The appearance of the house as a whole also interests us. In studying the human body and how to make the best use of it, we must likewise know first something of the general plan of the body and around this build up our knowledge.

The framework of the body

The framework of the body is shown in Figure 1 on page 4. Notice that while the body frame has many separate parts, yet they group themselves into a few main divisions:

1. The box-like skull.
2. The backbone.
3. The ribs and breast-bone.
4. The arm bones and hands.
5. The shoulder bones, to which the arm bones are attached.
6. The leg bones and feet.
7. The hip bones, to which the leg bones are attached.

The bony part of the body is called the *skeleton.*

Enclosed within the bony framework are many important parts, or *organs*, of the body. The body as a whole may be considered as separated into four main divisions (Fig. 2):

The main divisions of the body

1. The head.
2. The chest.
3. The abdomen.
4. The appendages (arms and legs).

The *head* contains the brain, the eyes, the mouth, tongue, and teeth, and the organs of hearing and smelling.

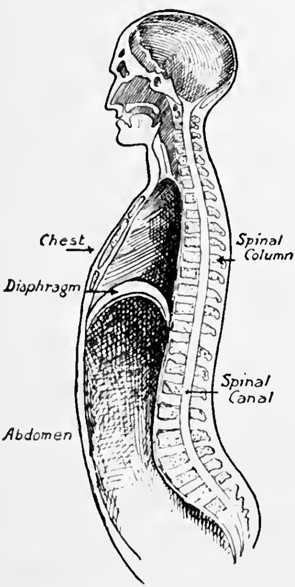


FIG. 2.—THE MAIN DIVISIONS OF THE BODY.[1]

The *chest* contains the lungs, the heart, and certain large blood vessels. (See Fig. 14, page 17.)

The *abdomen* contains the stomach, the intestines, the liver, and other organs of digestion. A strong partition, called the *diaphragm*, separates the abdomen and the chest.

The delicate organs in the head, chest, and abdomen are protected by the bones. The ribs, breast-bone, and backbone form a strong support and protection for the organs of the chest. The ribs, backbone, and hip

[1] It is interesting to note that the body may be divided into two vertical cylinders. The one behind contains the nervous system (brain and cord); the one in front contains most of the other important organs.

bones do the same service for the organs of the abdomen.

The backbone encloses the spinal cord. This cord is somewhat like a long rod which passes through the center of the backbone. It continues through an opening at the base of the skull and connects with the brain. The skull and the backbone perfectly protect these important organs. The backbone is composed of a series of separate bones, called vertebræ (Fig. 3).

The brain and spinal cord

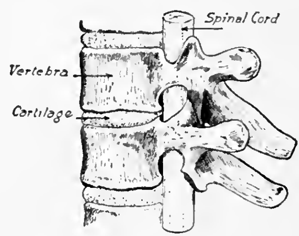


FIG. 3.—TWO VERTEBRÆ AND A PORTION OF THE CORD.

Showing how the spinal cord passes through the spinal canal, and how the vertebræ rest on cartilage.[1]

The muscles

Closely connected with the bones in the body is muscle. What we speak of as lean meat of any kind is muscle. When you eat the breast of a chicken or turkey, you are eating the large, strong muscles that move the wings and ribs. The meat of the drumstick is made up of the muscles that pull on the leg bones and make walking possible. Motions of various kinds are made by muscles pulling on the bones. (Fig. 4.)

How muscles and bones produce motion

If you wish to move a rock or other heavy object, you place a crowbar under it and then bear down upon the free end of the bar. The crowbar is used as a *lever*. In the body many of the bones act as levers. They lift weights and bring about motions of various kinds. Just

[1] *Cartilage* is a smooth, elastic substance which protects bones and prevents them from jarring against one another.

Fig. 4. — The Muscles of the Body.

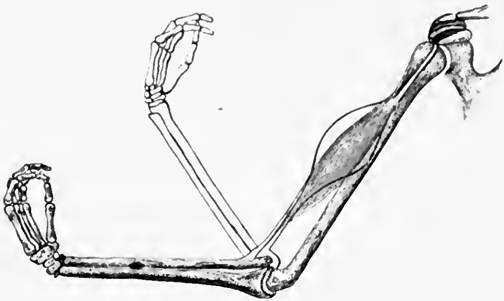


FIG. 5.—THE MUSCLE THAT MOVES THE FOREARM.
Showing the change in the muscle when it causes motion.

as some force must work on the lever in order to raise the rock, there must be a force pulling on the bone to produce motion. This force comes from the muscles. When a muscle pulls on a bone, the muscle becomes shorter and thicker (Fig. 5), and this causes motion.

It is in this general way that the arms, legs, hands, feet, head, eyes, and other parts of the body are moved. In walking, one foot pushes against the ground, we lean forward, and the other foot is carried forward to save us from a fall. In doing all this, which appears so simple, many muscles and bones of the body are brought into action.

The uses of bones

We see, therefore, that bones are necessary for two purposes:

1. To protect important organs, such as the brain, spinal cord, heart, and lungs.
2. For muscles to pull on, so that motion of various kinds can be made.

Not all the muscles in the body do this work of pulling on the bones to move them. The tongue, for example, is a rather large, strong muscle. It does not pull on any bones, but is used in speaking and in moving food about in the mouth. The walls of the stomach and the intestines contain muscles whose work is to force along the food. The tubes in which the blood flows (blood vessels) contain muscles by means of which the tube is made larger or smaller.

Muscles that do not pull on bones

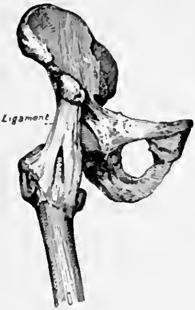


FIG. 6. — A BALL-AND-SOCKET JOINT.

At the hip; showing ligament.

The many bones and muscles of the body are firmly united. Bones are connected by strong *ligaments* (Fig. 6). Muscles are attached to bones by means of *tendons* (Fig. 7).

How the framework is held together

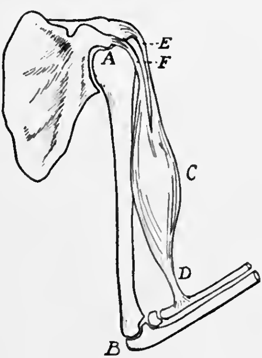


FIG. 7. — THE BONES OF ARM AND SHOULDER.

Showing ball-and-socket joint at *A*, hinge joint at *B*, biceps muscle at *C*, and tendons at *D*, *E*, and *F*.

In the skull the separate bones are joined in such a way that they cannot be moved. In other places bones can be moved freely by means of *joints* (Fig. 7). There are several kinds of joints in the skeleton. At a hinge joint, such as the elbow, the bones can be moved back and forth, as a door moves on its hinges. A ball-and-socket joint, as at the shoulder, allows the bones to move in every direction. A gliding joint, as in the wrist, occurs where the flat surface of one bone glides or slips over another bone.

The movements of bones and muscles are directed by the nervous system. This consists of the brain, the spinal cord, and the nerves. The nerves are string-like structures which connect every part of the body with the brain and spinal cord. Certain nerves carry messages to muscles and other parts of the body. A muscle never moves (*i.e.* shortens) until it receives a message from

General outline of the nervous system

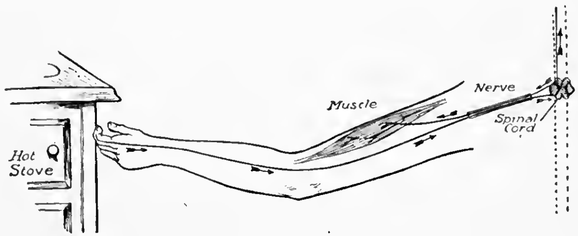


FIG. 8.—THE COURSE OF A NERVE MESSAGE FROM SKIN SURFACE TO MUSCLE.

the brain or spinal cord. Other nerves carry messages back to the brain and cord. For instance, if the hand is burned, a message passes along certain nerves to the brain, or cord, or both. The brain or cord then sends back word to the muscles; the muscles pull on the bones of the arm, and the hand is jerked away (Fig. 8).

Later we shall learn that there is another part of the nervous system not described here, which is known as the *sympathetic system*.

CHAPTER II

THE CELL STRUCTURE OF THE BODY

Now that we have surveyed the general plan of the body as a whole, we will see of what it is made. The body is built up from millions of tiny parts. We call these parts *cells*, because they were at first thought to be somewhat like the cells of a honeycomb full of honey. (Fig. 9.) Each cell is so small that it cannot be seen without the use of a strong microscope. Not a cell in the whole body is large enough to be seen with the naked eye. Each tiny cell lives a life of its own, and each has its work to do. The living substance of which the cell is composed is called *protoplasm*.

The cells of the body

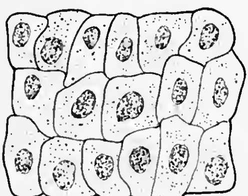


FIG. 9.—FLAT CELLS FROM THE SKIN.

Numberless single bricks, as we know, are put together to build a brick house. We can imagine that the cells in the body are built together in a similar way. The bricks must be held in place by mortar. The cells, also, need something to support them and hold them together. Such a substance is found between and around the cells (Fig. 10). Some parts of the body, where strength is required, contain a great deal of this cementing substance. Other parts, where strength is not so necessary, contain very little of it.

How the cells are held together

Other things besides the human body are made of cells. In fact, every ordinary living thing — plants as well as animals — is made up of millions of cells.

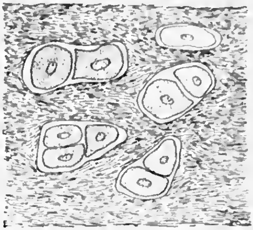


Fig. 10. — Cells and the Material that holds them Together.

The single cell

Every living plant and animal begins life as a single cell. This first cell grows and multiplies. One brick cannot produce other bricks from which to build a house, but the cell can do this. That is the way plants and animals grow.

There are some plants and some animals which always remain single cells, and yet they are perfect living things in their way. The amœba is a minute, single-cell *animal* found in stagnant water (Fig. 11). Yeast, which we use to make bread rise, is composed of millions of single cells, each one a complete *plant* in itself (Fig. 12).

In the human body millions and millions of cells result from the growth of the first single cell. The brain alone is said to have at least four hundred million cells (400,000,000). All cells become dependent upon one another, and they work together to perform the various things that must be done in the body. The life of the body must be thought of as the life of the cells that compose it.

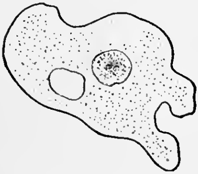


Fig. 11. — The Amœba, a One-celled Animal.

The food that we eat goes, not simply to the stomach, but to every little worker or cell in the body. The stomach is only a receptacle for the food. It helps prepare it for the workers. The blood carries this food to them. We breathe fresh air, not simply that the lungs may be filled with it. The lungs are only reservoirs. From the lungs air must be carried by the blood to every cell.

Nourishment for the cells

FIG. 12.—YEAST PLANTS.

What we must always remember in the study of the human body is this: its work can be done only by the aid of these many individual helpers. The care of the body is, after all, the care of a great army of small workers which we call cells.

The work of the cells

In this army some members are generals; some are ordinary fighters; some are rubbish carriers; some carry air; some carry food from place to place; some store away extra food for future use; some prepare food for the others; some help to repair injuries; some supply natural medicines. In fact, the army of cell workers in our bodies is much like an army of soldiers.

The life of the cells

"Each cell must take food for itself and grow. Each has a birth, life, and death, as each individual in a community of men; and as the community continues, while the individual members are constantly changing, so, in the body, while the form remains about the same from year to year (in the adult), the cells are continually changing, some dying, and others taking their places. Each lives for itself, yet all work together for the common good."

CHAPTER III

THE ORGANS OF THE BODY

In order that they may do their work, many of the cells in the body are arranged in groups. When a number of different kinds of cells group themselves together to perform a certain kind of work, they form an *organ*. The brain, heart, liver, intestines, stomach, lungs, kidneys, and tongue are examples of such organs (Fig. 14).

What an organ is

The cells which compose one organ are different from those which form another. This is because the organs have different kinds of work or, as we say, *functions* to perform. The cells of the brain, for instance, are unlike those of the heart, and the cells of the stomach differ from those of the tongue.

Each organ is made up of more than one kind of cell. For example, the brain has nerve cells, blood cells, and supporting cells. These groups of cells within the organ we call tissues. In other parts of the body, also, besides the organs, the cells of each kind are grouped in tissues. The whole body is made up of tissues.

Tissues

One of the most important organs of the human body is the brain. The cells of the brain have to send out messages to every part of the body. When we move our legs or arms or work the eyes, a message is first sent from the cells of the brain

The brain: motor and sensory cells

to the muscles of the part we wish to move. These cells which send out messages to muscles are called *motor cells.* (Fig. 13.)

Other cells in the brain are used entirely for receiving messages from outside. We have learned that when the hand touches something hot, a message travels like lightning along certain nerves to the spinal cord and the brain. Quickly a set of cells (the motor cells) sends a message to the muscles of the arm, and the hand is drawn from the dangerous place. When this message is received by another set of nerve cells in the brain, we become conscious of the burn. These cells which receive messages from outside we call *sensory cells.*

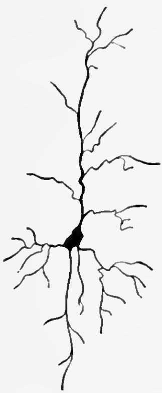


FIG. 13.—A NERVE CELL OF THE BRAIN.

These messages are sent along the *nerves.* The nerves which carry messages to the brain are called *sensory nerves*, and those which take messages from the brain to muscles are called *motor nerves.*

The heart

The heart is a large, hollow muscle which pumps blood through the blood tubes connected with it. It is composed of muscle cells. Such cells are meant for work, just as are the cells in the muscles of the arm.

Organs of excretion

The kidneys have the power of selecting and taking out from the blood which flows through them substances that are of no further use to the body. An organ which helps the body to rid itself of waste substances is called an organ

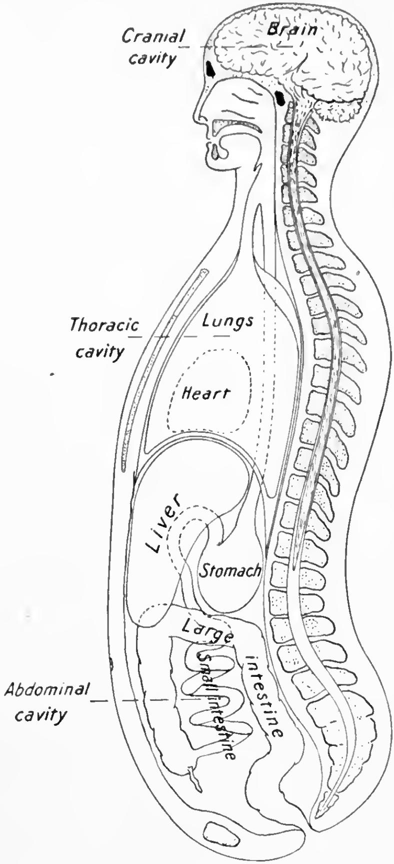


FIG. 14. – DIAGRAM SHOWING THE LOCATION OF THE PRINCIPAL ORGANS.

of excretion.[1] The principal organs of excretion are:

1. The kidneys.
2. The lungs.
3. The skin.
4. The intestines.

[1] To *excrete* means to throw off waste materials; to *secrete* is to separate material from the blood and make new substances of this material.

The lungs, skin, and intestines have other functions than that of excretion, but as they help to remove wastes from the body, they may be included among the organs of excretion.[1]

The kidneys and bladder

The kidneys excrete urine, a waste substance which contains a poison. It collects in a reservoir called the bladder. This is a thin-walled, somewhat elastic sac, which acts as a storage place or reservoir for urine.

The liver

The largest organ in the body is the liver. It is solid and compact. The liver has two principal uses:

1. Its cells manufacture *bile* from the blood passing through the liver. (See page 40.)
2. The liver stores up a form of animal starch called *glycogen*, which it gives back to the body as needed.

The intestines

We speak of the intestines as if they were made up of several organs, but this is not strictly true. The intestines consist of a tube about twenty-five fèet long. In order to accommodate itself to the body this tube is coiled. Different names are given to different parts of the tube. The first twenty feet, starting at the stomach, are called the *small intestine*. The remaining five feet make up the *large intestine*. The large intestine ends in the *rectum*. The *appendix* is at the juncture of the large and small intestines; it is inflammation in this place which causes appendicitis.

Vegetable-eating animals like the rabbit, horse, cow,

[1] The liver helps to rid the body of undesirable substances, but it also furnishes useful material. It is classed as a secreting organ.

and deer require more room in the large intestine than meat-eating animals do. In man the large intestine is much longer than is necessary. This is because his habits of life have become very different from what they were ages ago. As a result, the large intestine is likely to contain much waste food material. This material often ferments and decomposes and may poison the body.

The stomach

The stomach is usually spoken of as a separate organ. It is, in fact, only a part of the intestinal tube widened out for the purpose of receiving food. It is a sort of temporary storeroom where food is partially prepared to be absorbed into the blood. We shall later learn how food is digested; that is, prepared so that the blood can absorb it and carry it to the cells all through the body.

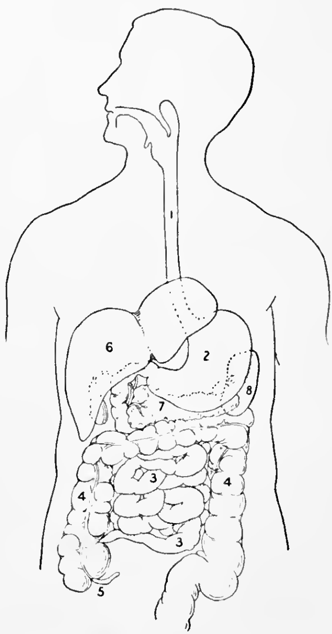


Fig. 15. — The Digestive System.

1, the gullet; 2, stomach; 3, small intestine; 4, large intestine; 5, appendix; 6, liver; 7, pancreas; 8, spleen. The liver is here represented as raised somewhat so as to show the organs behind it.

The digestive tract

Beginning with the mouth and including the gullet, stomach, small intestine, large intestine, and rectum, we have one continuous tube, wide in some parts and narrow in others. The entire tube is called the digestive tract. The work of the digestive tract is to prepare food for absorption and to carry away wastes from the body. Most of this absorption takes place in the small intestine. (Fig. 15.)

The glands

Certain organs in the body are known as glands. They *secrete* from the blood some substance useful to the body. Most glands have a little tube or *duct* leading from them to carry away the secretion. The *liver* is the largest of the glands. The duct from the liver is called the bile duct. It leads to the small intestine.

All through the body are little lumps or nodules called *lymph glands*. What are commonly called kernels in the neck are examples of such glands. They are lymph glands which have become swollen; sometimes they are very tender.

The ducts from the *salivary glands* lead to the mouth and carry saliva. (See Fig. 24, page 39.)

Such glands as the spleen and thyroid have no ducts; the blood directly absorbs the useful material which they produce.

The principal glands in the body are:

1. The liver.
2. The spleen.
3. The pancreas.
4. The thyroid.
5. The lymph glands.
6. The salivary glands.
7. The small glands in the walls of the stomach and intestines.

When organs perform a work in common, they form a *system.* The digestive tube, together with the liver, pancreas, and certain glands in the walls of the stomach and intestines, is called the *digestive system* (Fig. 15).

The systems of the body

The heart and all the large and small blood vessels connected with it form the *circulatory system* (Fig. 17).

The brain and the spinal cord, and all the nerves passing to and from them, form the *nervous system* (Fig. 29).

The lungs, together with the windpipe, nose, and throat, form the *respiratory system* (Fig. 16).

All the muscles taken together give us the *muscular system* (Fig. 4).

The bones of the body together comprise the bony or *osseous system* (Fig. 1).

Those organs, such as the kidneys, which take waste substances out of the body comprise the *excretory system.*

The principal systems of the body are:

1. The digestive system.
2. The circulatory system.
3. The nervous system.
4. The respiratory system.
5. The muscular system.
6. The osseous system.
7. The excretory system.
8. The glandular system.

Each system is composed of *organs.*

Each organ is composed of *tissues.*

Each tissue is composed of *cells.*

Any impairment of an organ or system in the body is sure to injure all the other organs and systems also. If the stomach refuses to do its full share of work, the food is not prepared properly for absorption by the blood. Food may remain much too long in the stomach and intestines; thus, instead of furnishing the body with material for growth and strength, it may become an actual poison. The blood absorbs such poisons from the walls of the stomach and intestines and carries them to all parts of the body. It follows, of course, that the individual cannot then do his full amount of useful work. Many headaches and the common feelings of depression are caused in this way.

Injury to one organ affects all others

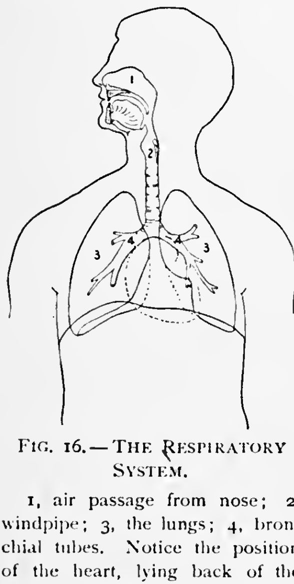


Fig. 16.—The Respiratory System.

1, air passage from nose; 2, windpipe; 3, the lungs; 4, bronchial tubes. Notice the position of the heart, lying back of the lungs; also the diaphragm.

No one can have pure, rich blood when the digestive organs do not prepare food in the proper way for absorption by the blood. The blood stream of a person suffering from constant indigestion is much like a polluted river. As the blood carries the absorbed food to every organ in the body, we can easily understand how important it is for the welfare of the body to have healthy digestive organs.

The work of the lungs

In much the same way, if the lungs fail to do full duty, a serious burden is placed on the other organs. As we breathe, the lungs take in oxygen[1]

[1] *Oxygen* is a gas which forms about one fifth of the air. It is necessary to all animal and vegetable life.

from the air and give out waste substances. (Fig. 16.) It is the business of the lungs:

1. To furnish oxygen to the blood.
2. To take from the blood certain waste substances[1] which various organs have produced.

If we fail to breathe deeply, if we fail to develop large, strong lungs, if we live in badly ventilated rooms, — then we cannot secure the right amount of oxygen for the blood, nor can we get rid of all the harmful things in the blood.

If we close the draft in a stove, we must not expect much heat. If we let the ashes accumulate, the stove will not work well. Yet many people do just such things as these with their bodies and expect good results.

As a piece of complicated machinery, the human body needs the best possible study and care to keep it in good working order.

[1] The waste substance which the blood leaves at the lungs is *carbon dioxide*. This is a gas which escapes from the body in the air which we breathe out from the lungs. It would poison the body if we could not get rid of it. Green plants, however, constantly make use of carbon dioxide in growing. This is one of the differences between animals and the green plants.

CHAPTER IV

THE BLOOD

Though blood is familiar to us, most of us know little about what it is and what work it does. If we can thoroughly learn what the blood does in the body, we shall then understand one of the most important parts of the whole subject of physiology.

General outline of the circulatory system

In some animals the blood does not run in closed tubes or vessels, but in the higher animals and in man it does. The blood system in our bodies is much like the waterworks system of a city. The water runs through a set of pipes and is kept running by means of a great pump at the central station. But there is one great difference between our blood system and a water system. In the body the blood runs from the central pump, which is the *heart*, through a set of tubes or *blood vessels*, and then, after passing to all parts of the body, it goes back to the heart again. In the waterworks system the water leaves the central pump, goes into the pipes, is drawn off at the water taps, and does not go back to the central pump. Instead of returning, it passes into the sewer pipes and is not used again.

Just as every street of a city must have its water supply and every house on all the streets, so every part of the body must have its blood supply, and every organ and cell in all these parts. The large pipes of

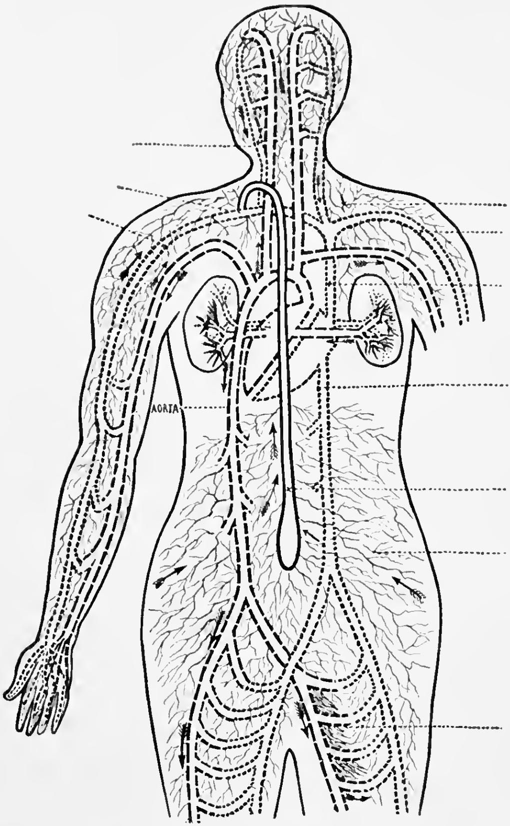


FIG. 17.—DIAGRAM SHOWING THE CIRCULATION OF THE BLOOD.

a water system divide into smaller and smaller ones, so that at last the water comes to our houses in very small pipes. In the same way, the large blood vessels which leave the heart divide into many smaller ones. An organ like the stomach or liver receives many very small

How the blood supply reaches the cells

blood vessels, which have divided off from the large tubes running near the organ. (Fig. 17.)

The little blood vessels not only become smaller in size, but their walls or sides become much thinner. The smaller tubes have walls so thin that some of the liquid part of the blood can ooze through. This liquid part of the blood, after it has oozed from the smallest blood vessels, is called *lymph.* It contains the food and oxygen with which the cells are fed. Every cell in the body is constantly bathed in lymph.

Arteries, veins, and capillaries

The tubes which carry the blood are called arteries, veins, and capillaries. *The arteries carry blood from the heart* to the different parts of the body. *The veins*[1] *carry the blood back to the heart.* The capillaries are the thin-walled tubes, through the walls of which food and oxygen pass to the cells (Fig. 18).

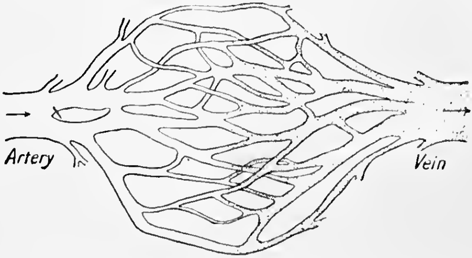


FIG. 18.—ARTERY, CAPILLARIES, AND VEIN.

The shading indicates the change in the color of the blood.

[1] In arteries the blood is red; in veins it is bluish in color. This is explained by the fact that the arteries carry blood rich in oxygen, while the blood in veins is poor in oxygen. The blood in arteries takes up oxygen at the lungs and contains very little carbon dioxide. In passing through the capillaries, it gives oxygen to the cells and

The movement of the blood from the heart, through the arteries, and then through the capillaries close to the cells, and finally in the veins back to the heart, is called the *circulation*. The parts of the body which do this work together form the *circulatory system*.

Fig. 19.—Red and White Blood Corpuscles.

The mistake must not be made of thinking of the blood as entirely liquid. It is, in fact, part liquid and part solid. It may be described as a stream in which float two kinds of solid bodies. The stream or fluid part is called *plasma*. The solid parts are called the *red and white blood corpuscles* (Fig. 19).

Plasma and corpuscles

Why do we need a set of blood vessels with a great pump called the heart to drive the blood through the body? The answer is a long and complicated one, but we shall try to make it as simple as possible.

Functions of the blood

1. Food must be carried by the blood to every part of the body. Every cell worker must be fed. The plasma of the blood carries food.
2. Air (oxygen) also must be carried by the blood to every part. The red corpuscles carry oxygen.
3. Waste substances which the body cannot use must be carried away by the blood. The plasma carries away waste substances.

receives from them carbon dioxide. Consequently, when it reaches the veins, the blood has changed its composition and color.

4. The blood keeps the temperature of the body nearly the same in every part. (See page 32.)

How food goes to the cells

We might think of the blood as a train of freight cars. These cars load up with food which has been *made liquid* at the stomach and intestines, and carry it to all parts of the body which need it. Now we can understand one reason why the blood vessels must have thin walls when they pass into an organ like the liver, to muscles like those of the arm, or to the brain, eyes, skin, or any other part. *Liquid food must pass through the walls of the capillaries to feed every cell of the body.* (Fig. 20.)

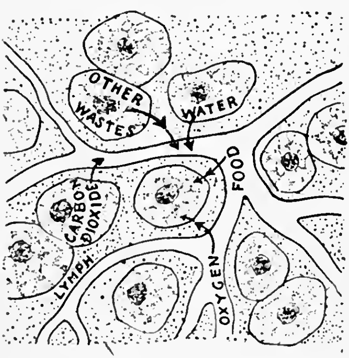


FIG. 20. — CELLS AND CAPILLARIES.

Showing capillaries branching among the cells, and the interchange of food and wastes.

How oxygen goes to the cells

At the lungs our train of freight cars (that is, the blood) picks up oxygen from the air we breathe. This it carries, along with the food which has been taken on at the stomach and intestines, to all the different parts of the body. Like the food, oxygen passes through the thin walls of the capillaries, and is taken up by the cells.

We may also think of the blood as a train of freight cars carrying substances away from the parts which have no further need of them. Some of these wastes are unloaded at the lungs, where they are breathed out, or *exhaled*; others are deposited at the kidneys and leave the body in the form of water. Others pass out through the skin and leave as *perspiration*.

How wastes leave the body

It is therefore plain that the blood is the *common carrier* of the body, bringing in those things which the body requires for its healthy growth, and carrying away those which are worn out and useless.

When we come to study something about diseases which affect the body, we shall learn that the blood has many other useful functions in addition to those just described.

The heart is an enlarged part of the blood tubes, constructed so as to serve as a receptacle and a strong pump. In some animals the heart is merely a large tube, which contracts and sends the blood through the other tubes. In certain other animals the heart has two parts or cavities; in others it has three such divisions; in man there are *four divisions*.

The structure of the heart

CHAPTER V

FOOD AND DIGESTION

THE USES OF FOOD

FOOD for the body is anything that can furnish material for growth, repair waste, and supply power and heat to the body.

Food is needed for growth

Food is what enables cells to grow and to make new cells. It is the building material of the body. After a person reaches full development, food for growth is no longer needed. For this reason a young animal or a growing boy requires more food than an adult.

Food is for repair

All through one's lifetime, however, portions of the body are wearing out and are in need of repair. Food is constantly needed to supply material for repairing the parts that are worn out.

Food supplies power

The body gets from food also the power to perform work. The amount of work an engine can do depends directly upon the amount of fuel it can utilize. In the same way, the amount of work which a man can do depends upon the amount of proper food which is supplied to the cells of his body.

Food supplies heat

The reason our bodies are warm is because we eat certain heat-giving foods (or fuel foods), and these unite with oxygen in the body. Oxygen is taken in through the lungs with every breath and is really part of the food for the body. It is carried by the blood, as we have learned, to every cell in the body.

A piece of wood burns because the substance of the wood (carbon) and the oxygen of the air unite. This union of carbon and oxygen produces combustion or oxidation, as it is called. If the union takes place rapidly, a great deal of heat is formed. When carbon and oxygen unite, a new substance is formed, called carbon-dioxide. It is a waste product of combustion.

Combustion or oxidation

In our bodies this burning or combustion process is almost exactly like the burning of coal or wood or gas. The principal difference is that it is slower. Combustion in our bodies begins with life, and fuel foods keep it up. These foods unite with the oxygen and are burned or *oxidized.*

The body in health produces an even amount of heat, the temperature being about $98\frac{3}{5}°$. With some diseases there is much *fever*, and the temperature may rise to 102° or even 105°, and occasionally a few degrees higher. When this happens, the tissues of the body are burning rapidly and the sick person becomes very thin. Animals that live extremely active lives, such as birds, use oxygen rapidly and have high temperatures. Other animals of more sluggish movements, such as toads and snakes, use oxygen slowly and have lower temperatures.

The rate of combustion

When we do very active work, as in running or in taking brisk walks, we breathe rapidly and use a great deal of oxygen. If enough food is eaten, the body will lose little or no weight. But if one does much work and takes but little food, the cells wear away faster.

than they are repaired, and the body loses weight rapidly.

The regulation of body temperature

One might think that when oxygen is taken in rapidly with active exercise, the temperature of the body should rise, just as the temperature of a stove rises when the draft is opened. This does not happen, because we have a perfect device for regulating temperature. As combustion increases, the blood vessels of the skin *dilate* (that is, become larger), and more blood comes to the skin surfaces. *Perspiration* then occurs, and this evaporates. Whenever there is evaporation, there is a loss of heat. Thus, you see, perspiration cools off the body and prevents the temperature from rising.

On a cold day the body naturally loses more heat to its surroundings than in warm weather, but our temperature apparatus meets this condition perfectly. The capillaries in the skin *contract* (that is, become smaller), less blood comes to the surface, perspiration is checked, and the body's temperature remains unchanged.

People in cold countries require more heat-producing food than do those who live in warmer climates. Those who do a great amount of muscular work or who exercise, need more food than people who live quiet or indolent lives.

In studying about food for the body we must keep clearly in mind that we need food for —

The uses of food

1. Growth.
2. Repair.
3. Work.
4. Heat.

KINDS OF FOOD

We eat a great variety of things, but they may all be classified in a few groups called *food principles.* These are:

1. Proteids.
2. Starch and sugar.
3. Fats and oils.
4. Mineral salts.
5. Water.

Organic and inorganic foods

All foods are either organic or inorganic. The first three groups of food principles comprise the organic foods. Inorganic foods include water and mineral salts. These are as necessary to the body as oil is to the locomotive or any other machine.

The organic foods may be classed under two heads:

1. *Carbon Foods.* Sugar and starch of various kinds, and fats and oils are the carbon foods. They are used for heat and work.

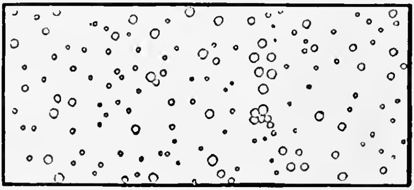
2. *Nitrogen Foods.* Lean meats and eggs are examples of proteid or nitrogen foods. These foods are used for growth and repair.

Sugars and starches

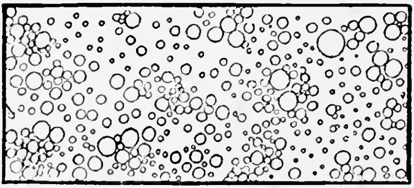
The sugar on our tables is made either from sugar-cane or from the beet. Brown sugar is cane sugar which has not been put through the process of refining. Molasses comes from brown sugar during the refining. Maple sugar comes from the sap of the maple tree. Milk sugar comes from milk. Fruits and vegetables contain sugar in greater or less amounts.

Honey is a natural sirup collected from flowers by the bees. Most of the table sirups are manufactured from starch. Starch and sugar are much alike. In the body starch is always changed to sugar before it is absorbed. Starch is also changed to sugar in fruits when they ripen.

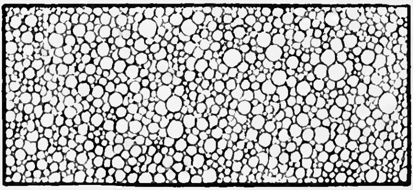
Starch is found in most of our vegetable foods. Tapioca and arrowroot contain much of it. Peas and beans contain only a little. Potatoes are largely composed of starch. Sweet potatoes contain more sugar and less starch than white potatoes, but of the two the sweet



Skimmed Milk.



Milk.



Cream.

Fig. 21.—Fat Globules in Milk and Cream.

potato is the more nutritious. Flour, and consequently bread, and the cereals contain much starch. It is found also in fruits.

Fats and oils

Fats and oils are the same substances, varying only in form—fats are solid, oils are liquid. They are found in both animal and vegetable foods. Milk contains fat in the form of cream (butter fat) (Fig. 21). Many nuts contain fat. The most common animal fats and oils are butter, cream, and the fats of beef, mutton, pork, and fish. The yolk of eggs is rich in oil. Important vegetable oils are olive oil, cotton-seed oil, and the oil of nuts.

About one fifth of the weight of the body consists of fat. But it is a mistake to think that very much of this comes directly from the fat of foods. The fat of the body is derived mainly from other forms of food, which make fat when eaten and taken up by the cells, or *assimilated*. Most of the fat that is eaten is at once oxidized, and it supplies a large part of the heat of the body.

Nitrogen foods

The principal nitrogen foods are lean meat, some kinds of fish, eggs, milk, cheese, peas, beans, and cereals.

These foods all contain a substance called *proteid*. The white of egg, called *albumen*, is a proteid. Milk contains a proteid called *casein*, from which cheese is made. Lean meat contains about twenty per cent of proteid, which is here called *myosin*. Peas, beans, and lentils contain much proteid, but not so much

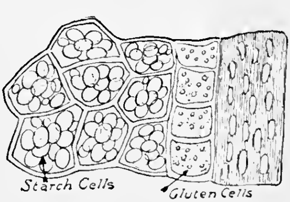


FIG. 22.—A GRAIN OF WHEAT.
Analyzed to show starch and gluten.

as meat. The proteid in flour is *gluten*. All cereals contain proteid. (Fig. 22.) Proteids are necessary for growth and repair.

Milk contains all of the food principles necessary for life. But as about eighty-seven per cent of it is water, an adult cannot support life on milk alone, for an immense quantity would be needed to give him sufficient proteid, sugar, and fat (Fig. 23).

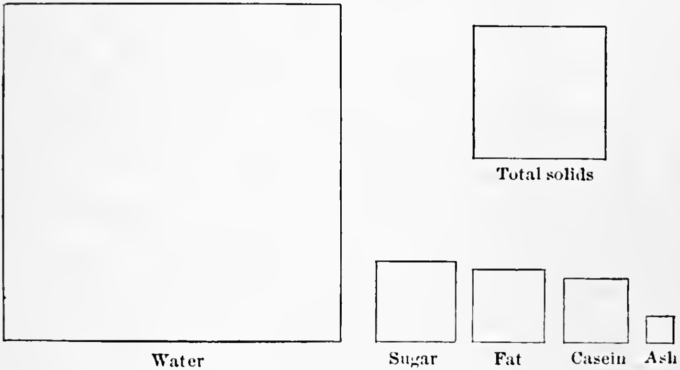


FIG. 23.—THE PROPORTION OF WATER AND SOLIDS IN MILK.

Salts and water

Salts, including the lime salts, are needed for many purposes in the body, but particularly for *bone building*. Our ordinary foods contain enough of these mineral substances so that we need not especially provide them. There is, however, one exception to this. We do need to provide ordinary table salt. Animals, like cattle and deer, visit salt marshes or deer licks to get salt. These deer licks are simply earths which have in them deposits of salt.

Water makes up about two thirds of the body. The blood is about four fifths water, the muscles are about three fourths water, and the secretions are all largely composed of water. A grown person needs two or three quarts of water every day, but much of this may be taken with liquid foods.

Wine, beer, soda water, and all such drinks satisfy the thirst only because of the water they contain, and none of them can take the place of water. Iced water or other very cold drinks, when taken in large amounts, interfere with digestion and are injurious.

Tea and coffee are not foods, except for the milk and sugar that may be used with them. They are used partly because of their pleasant taste, but mostly because they are *stimulants*.

Food flavors

Food flavors do not ordinarily contain anything nourishing to the body. They are desirable because they make food more appetizing to us. Things which are appetizing are always more easily digested.

Common flavors are pepper, mustard, cinnamon, cloves, allspice, vanilla, lemon, and nutmeg. Chocolate furnishes both a flavor and a real food.

We may now review what has been said about the food needed by man.

Review of foods

1. We need food for growth, repair, work, and heat.

2. We need proteid for growth and repair. The proteids in food are albumen, myosin, gluten, and casein. All proteid foods contain nitrogen.

3. We need starch for heat and work. Starch is found chiefly in vegetables and grains.

4. We need sugar for heat and work. Examples of sugar are cane sugar, beet sugar, fruit or grape sugar, and milk sugar.

5. We need fats and oils. These are the chief fuel foods, used for heat and work.

Starch, sugar, fats, and oils are carbon foods.

6. We need water and salts. These are inorganic foods. Salts are needed for bone building.

DIGESTION

The meaning of digestion

Before food can be absorbed by the blood and assimilated by the cells of the body, it must pass through certain changes called *digestion*. During this process the food is *liquefied*. The whole object of digestion is to change the form of food so that it may be absorbed and assimilated. Some of these changes occur in the mouth, some in the stomach, and some in the intestines.

Changes which occur during digestion

Starches have to be changed to sugars. Part of this change takes place in the mouth by means of the *saliva*. The rest of it occurs in the small intestine. Proteid foods, such as lean meat and the white of eggs, have to be changed into a new form called *peptones*. This change of proteids to peptones occurs in the stomach and small intestine. Proteids cannot pass through the thin walls of the capillaries to reach the cells, but peptones can do so.

Fats are not so greatly changed by digestion as other forms of foods. But before they can be absorbed they have to be *emulsified;* that is, the fat globules are separated from each other (Fig. 21). If you shake up raw egg albumen with olive oil, it forms an emulsion. Fats are emulsified in the small intestine.

Most kinds of sugar do not have to be changed by digestion, but are absorbed at once by the blood.

The principal food changes which occur during digestion are these:

1. Mastication, or grinding in the mouth.
2. Change of proteids to peptones in the stomach and in the small intestine.
3. Change of starch to sugar in the mouth and small intestine.
4. Emulsification of fats in the small intestine.

Mastication and the emulsification of fats are what we call *mechanical changes*. All the other changes are *chemical changes*. New substances are formed.

The digestive juices

These chemical changes occur because of the action of certain digestive glands which secrete substances called digestive juices. The secretions of digestive glands are manufactured by certain glands from the blood which passes through them.

Saliva is secreted by the salivary glands, which are located under the tongue, under the lower jaw, and in front of and below the ears (Fig. 24). This secretion is carried to the mouth by means of small ducts. It changes starch to sugar.

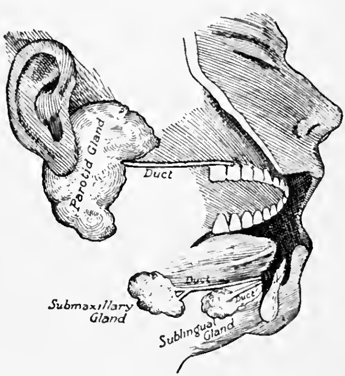


Fig. 24. — The Salivary Glands and Ducts.

Pepsin and *hydrochloric acid* are secreted by thousands of little tube-like glands in the walls of the stomach. They change proteids to peptones.

The pancreas secretes

pancreatic juice. This is carried by a duct to the small intestine. This juice brings about many changes, including:

1. The change of starch to sugar.
2. The change of proteids to peptones.
3. The emulsification of fat.

The liver secretes *bile.* This is useful in several ways:

1. It aids in the absorption of fat.
2. It helps to prevent fermentation of foods in the intestines.
3. It stimulates action of the bowels.

In reviewing the story of food and its uses and how the body does its work, we cannot do better than repeat the words of a great English physiologist and teacher, Professor Michael Foster.

THE WHOLE STORY SHORTLY TOLD

"Now you ought to be able to understand how it is that we live on the food we eat.

"Food, inasmuch as it can be burned, is a source of power. In burning it gives forth heat, and heat is power. If we so pleased, we might burn in a furnace the things which we eat as food, and with them drive a locomotive or work a mill; if we so pleased, we might convert them into gunpowder, and with them fire cannon or blast rocks. Instead of doing so, we burn them in our own bodies, and use their power in ourselves.

"Food passing into the alimentary canal is there digested; the nourishing food-stuffs are, with very little change, dissolved out from the refuse; they pass into and become part and parcel of the blood.

"The blood, driven by the unresting stroke of the heart's pump, courses throughout the whole body, and in the narrow capillaries bathes every smallest bit of almost every part. Kept continually rich in combustible material by frequent supplies of food, the blood as well, at every round, sucks up oxygen from the air of the lungs; and thus arterial blood is ever carrying to all parts of the body — to muscle, brain, bone, nerve, skin, and gland — stuff to burn and oxygen to burn it with.

"Everywhere oxidation, burning, is going on, in some spots or at some times fiercely, in other spots or at other times faintly, changing the arterial blood rich in oxygen to venous blood poor in oxygen. From most places where oxidation is going on, the venous blood goes away hotter than the arterial which came; and all the hot blood mingling together and rushing over the whole body keeps the whole body warm. Sweeping as it continually does through innumerable little furnaces, the blood must needs be warm. This is why we are warm.

"But from some places, as from the skin, the venous blood goes away cooler than the arterial which came, because while journeying through the capillaries of the skin it has given up much of its heat to whatever is touching the skin, and has also lost much heat in turning liquid perspiration into vapor. This is why, so long as we are in health, we never get hotter than a certain degree of temperature, the so-called blood-heat, 98° Fahr.

"Everywhere oxidation is going on, oxidation either of the blood itself or of the structures which it bathes, and whose losses it has to make good. Everywhere change is going on. Little by little, bit by bit, every part of the body, here quickly, there slowly, is continually moldering away and is continually being made anew by the blood — made anew according to its own nature. Though it is the same blood which is rushing through all the capillaries, it makes different things in different parts. In the muscle it makes muscle; in the nerve, nerve; in the bone, bone; in the glands, juice. Though it is the same blood, it gives different qualities to different parts: out of it one gland makes saliva, another gastric juice; out of it the bone gets strength, the brain power to feel, the muscle power to contract.

"When the biceps muscle contracts and raises the arm, it does work. The power to do that work, the muscle got from the blood, and the blood from the food. All the work of which we are capable comes, then, from our food, from the oxidation of our food, just as the power of the steam-engine comes from the oxidation of its fuel. But you know that in the steam-engine only a very small part of the power, or energy, as it is called, of the fuel goes to move the wheel. By far the greater part is lost in heat. So it is with our bodies: all the force we can exert with our bodies is but a small part of the power of our food; all the rest goes to keep us warm.

"Visiting all parts of the body, rebuilding and refreshing every spot it touches, the blood current also carries away from each organ the waste matters of which that organ has no longer any use. Just as each part or organ has different properties and different work, so also is the waste of each not exactly the same, though all are alike inasmuch as they are all the results of oxidation. The waste of the muscle is not exactly the same as the waste of the brain or of the liver. Possibly (in some cases) the waste things which the blood bears from one organ may be useful to another, and so be made to do double work, just as the tar which the gasworks throw away makes the fortune of the color manufacturer.

"Be this as it may, the waste products of all parts, traveling hither and thither in the body, come at last to be brought down to very simple things, with all their virtue gone out of them, with all, or all but all, their power of burning lost, fit for nothing but to be cast away, come at last to be urea or ammonia, carbonic acid, and salts. In this shape, the food, after a longer or shorter sojourn in the body, having done its work, having built up this or that part, having helped the muscle to contract or the liver to secrete, having by its burning given rise to work or to heat, goes back powerless to the earth and air from which it came. And so the tale is told."

CHAPTER VI

THE NERVOUS SYSTEM

WHERE any large group of men is employed, some one must direct their work. We often see numbers of ignorant laborers repairing railroad or street car tracks. Such men are usually unable to do important work of any sort alone. But the foreman in charge of these laborers so directs their efforts that most useful and often astonishing results are accomplished. The great pyramids of Egypt were built by ignorant slaves of ancient times, but their labor was directed and made useful by some superior intellect.

The need of direction and control

In much the same way the different organs of the body, each doing its separate kind of work, are governed and directed by the *nervous system*. If it were not for this superintendent whose duty it is to direct and control the work of the body, all would be confusion. The various parts, such as the muscles, glands, eyes, and ears, must receive directions as to how and when to act. Suppose, for instance, the five hundred muscles of the body were not made to act in harmony with each other. Each one might work at a different time and in a different manner. No useful action could then take place.

When a man has an epileptic convulsion or, in common language, a fit, the muscles are in a spasm. The man falls down; the body trembles; the arms, legs, and head jerk about, and all muscular control is lost. For the time being the nervous system has entirely lost its control of the muscles, and these and some other organs act independently of each other and without any useful purpose. But ordinarily all the parts of this complex human machine work together in perfect harmony.

The coördinating organs

The controlling part of the body is found in the *brain* and *spinal cord*. These are the *coördinating* organs of the body. They are the parts which make all actions harmonious and useful. They direct the other organs as to the amount of work to be done, and the time to do it.

The brain

We have already learned that the skull encloses the most important part of the nervous system, the brain (page 7). We have learned also something of the work done by the motor cells and the sensory cells in the brain (page 15). The brain consists of two chief parts, the *cerebrum* and the *cerebellum*, and a bulb-like portion, the *medulla*, which joins the spinal cord (Figs. 25 and 26).

The *cerebrum* is the largest part of the brain. Consciousness arises in the cerebrum. All voluntary action — action that we *will* to do — is controlled in this part. We *think* with the cerebrum. Here are located many different *centers* which direct various kinds of work or functions, such as the center for sight, hearing, touch, motion, sensation, thought, smell, and taste.

The *cerebellum* controls many complicated actions. It has much influence on muscular action. Equilibrium, or balance, is under the control of this part of the brain. A pigeon with its cerebellum removed does not die, but it cannot keep its balance.

The spinal cord

The spinal cord acts in two ways: 1. It connects the nerves of the trunk, arms, and legs with the brain. 2. It sometimes acts independently of the brain.

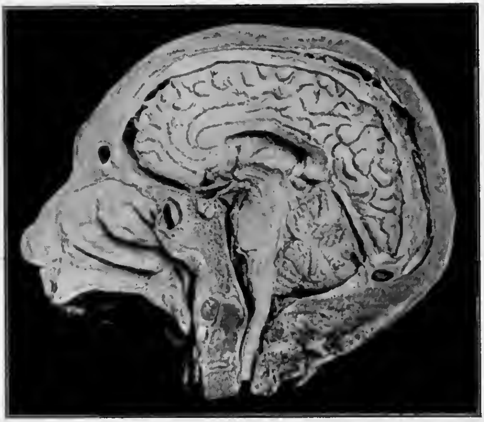


FIG. 25.—A SECTION OF THE HEAD.
Showing brain, cord, and brain coverings, enclosed by the skull; also bones of the nose.

When the spinal cord acts independently, we have what is called a reflex action. Such reflex actions occur without consciousness; we do not *will* to do them. The cord controls reflex actions as if it were a sort of unconscious brain. A chicken may run about for a while after its head has been cut off.

Reflex actions

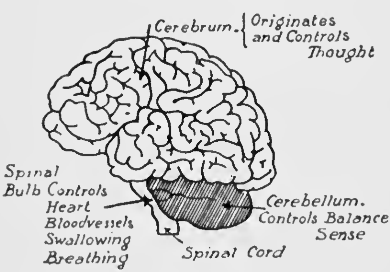


FIG. 26.—DIAGRAM OF THE BRAIN.

A frog with its brain destroyed will try to remove a drop of acid placed on its skin. Such actions are under the control of the spinal cord, and the will has, of course, nothing to do with them. Many of the lowest forms of animals perform all their actions reflexly.

In the case of some kinds of reflex actions, the brain later becomes conscious of them. The hand may pull away from a burn or pin prick before the brain knows anything about the injury, but while the action is taking place, the message travels up the spinal cord to the brain. (See Fig. 8, page 11.) The cord thus protects the body and saves the brain a great deal of work. It sends a message by motor nerves to the muscles, and the danger is averted before the message over the sensory nerves has reached the brain.

The cord performs many useful acts for us which do not originate in the brain and of which we are sometimes conscious and at other times quite unconscious.

The work of the medulla

The upper part of the spinal cord joins the bulb or *medulla*. The medulla connects the cord with the higher parts of the brain. There are several nerve centers in the medulla which send orders to very important organs. Messages are sent from these centers to the organs of breathing, to the gullet, to the heart, and to the muscles in artery walls which regulate the size of the arteries. Breathing, swallowing, the beating of the heart, and the regulation of the blood supply are the most important functions of the body. All of these are *reflex actions* which go on independently of our wills or consciousness.

Sometimes the spinal cord is badly injured. In such cases no messages can be sent from the brain to any organs below the point of injury in the cord. Likewise, no messages can reach the brain which start below the injured part of the cord. In such cases the foot might be burned and the reflex action of the cord would result in pulling the foot away from the fire, but the brain would know nothing about it. There would be no pain or other feeling in the parts below the injury in the cord.

The effect of injury to cord and brain

If a serious injury occurs in certain parts of the brain which control muscles, then a burn in the hand or foot might be felt as pain, but the brain would be unable to send any messages to the muscles to draw the burned part away. When such injuries occur to either the brain or the cord, we call the condition *paralysis*.[1]

Injury to the medulla, if at all serious, results in death, because the most important functions of the body are controlled from this part. Serious injury to the upper parts of the brain or the cord do not directly cause death, even though consciousness is lost and paralysis occurs.

Lying in front and on each side of the spinal column are strings of nerve fibers[2] and bundles of nerve cells. These compose what is called the *sympathetic nervous system*. This system is in close connection with the *central nervous system* (brain, cord, and connecting nerves) by means of fibers which pass from it to the spinal cord.

The sympathetic system

[1] *Apoplexy* is paralysis caused by a blood vessel breaking in the brain and forming a clot of blood which presses on the cells that control muscular action. When this happens, these cells cannot perform their duty, which is to send messages to the muscles.

[2] The *fibers* are like very minute threads or wires, which, bound together, make the *nerve* (Figs. 27 and 28).

The nerves from the sympathetic system pass mostly to the muscles over which we have no conscious control. They go to the internal organs of the chest and the abdomen, and to the walls of blood vessels. The beating of the heart is partially under the control of this system. To a large extent breathing also is controlled in this way. Muscle action in the intestines and the arteries, and the secretion of glands come under the control of the sympathetic nervous system.

The control of the most important functions

Those important organs which directly control life — the heart, lungs, and blood vessels — are fortunately not under the control of our wills, but are governed by the medulla and the sympathetic system. These organs are practically *automatic*. You may deliberately hold your breath for a long time, but even if consciousness should be lost you would not die, because automatic breathing would at once begin. In some animals, like the frog for example, breathing and the heart beat will continue for several hours after the brain itself has been removed.

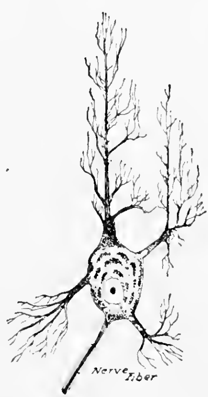


FIG. 27. — A NERVE CELL.

FIG. 28. — A NERVE.

Fig. 27 shows a nerve fiber starting from the cell, and Fig. 28 shows fibers united to form a nerve.

The nerves: the connecting parts of the nervous system

Every part of the body is connected with the brain and spinal cord by means of nerves. Muscles pull on bones, glands secrete, pain

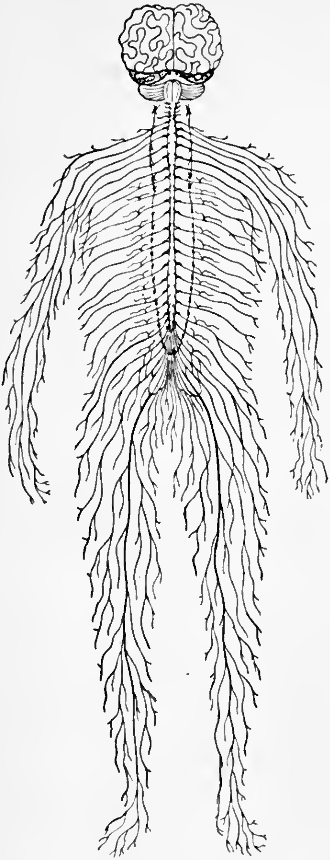


FIG. 29. — THE NERVOUS SYSTEM.

Notice the brain, the spinal cord, and the general arrangement of the nerves.

is felt, all because of this communication between every organ in the body and the brain and cord. (See Figs. 27 and 28.)

Two cities have, we will say, batteries and telegraph instruments, and they wish to communicate with each other. They can do so only by means of wires. So somebody connects by wire the batteries and instruments of one city with those of the other, and messages pass back and forth very easily. Our nerves correspond to the telegraph wires, our brain cells to the batteries, and the *will power* of our minds to the telegraph operator. If a wire is cut, no message can be sent past the point where the break occurs. If a nerve is cut, the same thing is true. If the batteries are destroyed, no message can be even started on the wires. If the cells from which the nerve starts are destroyed, no message can be started along the nerves.

In one important particular, however, the nervous system differs greatly from the telegraph system. We have learned that reflex actions may occur without the help of the upper parts of the brain. This is much the same as if certain messages could be sent along the wires when the telegraph operators were away or asleep.

In the brain, nerve fibers connect all its centers, and join them with the spinal cord. In the spinal cord, nerve fibers pass up and down, connecting all its parts. Nerve fibers thus not only connect all organs with the brain or cord, but also bring each part of the brain and cord into communication with every other part.

The education of the brain

At birth there are as many brain cells as there will ever be, but the nerve fibers connecting these cells may be developed until a person is at least sixty years of age. *Education* consists largely in developing these connecting fibers of the brain. Education may be either good or bad in its general nature.

The basis of habit

By repetition we learn to do things very easily. At last we succeed in doing many things almost without thought, that is, automatically. It is in this way, by automatic repetition, that one learns to ride a bicycle, or play an instrument, or run an automobile.

How habits become fixed

By such repetition of acts we not only gain useful habits, but we may as easily acquire bad ones. Habits of any kind always tend to become *fixed*, until they occur almost unconsciously. It is easy to say that we can break away from a bad habit at any time, but this is not true. Habits of all kinds have a *physical* basis; that is, actual changes occur in the nerve cells and fibers which make certain actions easy. It is much the same as when we make travel through the snow easy by digging paths. Beaten paths are made in the brain by constant repetition.

Good and bad habits

Every one knows that if a boy or a girl forms good habits, he or she will seldom make serious mistakes later in life. But when bad habits are learned and practiced early in life, it is only by the greatest effort that a strong character is formed in later life.

Such habits as smoking, drinking, drug taking, ordinary lack of self-control, anger, and fault-finding may all be explained to a large extent by early and continued practice. A confirmed coffee or tea drinker forms a habit. His nerve cells demand a stimulus, and thoughts and actions fail to do their best unless the usual habit is followed.

Bad habits of all kinds sooner or later wear out the nervous machinery. False messages are received by the brain, false messages are sent to the organs by the brain, and the person becomes the *victim of his habits*, not the master of them. Drugs which dull the senses, actions which exhaust the brain cells — all such things tend to make us less useful and less happy in the world.

Inasmuch as habits are to stay with us through life, it is wise to form those that will be useful rather than those that will do us harm.

CHAPTER VII

THE LIVING MACHINE

We do not often realize that the human body is a machine, differing from other machines largely in the fact that it is *living*. For our purpose we must study the body simply as a machine. We must learn how it does its work, how it keeps in repair, and what puts it out of repair. It is surprising that this most wonderful and complex of all machines is the one about which most people usually know very little. The body is the machine which more than all others generally receives the least intelligent care.

The human machine

When a steam engine runs, it does a certain amount of work; *energy* is expended. Energy is the power of doing work. Common forms of energy are light, heat, motion, and electricity. An engine receives its energy from the coal it burns. The body receives its energy from the food it consumes.

What energy is

No machine can create or destroy energy. All it can do is to change the form of energy. A machine is an apparatus which can change one kind of energy into another. The locomotive can change the energy in the coal into heat and work, and the living machine can change the energy of food into heat and work.

In the engine some of the energy is spent in driving the machine, but much of it is lost. The best constructed steam engine is, after all, a wasteful sort of machine. If all the energy in the coal could be changed to heat, and this heat could be converted into motion, we should have a perfect machine. But much of the heat is lost entirely. No machine is able to change the energy of coal into work without much loss. But compared with other pieces of machinery, the living body is the most economical machine and most nearly perfect in its use of energy.

The loss and waste of energy

Because the engine cannot change all its fuel into energy, it gives off certain waste substances. One of these is carbon dioxide; another is the vapor of water. In the case of coal, much ash is left which represents mineral matters which cannot be burned.

The body or living machine gives off waste materials just as the engine does. This is the reason that a badly ventilated room becomes charged with carbon dioxide gas, watery vapor, and other harmful products. Certain parts of the food leave the body as indigestible waste substances, much like the ashes of a locomotive; and other waste substances leave the body in the form of perspiration.

Every sort of machine wears out in certain parts and must constantly receive repairs. The living machine very largely makes its own repairs, though of course it does wear out at last. It not only repairs waste, but in the young it grows in size and increases in weight, so long as a sufficient amount of food (fuel) is furnished. So you see the living machine builds up as well as breaks down.

The work of repair

The living machine, as we have said, is the most economical of all machines. Not only can it use a large part of the energy received in the form of food and oxygen, but it can build up living matter from the food furnished it.

The body is the most economical machine

If the body is to do its work in the best possible way, it must, of course, receive the right amount and kinds of food. It must also be kept in good working order in all its parts. No one would expect the best work from a machine which was constantly furnished with the wrong sort of fuel, which was neglected and abused, or which was allowed to clog up with waste substances. Yet that is just what people often demand of the most important of all machines — the human body.

How to care for the human machine

Most of us could greatly improve the condition of the body as a piece of machinery if we only knew just how; that is, if we were good *human machinists*. If we could learn this lesson early enough, we should not have to make so many unsatisfactory repairs later in life.

We are to study in PART II about the things which interfere with the proper action of the living machine, and how this machine may be managed so as to give the best possible work with the least waste of energy.

PART II

HYGIENE

OUTDOOR EXERCISE AT SCHOOL; WITHOUT APPARATUS.

By permission of the Polytechnic Elementary School, Pasadena.

CHAPTER VIII

THE NATURAL DEFENSES OF THE BODY

The natural resistance of the body

The body is provided by nature with means for warding off disease. Some people have little power of this sort and others have a great deal. This is only another way of saying that some people "take a disease" much more easily than others. One may be well protected against most diseases but be very susceptible to some particular disease. For example, many persons are susceptible to consumption, and it seems as if some have little resistance to typhoid fever. The trouble comes not so much because one is exposed to a disease as because one naturally has little protection against it. We call this protection our natural resistance.

It was not very long ago when people thought that all diseases were caused by evil spirits, or that they were sent as punishments for sins. Now we know that most diseases are really accidents which may usually be prevented if we have the right kind of knowledge. This knowledge consists in understanding just what causes disease, how the causes may be avoided, and what nature does to help us out. When we become sick in spite of all we can do to avoid it, then we wish to know how to get well in the best and quickest way.

Most of the diseases that we hear about are caused by certain tiny plants, something like the pollen of flowers.

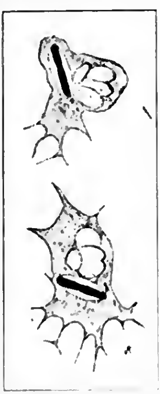
We call these plants bacteria or germs. They must be thought of as an *army of invaders* which possess various methods of attack. The white cells of the blood represent the *resisting army* whose duty it is to protect the body from the attacks of the bacteria or disease germs. There often occurs in our bodies a silent, unseen warfare, which is as interesting when understood as the noisy warfare of nations. The military methods are, after all, not so very unlike in the two cases.

Bacteria

BACTERIA OF VARIOUS KINDS.

Let us see what some of the defenses of the body are. In the blood there float, as we know, the red and white blood cells, or blood corpuscles. When disease germs get into the body, — through a cut in the skin, with water or food, by our breathing them in with dust, or in some other way, — the white blood cells usually try to destroy them. So there follows a battle between these soldiers of the body (the white corpuscles) and the attacking army (the bacteria).

White corpuscles are guards against bacteria



WHITE BLOOD CELLS DESTROYING BACTERIA.

If the finger festers after an injury, the pus that forms there is largely made up of these white blood cells which have rushed to the spot to destroy the bacteria. They seem quite like an army of soldiers rushing forward to the point of attack to defeat and kill the enemy. In this struggle some of the white corpuscles themselves are destroyed. As in a military battle, there is loss on both sides.

Besides this attack of the white corpuscles on the bacteria, there are other and very different ways in which nature fights against disease. When bacteria get into the body and begin to grow and multiply there, they often form poisons which affect the body just as seriously as if poison had been swallowed. What we ordinarily speak of as *blood poisoning* is of this nature. The blood sometimes develops a substance which attacks the poison produced by such bacteria, and makes it either quite harmless or at least much less harmful. Such a substance might be regarded as a natural medicine.

Natural medicine

Then again, the blood may contain substances which weaken the bacteria which have entered the body, so that the white blood cells can destroy them much more easily. It is somewhat as if an army should first send out messengers to poison the water supplies of the enemy before attacking them. In both cases the enemy would, of course, be weakened and more easily killed, because they are first reduced in strength by a poison.

Other protections against disease

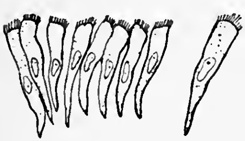
There are many other means which nature uses to protect the body. All through the body we have little nodules known as *lymph glands*. Sometimes they can be felt in the neck, especially when one has a sore throat. These glands act somewhat like *filters*, and bacteria and even coal dust, iron dust, and the like are often arrested here.

Sometimes bacteria are *walled in* and shut off so that they cannot spread to other parts of the body, and occasionally this wall becomes hardened with deposits of lime. This is common in the lungs, and the germs of tuberculosis[1] (consumption) are in this way kept from spreading.

When the appendix breaks or ruptures, as it sometimes does, then quickly bands and partitions (*adhesions*) are formed, and the part where the trouble occurs is walled off from the rest of the body cavity; thus the disease is kept within narrow bounds. If this does not occur as it should, the bacteria which are causing the attack of appendicitis spread to all parts of the abdomen, and death may result. It seems very wonderful that nature can so successfully protect our bodies in ways that appear almost conscious.

Defenses in the nose and throat

The nose is lined with many hairs, as you know, but it has not occurred to you perhaps that these serve as a sort of sieve and keep dust and bacteria from entering the lungs in breathing. The little tubes which carry air to the lungs (bronchial tubes) also are lined with minute hair-like bodies which are in constant motion. These little *cilia*, or hairs, sweep foreign particles back toward the throat, where they may be disposed of.



CELLS FROM THE BRONCHIAL TUBES, SHOWING CILIA.

Then we have many kinds of defense which, though

[1] The germs of *tuberculosis* may grow in various parts of the body. The resulting diseases are called tuberculosis of the bones, tuberculosis of the intestines, etc. These germs most frequently attack the lungs; tuberculosis of the lungs is commonly called *consumption*.

they have nothing directly to do with disease germs or any solid particles, protect the body in other ways. When one is exposed to heat, messages are sent from the brain or spinal cord along certain nerves to the skin. The result is that the little blood vessels in the skin dilate, producing *perspiration*, and the body loses heat. Exactly the opposite thing occurs when one is exposed to cold: perspiration is prevented, and heat is kept in the body. So it happens that whether the day is hot or cold, nature by a self-regulating temperature device keeps the body at about the same temperature ($98\frac{3}{5}°$).

Other natural defenses

If a speck of dust or a cinder strikes the eye, we all know how quickly the eye "waters." This is nature's attempt to wash out the offending particle. A severe diarrhœa may occur after injurious things have been eaten. This is nature's way of ridding the body of something harmful to it. For this reason it is never wise to check the diarrhœa at first. When the nose bleeds, or a finger is cut, or whenever bleeding occurs in any part of the body, a clot soon forms. If this were not so, we should easily bleed to death. Such a clot acts as a plug to the blood tube and stops it up.

Pain is a warning signal

Pain of all sorts is nature's warning signal that something is wrong. It is not a disease but a *symptom of disease*. It is never right to stop the pain without first attempting to discover its cause. Pain is like a bell buoy on a dangerous rock — it points to the place of trouble. One may easily stop the bell from ringing, but the dangerous rock is still there. Nearly all advertised "pain killers" are worse than useless, for the reason that they merely remove the pain by deadening the nerves that give the warning, without removing the cause of the pain.

One may stop the pain of a *headache*[1] with some headache remedy, but the cause is still there and will probably remain until man or nature removes it. For instance, it may be due to diseased tonsils, or imperfect eyesight, or a bad digestion, or constipation. We must *remove the cause, not the symptom*, if we wish to do any real good.

It is the same way with a *cough*, for this is usually the symptom of something else, and we must try to cure, not the cough, but the trouble which causes it. Sometimes it is even best to encourage the cough for a time, because by this means nature may be trying to get rid of mucus, bacteria, or other substances which are in the throat or bronchial tubes or lungs. Advertised "cough cures" cure nothing but the warning symptom. They merely stop the bell from ringing. Even *catarrh* is not itself a disease, but indicates some other serious condition in the nose or throat. You cannot cure a case of catarrh, but you can heed the warning, discover the cause, and usually remove it.

So the various warnings of disease — whether they be pain, headache, cough, catarrh, or "nervousness" — are really natural defenses of the body.

Skin protection

The skin which covers our bodies is another natural defense. Unless the skin is broken, bacteria on its surface can never enter the body. The lining of the stomach and intestines acts in much the same way, and this is one of the reasons why we

[1] For further discussion of headaches, see page 108; of catarrh, page 97.

ought to keep the digestive tract in the best possible condition. Dangerous germs then may often pass through it quite harmlessly.

Almost as soon as the skin is injured in any way, the surface of the injured spot is covered with a sort of natural plaster. In time this forms a *scab*. When the scab finally falls away, a clean, new, healthy skin surface is found beneath it.

Bone healing

When a bone breaks, nature quickly produces a great amount of material around the broken ends to hold them together. This material is called *callus*. In time it forms new bone, and the part broken may be actually stronger than before the break occurred. Such a callus acts much like the substance which forms around an injured twig or limb of a tree.

Foreign substances are isolated

Sharp objects and other foreign substances which are swallowed or get into the body in other ways, often become surrounded with a *sac* which nature forms. Needles, pins, bullets, broken knife blades, and even larger objects, have become enclosed in a sac in this way, so that they are rendered harmless. Sometimes they remain in the body for many years, or even for a lifetime, without the least harm.

Defenses of the brain

Even the brain has its natural defenses. Ordinarily only one side of it is in use. But when an injury occurs to it, the other and uninjured side may sometimes be brought into action.

Reflex actions protect us

Many of our actions are unconscious, or *reflex*. Such acts protect us constantly. The eye winks and closes when an object threatens to fly into it; the hand draws away from the fire before the brain knows what or where the trouble is.

Many of our everyday habits are reflex, and without them we should soon perish.

How organs help one another

One organ may sometimes take up the work of another and help to protect the body in this way. When the kidneys are diseased, the skin may do a good deal of their work. When one kidney is entirely lost through disease or accident, the other one enlarges and does double work. When an organ of special sense, such as sight or hearing, is lost, the other sense organs nearly always become more active and acute, and thus help to supply the defect.

Many other natural defenses could be named, but enough has now been said to show that our bodies are wonderfully well provided with the means of defense against disease and accident. The most important lesson we can learn from these studies is that in trying to cure disease and repair accidents in our bodies, we must *follow nature's methods* as far as possible. Nature nearly always points out the right way.

CHAPTER IX

WHAT HEALTH DEPENDS UPON

In order to understand thoroughly what health depends upon, it is necessary to study some of the general principles which govern the action of the body.

The successful action of a locomotive or any other machine depends upon the soundness of all its parts. If any essential part is thrown out of order, the whole machine suffers and perhaps refuses to work. This is true also of the human body. Its parts must be sound and in good working order, if we are to have good health.

The principle of division of labor

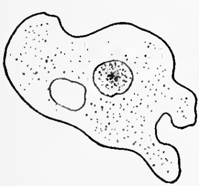
In a great factory, the manufacture of any article — as a piano or an automobile — is accomplished by the work of many different groups of workmen. In the case of the automobile, one group of men works only with the framework of the wheels, another with the tires, and others with the paint and varnish. Each group of men is dependent upon all the other groups, and a failure of any one of these to do its work makes a successful result impossible.

In all such cases there is a *division of labor*, and because of this division each group learns to do its work very skillfully. Any man may become skillful when he devotes his whole attention to one specialty. In a factory all the work is done by such specialists.

In early days a tailor not only did all the cutting and sewing on a garment, but he took the measurement, and he often made the cloth as well. And so it was with shoemakers, furniture makers, and various other artisans. There was no division of labor, and the work was usually crudely done. Yet such a workman was, in a sense, more independent than the specialist of to-day, who perhaps does nothing but shovel coal into a furnace, or sew buttons on a coat.

One-celled objects are independent but crude

The simplest living plants and animals that we know about consist of only *one cell* with no tissues or organs. This cell is simply a minute particle of living matter or protoplasm. It does all the work of life for the whole plant or animal. There is no division of labor. But in the higher forms of life, the body of the animal or the plant is made up of groups of cells, each doing its special work very skillfully. These groups of cells are like the special workers in a great factory. The low forms of the one-celled growths are like the unspecialized workman, quite independent in their mode of life. But they are also very crude and possess none of the higher qualities with which we are familiar in the animal and plant world.



A One-celled Animal.

Evolution has produced a complicated organism

At first all animals and plants were simple and uncomplicated, consisting of only one cell. All life then consisted of single cells only. After millions of years the higher forms have gradually developed from these single cells. This is what we call *evolution*. But as evolution has gradually taken place, all life has slowly grown more complicated. Special cells and organs have been added. These have duties to perform, so important that life itself depends upon them.

In the factory each man is expected to do his work correctly and promptly. In the body of the animal or plant each cell must do its work in the same thorough manner.

Perhaps one man, or even several men in any one group, may drop out or do poor work without very seriously affecting the work of the whole factory. In such a case the other men in this group may be able for a time to make up the deficiencies entirely or in part.

Failure of a few cells may be offset by others

In the human body some cells in a certain group may refuse to work, do imperfect work, or perhaps even be destroyed in some way. When this happens, the other members of that group will double their efforts and try to offset this misfortune. Usually such efforts on the part of the healthy and industrious cells in the group are successful, and the body as a whole hardly suffers.

If an entire group of workmen in a factory, or several such groups, refuse to work, the whole factory is thrown out of order. If a similar group of cells in the body does the same sort of thing, the whole body suffers.

In the manufacture of articles there are sometimes certain parts so important that only men of the highest skill can be depended upon to take charge of them. Any failure of such men to do their work would make the whole article either inferior or entirely useless. In the same way, in one of the higher living animals or plants, some cells perform such important functions that any failure on their part injures the whole organism very seriously, perhaps

Some cells are of vital importance

beyond repair. If the nerve cells which regulate the heart beat or the group which controls breathing is injured or destroyed, the whole body suffers and perhaps dies. What happens is much the same as when the sparker of an automobile refuses to work or the piston to drive. Some essential part has given out.

Important parts are hard to replace

The more complicated a machine or other lifeless thing is made, the more easily it gets out of order. Exactly the same thing may be said of the body. Important parts are hard to replace either in a machine or in man. Nerve cells once destroyed are never replaced. Many of the simpler and therefore less important cells of the body are easily reproduced, as for example the blood cells. Such cells are constantly wearing out and dying, while others quickly take their places.[1] But if a man loses a hand, it can never be replaced.

What health and recovery depend upon

A person is in health when all his cells and organs are working together for the good of the whole body. A person is sick or diseased when some of his cells or organs refuse to do their regular work.

The seriousness of sickness depends upon:

1. Whether highly important cells or organs are affected, or only the simpler and therefore less important ones.

[1] If a crab loses a claw, another one quickly grows in its place. Crayfish and similar animals cast off their entire hard outer coats. Many animals, such as deer, shed their horns and soon grow new ones. Birds shed their feathers (molt). On man, the outer skin is always being removed and replaced by new skin. We cut off our hair and our nails, which are composed of worn-out, dead cells.

2. Whether the injury to the cells or organs is slight and includes only a small area, or whether it is serious and includes a large area.

Recovery from disease occurs if there has not been too much injury to the cells or organs.

CHAPTER X

THE CAUSES OF DISEASE

THERE is always a definite cause for sickness. Sometimes the cause is hard to find, sometimes it is easy.

Health and disease follow natural laws

There is always a reason for the direction of the wind or for the course of a river. These things follow what we call *natural laws*. It is exactly the same with the health of the body. Health, too, is subject to natural laws. When we know what these laws are, we can usually obey them and profit by them; but when we are in ignorance of them, we suffer. Nothing in nature ever happens by chance. Health or sickness is not a matter of good or bad luck, but a matter of obeying or disobeying the laws of health.

Every organ in the body has a special work to do. We call this work the *function* of the organ.

What sickness is

When anything interferes with the work of one or several organs of the body, then we are sick. No machine can do its work properly unless all its parts are in good order. No person, likewise, can do the work of life properly unless all his organs are in good order.

If an engine is to do its work in the best possible way, it must, of course, receive the right amount and kind of fuel. The different parts must be clean and well oiled; ashes must not be allowed to accumulate; there must be a good draft under the furnace; the smokestack must be able to carry off the smoke and gases which the engine cannot use. Many people who understand these things perfectly about a machine, such as a locomotive or automobile or harvester, do not realize that the same rules apply to the most important of all machines — the human body.

How a machine is kept in good order

The body, like a machine, often becomes clogged with waste substances. It frequently does not get enough draft (pure air for breathing). It frequently receives the wrong sort of fuel (food). Many human machines receive more food than they can possibly use, and some do not receive enough. Many of them are not kept clean.

As engineers of our own bodies we ought to understand all the parts of this machine, how they do their work, and what things interfere with their work. But most of us let the machine run itself, and if it gets out of order we call a doctor to repair it.

A doctor is a specially trained *human engineer*, who understands the complications of the human machine which are too difficult for the average person. Every one ought to know how to do the ordinary repairs, but sometimes he needs the special "engineer." It is the business of the science of medicine to try to discover what things cause trouble in the human machine, just as it is the business of a locomotive engineer to discover what things interfere with the best action of his engine.

The physician as a trained human engineer

Many persons who would never think of allowing a poor mechanic to repair their automobile or watch or harvesting machine, will, when sick, turn themselves over for treatment to almost any sort of doctor or even a "quack." A skillful physician understands his work. People expect this much of the man who repairs their watch, shoes their horses, cooks their food, or drives their automobile. Why should they not ask the same of their doctor? If the proper qualifications were required of all who attempt to heal the sick, we could easily do away with the dangerous, unskillful healers in every community.

We must now attempt to understand what are some of the things or conditions which put our bodies out of order.

Things which interfere with health

These may be classed in two large groups:

1. Those things which *weaken the body* in some way so that we are likely to "take" many diseases. Eating the wrong kind of food, bad ventilation, and abuse of alcohol are examples of such things.

2. Those things which *directly cause disease*. Bacteria and other small forms of life which get into the body are examples of these.

Weakening the body's power of resistance

There are many ways in which we may weaken our power to resist disease. When this power of resistance is weakened, certain dangerous germs are able to get a start; but if the body is strong, the germs can do it no harm. We "take a cold," for instance, not because of sitting in a draft, but because the sudden chilling of the body weakens its power to resist and the germs gain a foothold in the nose or throat. These germs are always ready to begin their harmful work; but if we take proper care of our bodies, and strengthen them, we shall not be affected by the germs. By taking intelligent care, we can ward off almost any disease, no matter how much we may be exposed to it.

Unhealthful occupations

There are some occupations which are unhealthful and lead to certain diseases. Knife grinders, file workers, stone masons, and workers in bakeries and other dusty places have a tendency toward tuberculosis. Many children are forced to do unhealthful work, when they ought to be engaged in

Boys Working at Midnight in a Glass Factory.

Photograph by Hine, National Child Labor Committee.

healthful school work and outdoor play. Thousands of such children die or are made invalids every year by their unnatural way of living. This is particularly true of children who work in glass factories, sweat-shops, cotton mills, tobacco factories, and coal mines.

In many factories these poor children are obliged to work at night. They are robbed of their natural hours of sleep, and often form habits harmful to both minds and bodies. Very often they get into the habit of using strong tea and coffee, or even more harmful drinks, thinking that these will help them to keep awake. Sunlight is nature's great health giver, and children who work at night and sleep during the day are never healthy. Some of these small workers get very little sleep at any time, for they are obliged to do other work to help the family during part of the day.

Few saloon keepers or other people who handle liquors live to old age. Any occupation which tempts a man to use much alcohol usually shortens his life.

Some occupations tend to give long life. Farmers, fishermen, carpenters, gardeners, and clergymen are among those whose work leads to long life. Such people not only escape unhealthful surroundings, but they get plenty of fresh air and sleep and generally do not worry very much. Worry and unnecessary trouble shorten the lives of very many people. We ought all to learn the habit of cheerfulness.

Intemperance

Many persons *inherit weak constitutions.* Such people do not resist disease well. The children of intemperate parents often escape the evil of intemperance themselves, but they rarely escape weakened bodies. These children easily fall into bad habits of many kinds. They are likely to go to excess in many things, such as in the use of coffee, tea, tobacco, alcohol, and various drugs. The children of drinking parents form a large per cent of criminals, paupers, and the inmates of insane asylums. Very often they lack the ability to recognize their own weakness and faults. They generally have less moral control of themselves than other children have.

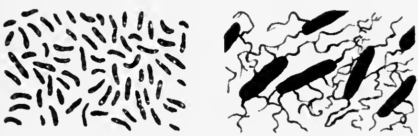
HEALTHFUL OUTDOOR WORK FOR CHILDREN.

There are many other conditions of life which weaken a person's power to resist sickness, such as living in unhealthful climates or in badly ventilated rooms, breathing sewer gas, eating poor food or eating too much food, and lack of cleanliness. During the period of childhood one is liable to have certain kinds of sickness, in old age others, and in middle life still others.

We must now study some of the direct or active causes of disease. We would not often become very ill if it were not for bacteria[1] or other minute forms of life, which take advantage of us when we are "run down." These little germs get into the body, and either form poisons there or do harm in some other way.

Bacteria, the active causes of disease

Bacteria are so very small that they can be seen only by the use of a powerful microscope. The head of a pin would furnish space for many millions of them. They have various forms; some are round, some oval, some rod-shaped, and others form spirals. Some bacteria are provided with hair-like extensions by means of which they swim about in water or other fluids. Many bacteria have no power of motion.



Diphtheria Typhoid Fever

Bacteria of Disease.

Notice also the picture on page 60.

When bacteria are furnished with favorable food, moisture, and temperature, they grow and multiply very rapidly. Disease germs multiply most rapidly at body temperature $(98\frac{3}{5}°)$. It has been estimated that if ideal conditions for their increase were provided, such as proper food, temperature, and moisture, one tiny germ would in a few days multiply so rapidly that all the oceans of the world would be filled solid with bacteria. Of course such ideal conditions could never exist.

All bacteria do not cause sickness. Some are most useful and indeed necessary to us. Certain useful bac-

[1] *Bacteria* are minute, one-celled *plants*. There are also very small *animal* forms of life, called *parasites*, which cause some diseases, as malaria.

teria ripen butter and give it a pleasant flavor; others produce the flavors of cheese; others change cider or wine into vinegar. Some have the wonderful power of helping plants of the clover family to take nitrogen from the air and give it to the soil, which needs nitrogen to make it more fertile.

Useful bacteria

If we did not have certain kinds of bacteria, nothing would decay. The world would then become covered with dead animals and plants. A tree falling in the forest would remain as it fell; a fish dying in the sea would never decay.

The bacteria of decay

Plants and animals all get their nourishment from the soil and air and water. When we eat mutton, we are using the things which the sheep took from the grass it fed upon. If we eat potatoes or other vegetables, we are using those things which the potato and other plants took from the earth and air to grow upon. When plants and animals die, their substance passes back to the air and soil, and can then be used again as food for new plants and animals. This decaying is the work which the *bacteria of decay* accomplish. Our world could not possibly exist without these small, busy friends of ours.

In order to *prevent fermentation and decay* we often take advantage of our knowledge of the following facts:

1. *Cold* prevents the growth of bacteria. It is for this reason that so much use is made of *cold storage*. On the same principle we use *ice boxes* in which to preserve foods in our homes.

2. *Heat* destroys bacteria. For this reason we boil fruits, meats, or vegetables, and then seal them in air-tight cans or jars, where they keep indefinitely.

3. *Thick sirups* prevent the growth of bacteria. Use is made of this fact in much of our preserving.

4. *Crystallized sugar* prevents the growth of bacteria. Ginger, various fruits, and some other foods are preserved in this way.

5. *Strong salt solutions* (brine) prevent the growth of bacteria. Pork, beef, and pickles are preserved in brine.

6. *Drying* kills bacteria and prevents their growth. We often depend upon this principle in preserving meat, fruits, and vegetables.

Disease germs

There are, however, some bacteria which are *enemies*, instead of friends, of man. Their number is comparatively small, but they do great harm. Our grandparents knew nothing about bacteria or how they cause disease. Even late in the last century little was known about these tiny but powerful plants. Now we know that most of our common diseases are caused by them. Expert students can examine and study these microscopic living things; and with our increasing knowledge of them the control and cure of diseases have become far more certain.

CHAPTER XI

CONTAGIOUS DISEASES AND THEIR CONTROL

A *contagious disease*, strictly speaking, is one which occurs only from contact — such a disease as a person may readily take, or "catch," from one who is ill. In a broad sense, however, contagious diseases are all diseases which are spread in any way by *bacteria* or other minute forms of life.[1]

Ignorance and disease

In olden times people thought that diseases such as cholera, smallpox, plague, and other contagious diseases, which spread as great *epidemics*, were caused either by evil spirits for revenge, or by a god for the punishment of sin. No attempts were made to make the surroundings of life clean and sanitary. Streets were used as open sewers; the sick were kept with the well; personal cleanliness was not practiced much; dwellings were poorly ventilated; food was poorly prepared; and in general people lived unsanitary lives. People have always paid a fearful penalty for this sort of ignorance.

All kinds of things were done to appease the particular god or demon who was supposed to be the cause of the trouble. These superstitious people used to ring bells to drive away the evil spirits of disease; burn human beings as sacrifices to the gods; consult sor-

[1] A better term than *contagious* for all these diseases is *communicable*.

ceresses; entomb living people in the walls of buildings; bury them alive; and do many other cruel and foolish things, all because of their ignorant ideas about disease. Even to-day we have left a suggestion of this early superstition and ignorance.

Mysterious cures are deceptive

Those who believe in *mysterious methods of cure* which they cannot understand, and those who take *patent medicines* about which they know nothing, are little better than their more ignorant ancestors who consulted sorceresses. It is because of this ignorance and superstition which still exist, that every town and city has so many special healers and impostors who promise cures for diseases. The advertisements of marvelous cures in the newspapers appeal to this same ignorance.

Although great numbers of people still ignorantly spend their hard-earned money for worthless drugs and for the services of worthless healers, yet we have made a great advance in such matters. Scientists have taught us that the causes of disease are not mysterious and that *diseases are never successfully treated by any mysterious methods.* Nothing in nature is really mysterious. Mystery is only another name for ignorance.

Intelligence can control disease

Long before bacteria were discovered, men learned that certain diseases are in some way contagious. They also learned that cleanliness of person and surroundings decreases disease. Now, with our new and exact knowledge of bacteria, we know the causes of contagious diseases and how to prevent them. Scientific students are all the time learning more about the control and cure of disease.

In countries like China and India there are still many sections where people are no better educated about disease than we were five hundred years or more ago. These are the places where great epidemics still rage unchecked. Hundreds of thousands die every year from the *bubonic plague* in India.

This terrible disease appeared in the United States in 1900. It was first discovered in San Francisco. Our knowledge of how it is caused made it possible for us to prevent its spread. Probably our country will never again have a great epidemic of any kind of disease, because we understand how diseases are carried and how to check them.

Yellow fever and malaria in Cuba and Panama

When our government took charge of Cuba, in 1898, one of the first things it did was to clean up the towns and cities and drain the wet places. In this way it succeeded in exterminating the mosquitoes, which breed in water and by their bite cause yellow fever and malaria.[1] These diseases had always been present in Cuba, destroying hundreds of people every year. Our government has made

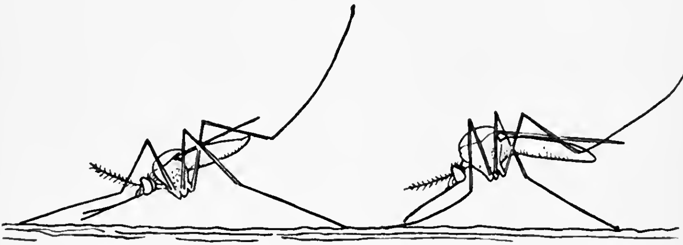
[1] So far as we know, yellow fever and malaria are the only diseases in this country carried by mosquitoes. It is interesting to know something of *how mosquitoes may be exterminated.* There are three methods commonly in use:

1. Kerosene oil may be spread upon the surface of ponds and other places where mosquitoes breed. This prevents the young insects, or larvæ, as they are called, from rising to the surface and getting air; without air they die quickly.

2. Fish may be placed in ponds, reservoirs, and the like. These fish feed upon the young insects and thus destroy them.

3. Swamps and other places where water collects may be drained. Rain barrels and other receptacles for water may be screened to prevent mosquitoes laying eggs in the water.

Cuba as healthful a place to live in as any place in our own country. It has more recently done a similar work in Panama.



MOSQUITOES.

On the left the mosquito that carries malaria; on the right the harmless mosquito. In resting position.

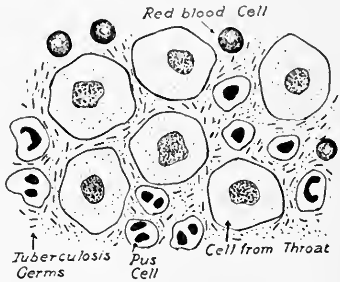
But there are two diseases in our country that we are far too careless about, in spite of our knowledge. These are consumption and typhoid fever. Sometime we shall succeed in wiping out these diseases in the United States, but comparatively little has yet been done. We have become used to these two fearful diseases, just as the Cubans had become used to yellow fever and malaria. It is true that both consumption and typhoid are harder to control than yellow fever or malaria, but *we can control them* when enough people become really educated in health matters. This is one of the reasons why every pupil in school to-day ought to study and understand how to care for his health.

The control of consumption and typhoid

Tuberculosis of the lungs, or *consumption*, is a contagious disease, spread largely by the expectorations of consumptives. Every year in this country at least 150,000 persons die from this *preventable* disease — this "great white plague" of the human race. At least 200,000 persons in our population are constantly sick and more or less helpless with it. (See page 199 for further discussion of tuberculosis.)

Sewage and disease

The prevalence of *typhoid fever* results in large part from dangerous habits of the past which thousands are still practicing in spite of all that has been learned about disease. For example, many cities pour their sewage into rivers and then draw water from those same rivers for drinking purposes. Most of the cities along the Mississippi, Ohio, Missouri, Hudson, Wabash, and many other rivers, do this. Until a few years ago the city of Chicago emptied all of its vast amount of sewage into Lake Michigan and then drew the water of the lake into the dwellings for drinking. In such cases, epidemics of typhoid fever occur from time to time because the typhoid germs pass into the drinking water with the sewage. Every year thousands of deaths from typhoid fever in this country occur in just this way. *Every one of these deaths is unnecessary and due to ignorance or carelessness.*



TUBERCULOSIS GERMS.

Expectoration, showing a great number of tuberculosis germs, which spread the disease if not destroyed.

Quarantine

Diphtheria, smallpox, scarlet fever, measles, pneumonia, chicken pox, mumps, and influenza are all contagious diseases, and these we have learned to control to a considerable extent. Boards of health insist upon the isolation of people sick with such diseases; this is called placing them in quarantine.[1] People sometimes think the regulations are very strict, and that it is a great hardship to keep pupils out of school and to isolate a family afflicted with a contagious disease; but it is only by such methods that the disease can be controlled and exterminated. If strict control were practiced, it would be possible to wipe such diseases entirely out of existence. (See page 169.)

A HYGIENIC DRINKING FOUNTAIN.
It helps to diminish contagious diseases.

Disinfection

After a case of contagious disease, the house must be thoroughly *disinfected;* that is, cleansed so as to destroy the germs of disease. The room occupied by the patient should be closed for some hours to allow dust particles to settle, and then *fumigated* with formaldehyde gas. After fumigation the room should be thoroughly cleaned with hot soda solution, chloride of lime, or two per cent carbolic acid solution. Finally it should

[1] Different states vary in their laws about quarantine. Measles, mumps, chicken pox, pneumonia, and influenza are not always quarantined.

be aired and sunned, and kept vacant for several days. The disinfection is best done by the health officer or the physician in charge; but for practical purposes the following method will prove fairly satisfactory:

1. Clean the rooms thoroughly.
   (*a*) Hang clothing, curtains, rugs, and bedclothes in the bright sunlight for several hours.
   (*b*) Wash the woodwork with water containing about one pint of formalin to every gallon of water.
   (*c*) Air out the rooms for several hours.
   (*d*) Boil all linen, bedclothes, and other things which have come in contact with the sick person.
2. Give the person who has recovered from the contagious disease, and those who have been with him, a hot bath with plenty of soap.
3. Burn infected articles which cannot be boiled. Toys and books should receive particular care.

Conditions that favor the growth of bacteria

Dark, damp places favor the growth of bacteria; sunlight and lack of moisture are destructive to them. Rooms that do not get sunlight are therefore likely to harbor disease germs. Briefly it may be said that heat, moisture, lack of sunlight, and poor ventilation favor the life of bacteria. These are some of the conditions we must guard against in fighting disease. We must remember also that *sunlight and fresh air are the best disinfectants* in the world.

How bacteria are spread: by the air

We must now consider how the germs of contagious diseases are spread. Many germs are spread by the air. Germs are often present in the expectoration of patients. If this is not destroyed, the germs become dry and float about with the dust of the air; then they are drawn into the lungs in breathing.

The air of cities and of crowded places is always more heavily laden with germs than the air of the country. On mountains and at sea the air is practically free from germs. Pneumonia, which is a germ disease, is very common in cities, but rare in the country. It is increasing in all large centers of population.

A Dark, Unventilated Bedroom.
Where disease germs flourish.

One of the reasons the rooms in a house, lecture hall, church, and theater ought to be well ventilated, is because germs are usually abundant in such places. Street cars, railroad cars (especially the sleeping cars), hotels, and restaurants are other places where germs are likely to be dangerous. The danger in crowded, badly ventilated places is largely because the air is *infected with germs.*

Several diseases are carried by water. Typhoid fever is one of these. This, as we know, is because of the sewage which is emptied into the water supplies. Cholera is spread in the same way. Whenever there is reason to suspect that the water supplies are contaminated, the *water should be thoroughly boiled before use.*

Bacteria in water, milk, and food

Typhoid fever is frequently spread by means of milk supplies. Usually the bacteria come from infected water in which the cans and other utensils have been washed. Diphtheria and tuberculosis, and occasionally other diseases also, may be carried by milk.

MEAT, SHOWING INSPECTOR'S MARKS.

Meat may carry the germs of tuberculosis when the animal from which the meat comes has had this disease. All *meat should be inspected* to guard against this.

Bacteria in clothing and furnishings

Many germs are carried by clothing, carpets, bed coverings, towels, hangings, dishes, and other household things. Probably measles, diphtheria, scarlet fever, pneumonia, and tuberculosis are frequently spread in this way. Carpets, heavy rugs, and hangings — everything that is not easily cleansed and aired — should be abolished from the sick-room. The luxurious Pullman sleeping car is very hard to keep clean because of the heavy upholstery, curtains, and decorations which it contains. These cars are not always hygienic. All places of public gatherings, including hotels, ought to have plain, simple furnishings.

Several important diseases are carried by insects. This is one of the latest discoveries of science.

Diseases carried by insects and animals

Malaria is carried by mosquitoes.

Yellow fever is carried by mosquitoes.

Typhoid fever is carried by flies.

Tuberculosis and diphtheria, and possibly some other diseases, may be carried by flies.

Leprosy is probably carried by bedbugs, and possibly by flies and fleas.

A BREEDING-PLACE FOR FLIES.

This is a dairy which furnished milk to a large city.

Glanders is carried by horses.

Tuberculosis is carried by cattle, dogs, cats, and some other animals.

Diphtheria is sometimes carried by cattle.

Plague is carried by fleas which infest rats.

There are many other methods by which contagious diseases are spread, but enough has been said for our purposes. It must be plain to every one that the control of these diseases is largely a matter of *absolute cleanliness of person and surroundings.*

The need of cleanliness

Mosquitoes cannot breed where there is no stagnant water.

Flies breed in refuse and manure piles.

Rats always live in filthy places.

Water polluted by sewage is not clean.

The habit of expectoration on streets is dangerous.

In a word, clean habits, sunshine, fresh air, and pure food mean death to disease.

CHAPTER XII

COLDS AND THEIR PREVENTION

Colds usually seem to be of little importance. For this reason most of us ignore them until they have gained a firm hold. But when we consider all the discomfort endured from colds and study carefully the consequences of them, it becomes apparent that they are far more serious than appears on the surface.

Colds are caused by bacteria

What we call a "cold" is a catarrhal fever. Every cold is due to some sort of *infection*. By this is meant that bacteria of some kind have lodged in the nose or throat and are there growing and multiplying.

Colds are contagious

Frequently one "takes a cold" after attending a crowded, badly ventilated church, theater, or lecture hall, or after sitting in close street cars. Colds contracted during trips in sleeping cars are very common. Wherever many people are crowded together with poor ventilation, the air is always heavily laden with bacteria. These facts show us that colds are contagious. Every one must have noticed how colds run through a whole family. Epidemics of colds sometimes follow dust storms or dusty days with considerable wind. This is because certain germs capable of causing colds are carried with the dust and are inhaled.

It is an interesting fact that travelers who have returned from the polar regions report the entire absence of colds, even after the severest exposure to very low temperatures and wet. This is of course explained by the absence of bacteria in such regions. Far out at sea colds are rarely experienced, for the same reason. The passengers on ships approaching land from great distances often notice epidemics of colds as soon as they encounter the land breezes bearing dust and therefore bacteria. Residents in mountainous regions and in sparsely settled countries suffer far less from colds than do people who live at lower levels and in or near centers of population.

Why we take cold

The reason a person takes cold after sitting in a direct draft or after a drenching, is because the body is chilled. This chilling *reduces the body's power of resistance*, and if the right kind of bacteria are present, one comes down with a cold. An attack of indigestion will sometimes bring on a cold in much the same way. Every one must have noticed how easy it is to take cold when very tired or exhausted. Anything which reduces the resisting powers of the body makes us more susceptible to disease.

It is because the bacteria of colds are nearly always present and because we do so many things which weaken our natural powers of defense, that we have so many colds. Those who learn how to live normal lives hardly ever suffer from colds. On the other hand, many people eat too much, bathe too little, exhaust themselves with work or pleasure or worry, overdress themselves, live in badly ventilated places, or do other unhygienic things — and then wonder why they are constantly subject to colds.

There are many other reasons to account for a tendency to colds. For example, diseased tonsils[1] and obstructions in the nose, such as adenoids and certain other growths, render an individual an easy victim.

The indirect causes which make one liable to take cold are usually one or more of the following:

Poor nutrition.	Exhaustion.
Constipation.	Exposure to dust.
Indigestion.	Bad ventilation.

Improper methods of clothing the body, which usually result in keeping the skin surface damp.

Improper care of the feet.

Disease in the nose or throat, such as adenoids and diseased tonsils.

Neglect of bathing or improper methods of bathing.

Congestion of the throat, as from singing, with exposure afterward.

Prevention of colds

Once knowing the causes of the disease we call a cold, the prevention is fairly easy. Any one who is not in delicate health can learn to avoid colds. No one can afford not to do so.

Cool daily bathing increases the resistance of the body. Such baths train the blood vessels of the skin to dilate and contract quickly. This is desirable in order that we may promptly meet sudden changes in temperature by increasing or checking perspiration. The practice of cool bathing is beneficial because it trains the capillaries, or, to be more exact, it trains the nervous system which controls them.

[1] For explanations of diseased tonsils and adenoids, see pages 104 and 105.

The use of heavy underclothing which keeps the surface of the body constantly moist is to be avoided. Linen or cotton mesh is better than wool; the material must be such as to allow evaporation of perspiration. The habit of bundling up the neck with furs or other wraps is a bad practice, except when one is exposed to very cold weather. Rubbers and overshoes should never be kept on long at a time, and heavy stockings need never be worn.

Bedrooms must be well ventilated with open windows, and the bedclothes should be warm but light in weight. The practice of sleeping out of doors is desirable when the climate and surroundings permit. We should be careful that the air of the rooms is not too dry, as is apt to be the case in steam-heated houses (see page 120). Air that is too dry affects the nose and throat and is likely to result in catarrh.

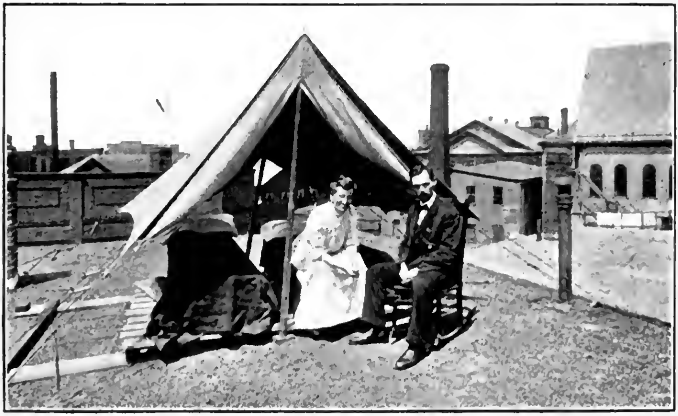
We should avoid sudden changes in temperature as far as possible and never allow ourselves to become chilled. Sensible care of the digestive apparatus and attention to the bowels is most essential.

The treatment of colds

When one does come down with a cold in spite of precaution, it should never be neglected. The best method of cure is to go to bed for a day or two in a well-ventilated room, take plenty of hot drinks, eat little food, and use some simple cathartic (a drug which acts on the bowels). Washing out the nose and throat with hot salt water frequently is of great benefit. If the cold does not promptly yield to such treatment, call a doctor without delay. Do not resort to "cold remedies" about which you know nothing, and avoid such common but foolish

A Balcony Built for Outdoor Sleeping.

Outdoor life obtained on roofs and balconies of city houses is far better than bad air in close bedrooms. Consumptives have been restored to health by living in the places pictured here.



Sleeping Quarters on a City Roof.

practices as closing the windows, bundling up in bedclothes, and applying poultices to the throat or chest.

Results of colds

The results of frequent or neglected colds are often serious. Many people, through bad methods of living or because of defects in nose or throat, are constantly having colds. One result of this is *chronic catarrh*. Much mucus is secreted from the nose and throat, and even the bronchial tubes may become involved. This means that inflammation is always present and that certain harmful bacteria never cease their labors. People who suffer in this way are likely to have a decided tendency toward tuberculosis. Sometimes these catarrhal conditions travel back through the eustachian tube connecting the throat with the ear, and serious trouble in the ear follows. Most cases of deafness are due to neglected cases of catarrh.

The usual "catarrh remedies" are either worthless or only temporary in the relief they give. Catarrh always needs careful attention from a skillful physician.

You can now understand that a person who is constantly taking cold is in a truly unnatural condition. No one can be constantly subjected to colds and not suffer seriously; for though a single cold may seem trivial, repeated attacks predispose a person to catarrh, tuberculosis, and probably to pneumonia.

CHAPTER XIII

PERSONAL HYGIENE

By personal hygiene we mean those things which have to do with the health of the person, as distinguished from that of the town, city, or community. The various states have their state boards of health to care for the health of the state as a whole. Cities and towns have their local health officer. Counties have their county health officer. All of this is necessary, because there are many things affecting health which the individual cannot possibly control. An individual cannot prevent a city from emptying sewage into public water supplies, but a state or city health board can do so. But each one of us can, to a large extent, control our personal health.

Personal and public health

We may learn what foods are best for us, may clothe ourselves properly, take the right kind of exercise, breathe pure air and plenty of it, bathe properly, care for our teeth, avoid alcohol and tobacco and injurious drugs, and, in a word, live sensible and reasonable lives.

Let us briefly study some of the things, or conditions which affect our personal health.

If a careful physician were to study the physical condition of all the pupils in a large school,[1] he would prob-

[1] The best schools now employ a school physician to examine the physical condition of pupils.

ably find that, next to bad teeth, eye defects are the most common. In the first 99,000 children examined in New York City, about 33,000 were discovered with eye troubles of various kinds.

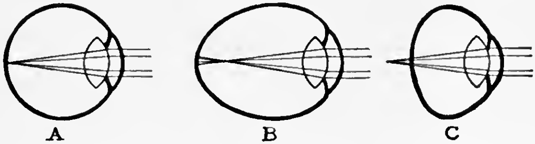
Eye defects are common

Many pupils are constantly straining their eyes, without being conscious of it. In order to overcome some

A MEDICAL EXAMINER AT WORK IN A PUBLIC SCHOOL.

defect, they make a great effort to focus on what they look at, much as you would focus an opera glass. These efforts will in time injure not only the eyes, but the nervous system also. Sometimes people have had nervous breakdowns simply because their eyes were being strained without their knowledge. Many others are constantly "nervous" for the same reason.

When a pupil does not easily see from his seat letters on the blackboard, or does not read from his book easily when it is held about fourteen inches from the eyes, when words are blurred, when the eyes smart, when one



A, Normal Eye. *B*, Long Eye. *C*, Short Eye.

Notice that the lines of the image meet too far forward in the long eye, and too far behind in the short eye.

tires easily after reading, when reading makes the eyes or head ache, — then there is usually something wrong with the eyesight.

Expert care for the eyes

Our sight is priceless, and we cannot care for it too well. The success of a boy or a girl, not only in school but in life, often depends upon good eyesight. When there seems to be any trouble, a person ought always to see a good *oculist* — that is, an eye specialist, not an optician. An optician is generally a man who has studied the fitting of lenses and eyeglasses, but knows almost nothing about the diseases of the eye. Any treatment of the eye requires the very best medical training. Remember that the best skill procurable is none too good for your eyes.

The best conditions for reading

Many people do foolish things when reading, and in this way injure the eyes. One ought not to read very fine print. The walls of a place used for reading ought to be tinted rather than white. Glazed paper is bad for the eyes. One ought not to face the light or read in the bright sunlight. Light for reading should come over the *left shoulder*, or

AN ATTRACTIVE, WELL-LIGHTED, WELL-VENTILATED SCHOOLROOM.

By permission of the Polytechnic Elementary School, Pasadena.

from behind and above; sometimes light from both sides may be arranged to advantage. The best light, when it can be so arranged, is *north light*. Hospital operating rooms and laboratories are generally arranged so as to get their light from the north.

A steady light is necessary for reading or doing other eye work. Electricity or kerosene is better than gaslight, unless an Argand burner is used. Electric lights for reading should have ground-glass globes. Reading lights should be shaded so that light does not enter the eyes from all directions. For this same reason, reading out of doors is likely to be injurious.

If one reads in bed at all, a well-shaded light must be properly adjusted at the head of the bed, and one's head must be well raised. The use of the eyes when lying flat is always hard on them. With all close work, the position of the body should be as erect as possible. The habit of placing the book or paper on the desk or table and then bending over it should be avoided.

What has been said about reading applies equally well to any other kind of eye work which requires close, careful attention. Fine sewing is particularly severe on the eyes. The object on which one is working should not be laid against a white surface if that can be avoided. Covers on reading tables should not be white for this reason.

Crossed-eyes are nearly always due to a defect in sight. They may often be remedied without an operation, if attended to early enough. If the condition is neglected, the crossed-eye is likely to become entirely blind. Red lids, watery or red eyes, and granulated lids always need medical attention. Dirty towels and public bathing pools are often the cause of *infected eyes.* The use of a public towel ought never to be permitted; this precaution should be taken particularly in schools.

Use of the eyes of young children

Children under ten or twelve years of age ought not to do much reading or other things which require near eye work. Until about eight years of age, a child is naturally *far-sighted*, and to give such a child near eye work to do is always wrong. Most of the reading of children up to about ten years should be from large letters on the blackboard and from charts. Nearly all children in our public and other schools are taught near work with the eyes far too early. This is one of the reasons why eye defects become more common as we pass from the lower to the higher grades in schools.

Conditions in the schoolroom

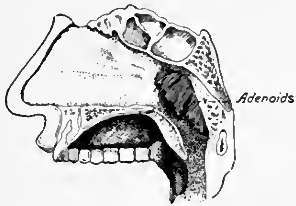
Many schoolrooms have the windows so arranged that direct sunlight falls into the eyes of pupils during part of the day. This condition should be corrected with tinted window shades. All parts of a schoolroom should receive nearly the same amount of light, and there should not be any dark corners. Green or brown tints are far better for boards than the ordinary blackboards, and the surface should be dull, not shiny.

The amount of window space for a schoolroom, or other place where much eye work is necessary, should be about one fifth or one sixth of the floor space.

It is very important that school books should have rather short lines, not over four and a half inches long. If lines are longer than this, too much rotating of the eye muscles is required, and the eyes become very tired.

In order of frequency, nose and throat troubles usually come after eye defects. One cause of trouble is adenoids, which are soft, spongy growths that sometimes appear up behind the soft palate. Adenoids often grow in children and young people. They prevent proper breathing through the nose, so that a person who has this growth breathes with the mouth open. Many pupils in every school do this. It gives them a rather stupid appearance, prevents the full development of the face and lower jaw, causes crooked or prominent teeth, and often results in a receding chin. Many cases of actual mental dullness are caused by these obstructions to breathing.

Nose and throat troubles: adenoids



ADENOIDS.

Growing between the nose and the throat, they swell and obstruct breathing.

Such children do not get enough oxygen, their chests do not develop properly, and they are usually more subject to contagious and other diseases than are those who can breathe in the right way. It is much the same as if we should keep the windows of a room shut and breathe the same air over and over again. We could not possibly be healthy in such an atmosphere. Neither can the child be healthy who never gets enough oxygen, and who has to keep his mouth open in order to get what he does breathe. Holding the mouth open is not a bad habit but a necessity with such a child. There is only one thing to do, and that is to have the obstruction removed. This is neither dangerous nor serious.

The tonsils

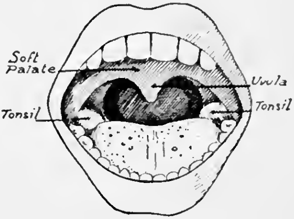
On each side of the tongue, back in the throat, is a body called the tonsil. The tonsils ought never to project much into the throat, but they often become enlarged and sometimes they nearly meet. They

ADENOIDS AND CROOKED TEETH, DISFIGURING THE FACE.

AFTER ADENOIDS HAVE BEEN REMOVED AND TEETH STRAIGHTENED.

By permission of Dr. Roy Robinson.

easily become diseased, especially when they are enlarged. Large and diseased tonsils cause a great deal of trouble. They obstruct breathing; they make a person more susceptible to many diseases, particularly to tuberculosis; and sometimes they become much diseased and very foul. From such tonsils bacterial poisons are always being absorbed, and the whole body is weakened in this way. When one has had many attacks of *tonsilitis* (a form of sore throat), the tonsils are likely to be in such condition that they ought to be removed. No one can be healthy who has enlarged or diseased tonsils.



THE NORMAL TONSILS.

Catarrh

Catarrh is a symptom, not a disease. It means that there is something wrong in the nose and throat which keeps up a constant irritation and inflammation. The cause must be removed before the catarrh, or symptom, can be removed. The cause and the treatment of catarrh we have already studied in the chapter on colds (page 97).

Defects in the ears

The nose and throat have close connection with the ears, and troubles in the nose and throat often accompany defects in hearing. Leading from the back of the throat to the middle chamber of each ear is the *eustachian tube.* It carries air and keeps the pressure of air within the ear the same as the outside air pressure. When one has adenoids or diseased tonsils, the opening of this tube may be covered or disease germs may travel back to the ear. In this way the middle ear chamber becomes inflamed and pus may form there. If the opening of the tube becomes closed, the air pressure may be changed so as to injure the hearing.

Nearly all cases of deafness, earache, and discharge from the ear begin with some trouble in the nose and throat. Such symptoms of ear trouble must never be neglected. Permanent injury is apt to follow, and sometimes neglected cases cause death.

If the eye, ear, nose, and throat received the proper care, many kinds of sickness might be avoided. Eye strain, with all the nervous troubles and headache which result from it, is caused by ignorance or carelessness. Frequent attacks of tonsilitis are never necessary. They are due to neglect. Catarrh is almost universal, but is quite unnecessary. Deafness can nearly always be avoided. Few persons realize how much health, efficiency, and happiness depend upon the proper care of these organs.

Indigestion is often indicated by a burning sensation in the stomach, and food may be thrown up without any sick feeling in the stomach. Those who have this trouble can usually correct it by avoiding foolish diet errors which they can easily discover. They should put themselves on a very simple diet and avoid overloading the stomach. Sweets are especially to be avoided. Eating between meals should never be indulged in. Regularity in eating is of great importance. Most people eat too much, and often of the wrong kinds of food. (See the chapter on the Use and Abuse of Food, page 130, for more information upon this subject.)

Digestive troubles

Free movement of the bowels should occur once or twice each day. Regularity is very important. Any neglect in this matter always results in more or less disordered health. Many cases of headache, skin eruption, yellow skin, colds, conditions of mental dullness, sleepiness, and digestive disorder are due directly to *constipation*. Such a condition may usually be corrected by the free use of drinking water, especially a glass of hot water before breakfast, and by eating plenty of fruit, especially stewed prunes, apples, figs, and fresh fruit. The habit of using cathartics should be avoided.

Where constipation is continually present, one must give particular attention to the diet and make use of foods which leave a residue (that is, undigested material) in the intestines and promote peristaltic action.[1] Such foods include corn bread, graham bread, whole wheat bread, crackers, prunes, apples, turnips, cabbage, and

[1] *Peristaltic action* refers to the contraction of muscles in the walls of the intestines, which forces the contents along.

celery. On the other hand, fine flours and foods which are digested without leaving much residue in the intestines must be avoided. Such foods include white flour, milk, pastry, prepared cereals, and potatoes. The free use of water between meals is particularly valuable in overcoming constipation.

Headache

Headache is not a disease, but a symptom of disease. It has many causes, among which may be mentioned the following:

Eye strain.	Nervous exhaustion.
Constipation.	Poor nutrition.
Indigestion.	Jaundice.
Catarrh.	Rheumatism.
Neuralgia.	Bad ventilation (air poisoning).

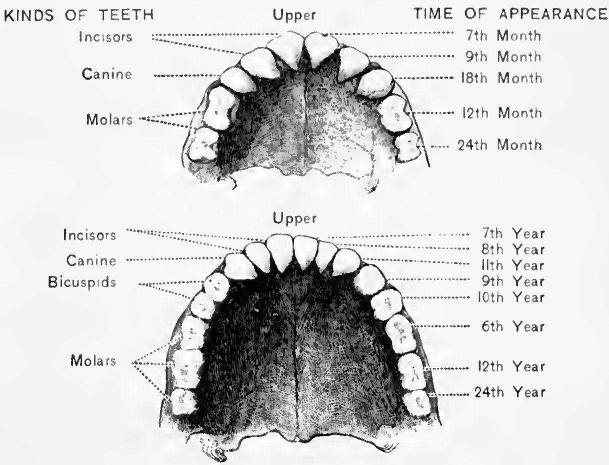
Eye strain, constipation, indigestion, and nervous exhaustion are by far the commonest causes of headaches. One ought always to attempt to discover the cause of a headache before trying to treat it. Such causes are usually not hard to find, and, once known, the treatment is usually successful. If the cause is not easily discovered and remedied, medical attention is necessary, for headaches should never be neglected.

The common method of resorting to "headache powders" and other drugs, without much thought as to the cause of the trouble, cannot be too severely condemned. Most headache powders advertised as cures contain coal-tar products, such as acetanilid, which are likely to injure the heart and do much other harm. Some deaths have been attributed to the use of such patent medicines.

It would seem as though very little need be said about the care of the teeth, but such is not the fact.

Any intelligent person ought to understand the necessity for keeping the teeth in good condition as a matter of ordinary decency. Decayed teeth are repulsive to others; they render the breath foul; they harbor germs which may result in various

Care of the teeth



TEMPORARY AND PERMANENT TEETH.

diseases; they lower the general resistance of the body; they lead indirectly to indigestion.

The teeth should be cleaned twice or oftener daily, and the use of a powder or paste containing prepared chalk is desirable. Mouth washes are usually not necessary in normal mouths. A visit to the dentist at least once or twice yearly during the developing age is desirable, not only from the standpoint of hygiene, but as a matter of economy as well.

The teeth are covered with a hard protecting substance called *enamel*. If this is broken by cracking hard substances such as nuts, or by biting on other hard things, the teeth are almost sure to decay. Toothache is nearly always caused by decay in the tooth. If the condition is neglected, a cavity soon forms, and in it food and various bacteria collect. Decayed teeth should never be neglected under any condition, even if they are the first or baby teeth.

Teeth seldom need to be extracted, and good dentists rarely advise pulling one out. Crooked teeth, and teeth

Plaster Casts of Crooked Teeth caused by Adenoids.

By permission of Dr. Roy Robinson.

which protrude from the mouth, usually indicate some obstruction to breathing, frequently adenoids. Such teeth can always be corrected, and it is quite unnecessary for any one to have such a deformity. It is a common error to think that a child should wait until he is twelve or fourteen years of age before having his teeth straightened. It ought to be done as soon as the second teeth have come.

Sleep

Sleep is a building-up process by which new energy is stored up to replace that which is more or less exhausted by the day's activities. It is like the charging of a storage battery. If the supply of a person's energy is drawn upon too much without re-storing, serious injury results. The idea of drawing upon the stored-up energy of the body for a long time, and then making up the loss with long hours of sleep, is just as unwise as doing the same thing with a set of batteries. Batteries, to be kept in the most useful condition, must be regularly and frequently recharged, and human beings must do the same sort of thing with their bodies.

It is never a matter of credit to any one to get along with only a few hours of sleep. Actual experience and observation prove that most adults require about nine hours of sleep. Until the age of about fourteen children should have at least twelve hours of sleep, and infants to the age of four or five require fifteen to eighteen hours daily. Elderly persons require less sleep than young or middle-aged people, or perhaps it would be more exact to say that they are unable to get as much sleep.

Boys and girls, and young people generally, do best with *regular hours of sleep*, and late hours are never good for them. For older people the period for sleep makes less difference, and the sleeping hours may be arranged to suit their individual peculiarities and conditions of life. There is no particular advantage in the mere fact of early rising or going to bed early. But we should remember that *sunlight is nature's best health giver and tonic*, and we ought not to spend in sleep the hours of good morning sunshine.

For purposes of cleanliness, a hot bath once or twice a week is all that is ordinarily required. But for purposes of hardening the system against colds and for stimulating effects, the daily cool bath in the morning is very desirable. In this way the skin capillaries must be trained to react quickly, not sluggishly, to changes in temperature. (See page 94.)

Bathing

Some people do not endure very cold water well, and it is not desirable for all persons to practice cold bathing. Most invalids, if not all, are injured by cold bathing, for they do not react[1] quickly and are consequently apt to suffer all day from depression. Each person must determine by experiment what temperature of water best agrees with him, and must be led largely by the amount and rapidity of reaction which follows. Some do best with a cool bath at 85° temperature, while others enjoy a bath at 65° or 70°. Standing in hot water while sponging or spraying the body with cold water adds to the comfort of the cold bath.

There are some special dangers in sea bathing and fresh-water bathing. One ought never to remain in the water after a feeling of chilliness has come on, but should take a thorough rub and dress quickly. One should not bathe until at least two hours after a meal. Any one who practices diving ought to use cotton in the ears. Swimming is a rather violent exercise and is likely to strain the heart if over-indulged in. Many cases of sudden drowning are due to heart strain and exhaustion.

Sea bathing

Swimming pools and plunges where many people bathe in comparatively little water are likely to become contaminated. Many cases of eye infection (red, sore

[1] After the body has been chilled by the cold bath, the warm blood from the interior flows back to the skin. This return of the blood is called the *reaction*.

eyes) follow bathing in these tanks. Such places ought to have a constant and rapid change of water, and even then they are not desirable when crowded with people.

Public bathing suits are likely to carry infection unless sterilized (that is, treated so as to kill bacteria) each time after using.

Never use a public towel. Many eye and skin diseases are contracted in this way. The same rule applies to hair brushes and combs.

General cleanliness

It is the duty of civilized man, as well as his privilege, to keep reasonably clean. Cleanliness refers not only to the hands, face, feet, nails, hair, teeth, and surface of the body in general, but to the inside of the body also. One cannot be clean unless one observes great regularity in matters pertaining to the daily toilet. One cannot be clean and practice overloading the stomach with food. Part of such food will surely ferment and decompose, and that condition is no better because it is inside the body than it would be outside.

Clean food

The food that is eaten must be clean. This means that we must know that our water, milk, meat, bakery goods, vegetables, and other foods are produced under clean conditions and are handled in a sanitary manner. It means cleanliness in *all* things, not in those things only in which it is *customary* to be clean.

As a matter of fact, in many ways we are far from being clean. It requires education, for example, to make people think about the uncleanliness, to say nothing about the disease, caused by drinking water polluted by sewage. We are apt to eat, without much thought, vegetables and fruit which have been exposed to dust, disease germs, and the like, because we are accustomed to do so. It is only rather recently that anybody has thought how filthy milk may be and how much disease can be spread in that way. We are now making laws to prevent the adulteration of foods, but we are very slow in making laws to regulate the cleanliness of foods.

A nation's rise in importance in the world is sure to be in keeping with its idea of cleanliness. In matters of cleanliness, and therefore of sanitation, Japan has taught other nations many a lesson. No other army in the world equals the Japanese in healthfulness, and this is due absolutely and entirely to the practice of clean, sanitary principles.

Sanitation and civilization

In the long run, disease and dirt, as well as health and cleanliness, are first cousins, so to speak. A dirty people are always unhealthy; a clean people are usually healthy. The prevention of disease is largely a matter of simple but absolute cleanliness. Sanitation and hygiene are really the practice of simple habits of cleanliness.

A Healthful Home.

Where sunshine, fresh air, and flowers are abundant.

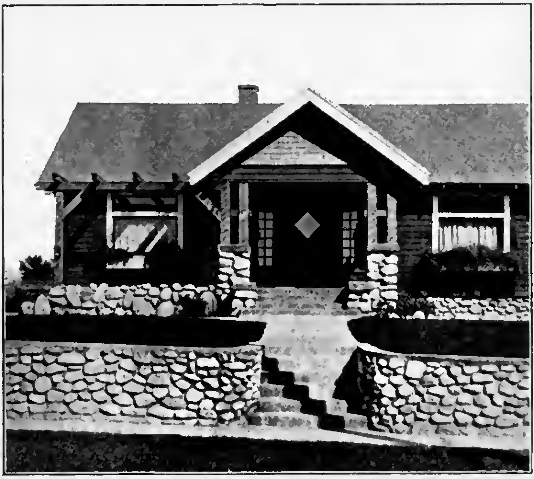
CHAPTER XIV

THE HEALTHFUL HOME

We have studied the health of the individual; now we must learn about health in the home. The home is the place where, more than anywhere else, health should be studied. It is just as easy for children to learn and to practice the rules of health as it is not to do so, and the home is the natural place to get this knowledge. We must realize that it is very necessary to learn how to care for the health, for by so doing we may avoid most of our illnesses and much expense and unhappiness.

A healthful home must be located so as to have good drainage, that is, arrangements for carrying off rain water, ground water, and sewage. The house should have plenty of windows, and some of the rooms at least must get direct sunlight. Dark, damp rooms are always disease breeders. A home must have plenty of fresh air and sunshine. The rooms which are used the most ought to be the sunniest.

Location



AN ATTRACTIVE HOME OF A WORKING MAN.

Here health makes wealth.

Ventilation

Fresh air must always be provided for the rooms in which people live. The air in a poorly ventilated room in which several persons are present soon becomes foul with carbon dioxide — the poisonous gas exhaled from the lungs — and with other harmful substances. The air must be in constant motion, for it is only by this means that clean, fresh air can be brought in and air that has been used can be driven out. A place must be provided where the foul air can go out of a room and also where fresh air may enter. One must remember that no more fresh air can come into a room than there is air leaving it at the same time.

Methods of ventilation

The ventilating of a house is sometimes a difficult problem, but usually it is an easy matter. Open fireplaces are the best of ventilators, and our grandparents depended almost entirely upon these to secure ventilation. They serve, however, only to carry air out, and some means must be provided to secure fresh air without having direct drafts.

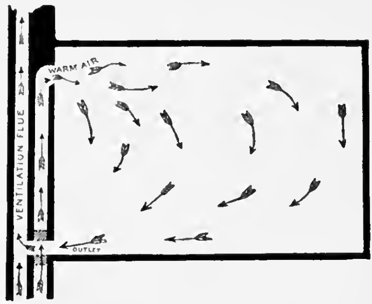


FIG. 1.—A GOOD VENTILATION PLAN.

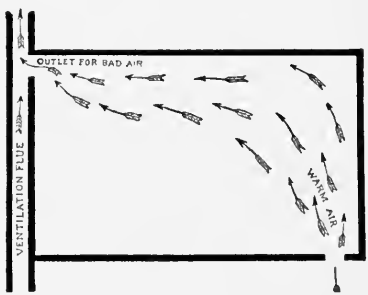


FIG. 2.—A POOR VENTILATION PLAN.

Grated ventilators near the floor which open into ventilating pipes are a good arrangement for the escape of foul air. When air exhaled from the lungs cools, it becomes heavy and falls; hence the opening for escaping air should be near the floor. If there are no fireplaces or special openings where foul air can escape, ventilation must be secured by the opening of windows and doors. This is a very uncertain and poor arrangement; but if one is careful to open doors and windows often enough and to keep out of the draft,

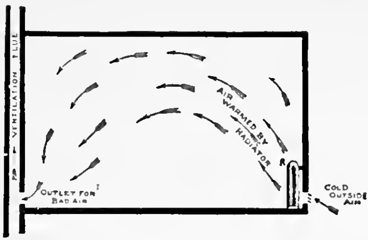


FIG. 3.—VENTILATION WITH STEAM HEATING.

the air can be kept pure by this means.

One of the simplest plans for ventilating a house is to have several windows fitted with a board under the lower sash so that an opening for air is left between the upper and lower sashes. Even with this arrangement, the outside doors should be thrown wide open for a few minutes every day.

If a house is heated by a hot-air furnace, the fresh air from the outside must pass through a cold-air box to the furnace where it is warmed, and then it rises to the various rooms through the hot-air pipes. The air for such a furnace should never come from the cellar or from the hall or vestibule, as it sometimes does. One of the best methods with a hot-air furnace is to have the warm, fresh air enter a room high in the wall and the foul air escape into a flue at the floor on the same side. This arrangement is well illustrated in Figure 1. Figure 2 shows a method which is much less effective; the air circulates through only half the room when the outlet is near the ceiling and the inlet is at the floor on the opposite side.

When a house is heated by hot-water pipes or steam pipes, there must be some special plan for changing the air. Two sets of ventilators may be used for this purpose, both sets being placed near the floor (Fig. 3).

In many modern buildings architects now arrange an artificial system of ventilation by which fans and blowers are used to suck the exhausted air out of the rooms and to force the fresh air in.

Houses in the country which are heated by air-tight stoves usually have no regular means of bringing in fresh air or of discharging the old air. In such places one must rely upon windows and doors for ventilation. In very cold weather the air in these houses is nearly always bad. This is especially true in the houses of the poor, where they imagine that they cannot afford to let any cold air come in. To make matters worse, such houses are most often lighted with lamps, which exhaust the oxygen in the air faster than the same number of people would do. One of the reasons why tuberculosis is common in the country, where one expects people to be healthy, is because so much bad air is shut up in the living rooms all winter long.

Stoves and ventilation

Most of the advantage of living in a mild climate comes from the fact that one may be out of doors and may always breathe pure, fresh air. Many invalids go to California to recover their health and then shut themselves up in a close hotel or in an unventilated, gas-heated room; no one was ever benefited by such a change. In California and some other warm places, houses are often heated with coal-oil or gas stoves. These are regular air destroyers. A gas stove ought never to be used unless it is connected with a flue so that the fumes and impure air may escape from the room.

It is important that air in sleeping rooms should be constantly renewed during the night. "Night air," so much dreaded by many people, is the only air there is at night, and is not different from day air except that it is cooler. Bedrooms may always

Ventilation at night

be easily ventilated, for the windows may be thrown wide open. If a person is properly covered in bed, he need never fear taking cold.

A room must not only be well ventilated, but its air must be neither too dry nor too humid. The air in apartments heated with steam pipes or hot-water pipes is nearly always too dry. This may be remedied by heating water in an open receptacle so as to evaporate it in the room. When many people are crowded into a room, there is always an excess of humidity. This causes much discomfort. The perspiration on the skin does not evaporate easily and impurities are retained in the body. Humidity from overcrowding or other causes is always injurious to health.

Dryness and humidity in rooms

Poor ventilation reduces the strength of the body rapidly. A person living long in a poorly ventilated house, store, or other place is constantly poisoned. He might as well swallow a large dose of poison every day and expect to keep healthy, as to try to do so when constantly breathing bad air. It is not only because he is *self-poisoned* in such an air, but he is breathing over and over again the germs of disease. No crowded, ill-ventilated place can long be free from disease germs.

Consequences of poor ventilation

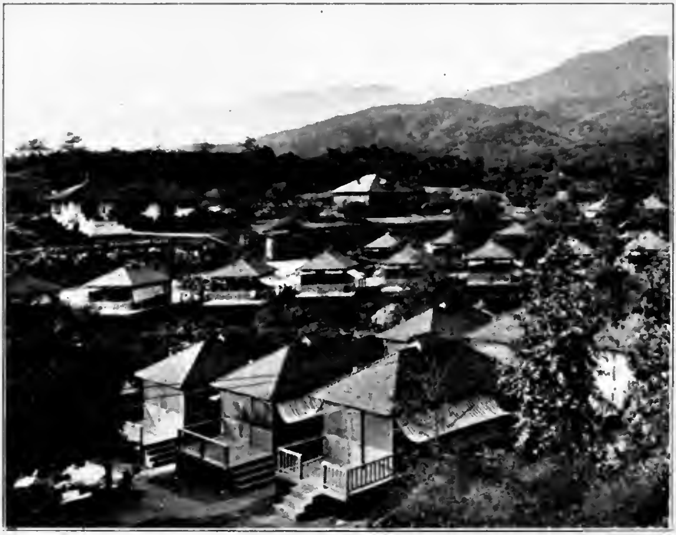
The air of the country is always purer than that of cities, for in cities the air is filled with smoke, gas, dust, and germ life. This does not mean that every part of a city has such bad air, but that many parts do. In Chicago the strong Lake Michigan breezes bring in much pure, clean air and drive away the polluted air of the city. Every one who has lived there must have noticed what a relief a change

City air may be unhealthful

of wind brings, when the suffocating, hot southwest wind of summer changes to the pure, invigorating east or northeast wind from the lake.

Fresh-air education

Thousands of lives are saved every year by the work of many organizations which establish summer camps for mothers and children in the country and along the shores of the ocean and of lakes. Not only are lives saved, but this fresh-air campaign



A FRESH-AIR COLONY.

In this sanitarium for consumptives, people sleep in the open air.

By permission of Dr. F. M. Pattenger, Monrovia, Cal.

brings happiness, increased vigor, and a fresh-air education to those who have these privileges. When one learns the value of clean air, one will never be satisfied with foul, poisoned air.

Dust is likely to carry disease, and care should be taken that it does not collect in houses. The common methods of dusting and sweeping merely spread the dust about and do not destroy it. When this work is properly done, the sweepings are burned. Dusting should be done not with a feather duster, but with a damp, soft cloth which will actually gather up the dust and not spread it around to other places. Floors are best swept by some damp method. Damp sawdust and damp newspapers torn into bits are useful for this purpose. A person who is sweeping a very dusty place ought to wear some protection over the nose and mouth; a damp towel does very well.

Dust and its dangers

A Tent House.

A sleeping porch sheltered by canvas curtains adjoins a small room.

By permission of Dr. F. M. Pattenger, Monrovia, Cal.

Carpets and straw mattings are undesirable because they gather so much dust. Rugs which can be frequently and thoroughly cleaned and hung up in the bright sunlight are much less objectionable. Carpets in public places are absolutely unhygienic and even dangerous. Furnishings should be of the kind that allows thorough cleaning. Heavy upholstery which accumulates dust and cannot be frequently cleaned and exposed to sunlight is most undesirable.

Hygienic furnishings

There is no reason why a home may not be beautifully and even elegantly furnished and yet be strictly hygienic. The time is fast coming when things which are elegant but not at the same time clean, will not be considered in good taste. The elegance of many of our wealthy homes, hotels, restaurants, steamships, churches, and cars renders cleanliness impossible. The really elegant home to-day is the clean one.

Many houses have been hotbeds of contagion because of the furnishings. Some houses harbor the germs of tuberculosis and other diseases for long periods because they can never be thoroughly cleaned.

Bedroom arrangements

Bedrooms especially should be simply furnished. Mattresses should always have some washable cover. Quilts should never be used, for they cannot be washed and are not clean after a little use. Never carpet a bedroom. Never use an inside room for a sleeping room, or indeed for anything but storage. In cold climates, whenever it is possible, bedrooms should have open fireplaces as a means of ventilation. About one third of your life is spent in the bedroom. It ought to be made as healthful and cheerful as possible.

In warm climates an *outside sleeping room* is most desirable. A screened porch with shingle roof and canvas curtains furnishes the best sort of outside bedroom. Even in cold climates such rooms are desirable for those who need a great deal of out-of-door life. Inside dressing rooms ought to be connected with these porches. Tent life is often possible for at least a part of the year, and it is always an excellent thing.

Plumbing must be of a kind which can be approved by a plumbing inspector. Every bathroom should have an outside window. An inside room ought never to be used for a toilet or bathroom, because it can never be well ventilated. The bathroom ought to be the cleanest room in the house.

Plumbing

Sewer gas is poisonous and must never be allowed to escape into a house. It may be present even when no odor can be discovered. Great care should be taken to prevent leaks in sewage pipes. Sometimes such leaks occur in cellars and are badly neglected. Sewer gas lowers the health and renders people more likely to take disease.

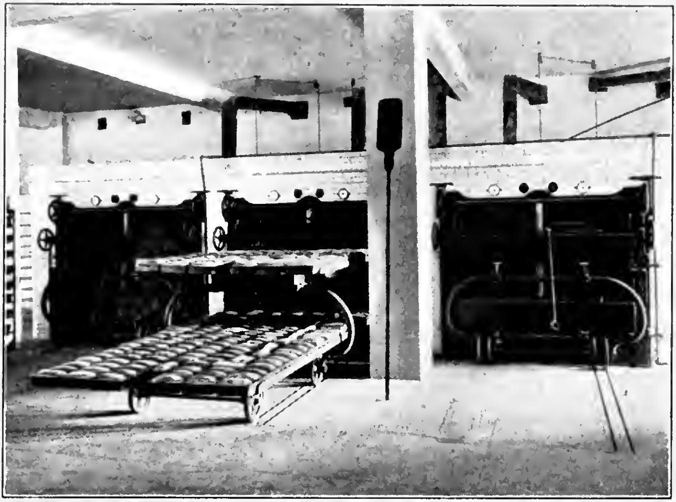
In the country there are often no sewers. In such places the sewage has to be carried into cesspools. The contents of the pools often drain through a porous soil into wells or streams used for drinking water. Many cases of typhoid fever have been caused in this way (see page 140). The best cesspools are made of brick cemented on the inside. These may be pumped out from time to time. Cesspools ought to have a ventilating pipe connected with them. They must not be located too near the house.

Cesspools

The hygiene of the kitchen includes not only the kitchen and its surroundings, but everything that comes into it. The careful housekeeper will know where the milk supply comes from, and will visit the dairy or in some other way satisfy herself that it is run in a clean manner. She will know whether the water supply is pure and safe; she will make sure that it does not come from a river or lake into which a town or city empties its sewage, or from wells into which a toilet drains, or from a reservoir which is ex-

The problem of pure food supplies

posed to contamination. She will not accept meat from a market where it is exposed to dust, flies, and infection, or where it may be treated with chemicals to prevent it from spoiling when it is old. She will not patronize the unhygienic grocery store, where fruits and vegetables are exposed for sale on sidewalks and other open places.



A Clean, Sanitary Bakery.

By permission of Jevne and Company, Pasadena.

She will buy her bakery goods from clean bakeries, not from a place which is unventilated, full of sewer gas, exposed to flies and other insects, and handled by people with filthy hands and habits.

Hygiene of the kitchen

The kitchen ought to be completely screened and kept free from flies and other insects. It is probable that flies are one of the commonest carriers of diseases such as typhoid and tuberculosis.

The *ice box* must receive particular attention. Ice boxes are often badly neglected, even in well-run houses. They should be frequently cleaned and scalded out. Foods with strong odors will taint other foods in the ice box. Milk or water is best kept in the ice box in bottles or covered jars. Water kept cold in this way is far better for drinking purposes than iced water.

Kitchen floors ought to be uncovered and well painted, or covered with linoleum only. The floor of a kitchen should be impervious to moisture and free from cracks. Kitchen tables and sinks and the woodwork in general should also be kept in the same condition.

Open plumbing only should be found in the modern kitchen. Dark, damp cupboards and storage spaces under sinks are always bad. Vermin of various sorts accumulate in such places.

A kitchen ought to be a sunny, bright, and cheerful place. Absolute cleanliness in the kitchen is insisted upon by every intelligent home maker. In olden times the kitchen was the best room in the house and the pride of the neat housewife. In matters of domestic hygiene Americans might well follow the example of the beautiful housekeepers of Holland.

Nursing in the home

Sickness sooner or later comes into every home, and we should understand something of how to meet it. For serious illnesses it is always advisable to call a trained nurse, but when one employs no nurse, members of the family can give many little attentions to make the patient more comfortable.

Never allow a patient to wear in bed anything except the lightest of night clothing, and under no circumstances should underclothing be worn. The bed-covering

A Clean, Sanitary Kitchen in a Large Establishment.

By permission of Jevne and Company, Pasadena.

should be warm but light. Always avoid the use of quilts.

In most cases a daily morning sponge bath is desirable. This can be given under the sheet without exposing the surface of the body. Tepid water followed by an alcohol rub is best. Nothing adds more to a patient's comfort than the daily bath when it is given skillfully.

Frequent change of position in bed is necessary. A nurse ought never to forget that a perfectly smooth and clean bed is absolutely necessary to the comfort of the patient.

Cool sponging with alcohol and water relieves feverish conditions wonderfully. An ice bag for a hot head is a comfort. Headaches are often relieved by the application of hot cloths. Pain is often relieved by the use of a hot-water bag, but care must be used not to burn the patient.

Foods for the sick must be made attractive and appetizing.

Settle all questions for the sick and do not bother them with deciding anything. Do not argue with them, or notice any unreasonableness.

Care of the sick-room

Keep the room quiet and do not allow much conversation. No sick person likes to see many visitors, and even members of the family ought to be kept away most of the time. Do not allow unpleasant topics of conversation or the discussion of other cases of sickness.

Keep the room comfortable, but do not make the common mistake of overheating it and piling bedclothes on the patient. Of all rooms the sick-room must have the best of ventilation.

The room of a sick person should always be furnished as simply as possible. Carpets, hangings, and upholstered furniture are especially undesirable. No sweeping should be done, but the various surfaces should be wiped with a damp cloth every day.

System and regularity in all work about the sick-room are necessary.

In the successful care of the sick there are many little details which must be observed, but more depends upon tact, natural aptitude, and common sense than upon special education, although this is most desirable.

Contagious disease in the home

When infectious disease appears in the household, the patient should be isolated in a large, airy room on the upper floor. The upper floor is to be preferred because it is farther removed from annoyance by street noises and from dust. All well persons, except those caring for the patient, should be kept away from the room. The other members of the family should usually be prohibited from attending any school or other public assembly. (See pages 85 and 169.)

A moistened sheet suspended in front of the door of the sick-room will help to prevent dust particles and germs from spreading to other parts of the house. Such a sheet may be wet in a bichloride of mercury solution.

Personal clothing and bed linen should be disinfected in the room before being sent away. Napkins, dishes, and utensils may be boiled in the room before being sent to the kitchen. Unconsumed food should always be burned.

CHAPTER XV

THE USE AND ABUSE OF FOOD

Health and digestion

THERE is no better way to keep healthy and happy than by learning the importance of careful habits of eating. Most of our headaches, "fits of the blues," and depressed feelings come from the abuse of food. *People with healthy digestions are rarely sick.*

Unless we take good care of the digestive organs, we cannot expect to have much resistance against disease. People with digestive organs which they either consciously or unconsciously abuse, are far more likely to have typhoid fever or cholera when they are exposed than are those whose organs are normal. The digestive organs naturally secrete juices which are antagonistic to many disease germs. Abuse of these organs weakens their powers of defense. Many colds are taken because of disordered digestion. Decayed teeth are more often caused by indigestion and bad nutrition than by anything else.

It is no disgrace to be sick when we cannot prevent it, but ignorance of how to keep well is rather worse than any other sort of ignorance. One may be justly proud of vigorous health, especially when it is the result of careful study and obedience to nature's laws.

Probably more sickness is caused by the improper use of food than by any other one cause. Most people eat too much food. *Overeating* easily becomes a habit. When the stomach is overloaded, digestion is retarded and some of the food is sure to *ferment*. Gas forms and also certain other products of fermentation. The gas causes bloating, with uncomfortable sensations. Sometimes the stomach pushes up against the heart and causes palpitation; many persons imagine they have heart trouble, when indigestion is really the cause of the symptoms. The fermentation products are absorbed by the blood and circulate in the body. Some of these are *poisons*. By overindulgence in food, which may in itself be harmless, a person may thus poison himself, just as if he had swallowed actual poison.

Fermentation of food

Eating too much starch or sugar food is especially likely to produce fermentation. This is one of the objections to eating more than a very moderate amount of candy. Nearly all fruits are apt to ferment, unless eaten in moderation. An excessive diet of rice or other cereals, potatoes, bread, or pancakes is sure to cause this fermentation. The best kind of diet is a *mixed diet*; that is, one which does not contain too much of any one food principle. (See page 33.)

No one can be really healthy who constantly eats a large amount of rich food. Many of the wealthy who live at fashionable hotels and restaurants suffer sooner or later from foolish habits of eating. Many of them grow too stout, their muscles are likely to be flabby, and the habit of constantly eating a great variety of rich foods often results in dyspepsia, kidney and liver troubles, and many other disorders. Intemperance in eating is as bad as intem-

Intemperance in eating

perance in drinking. In the end it probably causes just as much misery. Overindulgence at the table is a sign of vulgarity, even when practiced by people of fashion. The truly intelligent, cultivated person will be satisfied with plain, nutritious food in moderate quantities.

Eating too rapidly causes many cases of dyspepsia. The importance of thorough mastication must not be forgotten; people who sufficiently chew their food rarely overeat. The American people are particularly subject to this habit of rapid eating. It is far better to miss a meal altogether than to eat it in a hurry. Most cases of dyspepsia are caused by careless or ignorant habits of eating, and could easily be avoided.

Rapid eating habits

Regularity in eating is most necessary. One ought never to eat between meals. The use of candy, soda water, pop-corn, peanuts, and other such things is injurious because they are abused. These things are usually taken after one has already had enough food.

Regularity in eating

The state of the mind has a great deal to do with how our different organs do their work. Pleasant company, good cheer, and attractive food all stimulate the organs of digestion to do their best work. Unpleasant surroundings, unattractive food, or worry may cause an attack of indigestion. People hardly ever suffer from indigestion after a pleasant banquet, even when they overeat. But the most frugal meal with a bad temper or other unpleasant conditions may actually stop the process of digestion.

The mind and digestion

Many persons suffer from chronic dyspepsia simply because they imagine that their food will disagree with them. When the mind is directed into cheerful and healthy channels and common sense is used about eating habits, dyspepsia usually disappears. Dyspeptics generally form the habits of thinking too much about themselves and of resorting to drugs.

A healthy person has a good appetite and enjoys eating. But such a person does not form unnatural food habits. One should not be fussy about food. It is easy to get into the habit of thinking that one cannot eat this or that particular kind of food. With few exceptions, we can eat any wholesome food. The less one thinks about his food, the better. One who is constantly thinking about his food is a *gormand*.

Food fads

Fads in regard to food and peculiar diets ought to be avoided. We hear much of fruit diets, vegetable diets, nut diets, milk diets, and the like. One needs only to remember that experience has proved, and science has demonstrated, that a mixed diet is best for man.

The wise selection of food

Sensible people will learn to eat simple, well-selected foods. But it requires some skill to select foods which are best for us. The poor usually eat too much starchy foods because they are cheap. They often waste money on luxuries which have little or no nutritive value.

Many "breakfast foods" with striking trade names have come into use. Most of these are useful foods, but are expensive. The same amount of nourishment can be obtained from the old-fashioned simple cereals at less cost.

It is possible to procure excellent nutritious food at a small cost, if one will study the question a little.

TABLE OF FOODS

Nutritious Vegetable Foods

	Inexpensive		*Expensive*
CEREALS	Cornmeal Hominy Wheat Products Oatmeal Rice Macaroni	CEREALS	Breakfast foods with various trade names
VEGETABLES	Dried beans Dried peas Potatoes Carrots Peanuts Parsnips Canned corn	VEGETABLES	Fresh peas Fresh beans
FRUITS	Bananas Fresh apples Dried apples Dried apricots Dried peaches Dried prunes	OTHER EXPENSIVE FOODS	Cocoa Chocolate Nuts

Nutritious Animal Foods

Inexpensive	*Expensive*
Skimmed milk	Whole milk
Cheese	Butter (at 40¢ per lb.)
Salt cod fish	Eggs
Salt mackerel	Fresh fish (at 30¢ per lb.)
Canned salmon	High-priced cuts of beef and mutton
Cheaper cuts of beef and mutton	Veal
Pork	Lamb
	Poultry
	Game

Expensive Foods which are Not Nutritious

Lobster
Oysters (14 equal 1 egg)
Early green vegetables
Fruits out of season
Artichokes

Flavors and Relishes

(*Not classified as to cost*)

VEGETABLES	Onions	Peppers	FRUITS	Strawberries
	Radishes	Cucumbers		Peaches
	Celery	Cabbage		Oranges
	Pickles	Cauliflower		Lemons
	Lettuce	Chicory		Plums

Tea and coffee

We should remember that tea and coffee contain no nourishment except the sugar and milk which may be added. On the contrary, they contain injurious substances (caffein and tannic acid), which are in fact drugs. We should hesitate about taking injurious things into our stomachs even in small amounts, especially when a habit may easily be formed. Young people particularly should always avoid tea and coffee. (See page 149.)

Some diseases are caused by foods

Meat, fish, cheese, canned goods, ice-cream, milk, and some other foods may be the cause of serious sickness. This happens when certain bacteria grow in the food and form poisons there. These poisons are called *ptomaines*.

Foods which have been kept in *cold storage* should be used very soon after being bought. They are likely to spoil quickly and thus produce poisoning. *Canned goods* should never be kept standing in the can after opening. Such foods should be emptied into a clean dish at once and kept in a cool place. If a can is puffed out, it shows that the contents were not perfectly sterilized, and that bacteria have grown in the food and produced gases and poisonous substances.

Pork often causes a serious disease because of a parasite called *trichina* which it may contain. This is one of the reasons why pork should always be thoroughly cooked before being eaten.

CHAPTER XVI

MILK AND WATER SUPPLIES

MILK and water supplies are of so great importance that they deserve a special chapter to themselves. We are altogether too likely to drink the milk or water which is offered to us without any thought about its possible dangers. Yet impure milk and impure water are causing thousands of deaths every year.

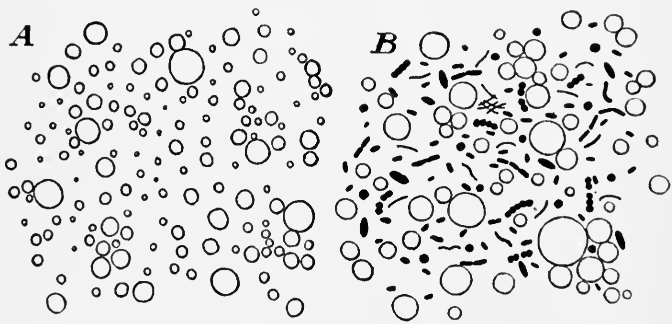
Milk is the most nearly universal of all foods. It is the sole food of infants and the chief food of young children. It is, for many reasons, a very desirable food, when pure. It is relatively inexpensive, requires no preparation, and contains all the food principles needed by the body. It is only when milk is improperly handled that we need hesitate to use it. It is true, however, that *milk may easily become one of the most unclean and dangerous forms of food in use.*

Bacteria in milk

The very high death rate of children in large cities in summer is largely due to the use of impure milk. No other article of food is so likely to become contaminated with disease germs. No other food furnishes such a favorable medium for the growth and multiplication of bacteria. Many samples of city milk contain as many as a *million bacteria* to every quarter of a teaspoonful. It is not uncommon for city milk to contain more bacteria than sewage does. This does not mean that all of such germs are of the disease-producing sort, but it does mean that any such milk is dangerous to health. No milk can contain a very large number of bacteria and be clean.

Clean and dirty milk

Dirty milk always contains bacteria. Clean milk does not contain many bacteria. It follows, then, that the number of germs in milk furnishes an exact index to its cleanliness. Sometimes a sample of milk may contain vast numbers of germs, none of



A, Clean Milk, showing No Bacteria. *B*, Dirty Milk, containing Many Bacteria.

which are of a disease-producing sort; but when many germs are present, it is evident that the milk has not been handled in a cleanly manner. Whenever milk is carelessly handled, it is very likely to contain disease germs.

Milk from a healthy cow is free from germs, but by the time it is delivered to the customer milk usually contains vast numbers of germs. It is not a pleasant thought to consider what carelessly handled milk may contain. Aside from the question whether disease germs are present, who really wants to drink *dirty milk?*

Milk may be filthy; it may be much diluted; it may be adulterated. It may be rich, fairly clean, and unadulterated, but contaminated with disease germs. It may be free from disease germs, but may contain other bacteria which bring about changes that render the milk harmful.

How bacteria get into milk

Germs get into milk from a great variety of sources. Dust always carries them. Water in which dairy utensils are washed may contain them. They are on the hands of the milker, on his clothing, on the body of the cow, and in the milk can. In a word, germs are present almost everywhere.

The black square represents the bacteria in un-Pasteurized milk. After Pasteurization the bacteria are reduced to the amount indicated by the white square. (See page 142.)

By permission of Dr. H. L. Russel.

If a cow is kept in a dirty condition, it is easy to understand how dirt will reach the milk pail. It seems strange that people will take far less care of cows than they do of horses. A horse is curried and kept fairly clean, but often no attention is paid to the condition of a cow. A horse is driven in public places and the owner is ashamed to have him seen in a dirty condition. A cow is kept in the stable or pasture and the owner is not concerned about her appearance because the animal is not observed.

We are clean in those things about which it is customary to be clean. But all of us have to be *educated* into clean habits. We simply have not thought enough about these matters. When we think of them, then we demand a change; but somebody must *make us think*.

Most persons accept the milk which is brought to them without question. They may be fairly particular about their meats, fruits, vegetables, and bakery goods, but they merely accept milk as milk, without much thought.

Typhoid and milk

Great epidemics of typhoid fever have often been caused by the carelessness of a single milkman. Such a case occurred at Stanford University a few years ago, when many students lost their lives and dozens were dangerously sick. In this instance a dairyman had washed his cans and other milk utensils in water which had been infected with typhoid germs. This water came from a well and into this well the sewage from the house had drained. Somebody in the house was sick with typhoid. The ignorance of this dairyman caused many deaths and much suffering and expense. This is not an unusual case; such things have occurred over and over again in all parts of the world.

Tuberculosis and milk

Many cattle suffer from tuberculosis. Figures vary, but it is safe to say that from twenty-five to forty per cent of dairy cattle have this disease. It affects dairy cattle much oftener than it does range cattle, and the finer breeds are especially likely to have it. This is because they are kept in badly ventilated stables and in close confinement, and because their powers of resistance are lowered by unnatural conditions of life.

In a herd of selected cattle, owned by a wealthy gentleman and supposed to be unusually fine, it was recently found that thirteen of the thirty-two cows had tuberculosis. This was not discovered by their appearance, but only by means of the *tuberculin test*. This test is a simple one that any veterinarian can apply. All dairy cattle should be tested in this way. Every city and town ought to require the tuberculin test and make it part of the ordinance regulating the sale of milk.

Tuberculosis among cattle is dangerous not only because it may spread the disease itself to human beings, but because the milk from such animals cannot possibly be healthful to drink. Milk or meat from a diseased animal is always unhealthful.

Milk may be the means of spreading still other contagious diseases. Diphtheria and scarlet fever are sometimes carried in this way.

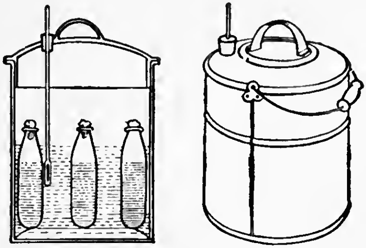
The care of milk bottles

Where there is a contagious disease in a family, no bottles should be collected until the disease is over. Then all the bottles should be thoroughly sterilized by means of boiling water or live steam. Bottles of milk ought never to be left standing in a sick-room. Such bottles have sometimes carried disease from one family to another, because the milkman did not sterilize them before refilling. Even when no disease is present in a family, great care should be observed to clean milk bottles thoroughly as soon as they are emptied.

When one cannot be sure about the purity of milk, it is best to *Pasteurize* it.[1] If one does not understand

Pasteurized milk

how to do this, it can be *boiled.* A thoroughly clean milk should not be either Pasteurized or boiled. Such methods are simply means for guarding against the consequences of carelessness in handling. Raw milk is far more digestible than Pasteurized or boiled milk.



A Home Pasteurizing Apparatus.

Any disagreeable odor or flavor in milk indicates that it is not clean. Clean milk kept on ice will remain sweet for several days. Any sediment in the pan or bottle is also an indication of dirty milk.

There are a few things that everybody ought to know

Some dairy rules

about the proper handling of milk supplies, whether they are in the dairy business or not. The most important of these things are as follows:

The cows must be kept clean.
The barn must be kept clean.
The floors of the stables must be moisture proof.
Gutters behind the stalls should be made of cement and must have proper drainage.
Manure must not be allowed to accumulate.
Wooden barns must be frequently whitewashed inside.
Dust must be avoided during milking time.

[1] Milk may be Pasteurized by placing the bottles containing it in water, and heating this to 160° (Fahrenheit). The water must then be kept at this temperature for about twenty minutes.

A Sanitary Bottling Room.

Here milk is kept pure by absolutely clean handling. Notice the costumes of the men.

Used by courtesy of Brookside Farms.

The milk house must be separate from the barn and used for no other purposes.

It must be clean and properly screened.

The water supplies must be pure.

There must be no chance for sewage contamination.

Every milker should have a clean milking suit which is used for nothing else.

He should keep his hands absolutely clean.

He must be in good health and not associate with any person sick with a contagious disease.

The milk bottles and all utensils must be kept clean. Scalding water or live steam should be used for this purpose.

The milk pail should have a rather small opening in the top, and this should be covered with *clean sterile* cheese cloth or gauze. Through this cloth all milk should strain as it is being milked from the cow.

Flies must be kept away from milk. They often carry disease germs, especially those of typhoid and tuberculosis.

All small animals must be kept away from the dairy premises.

Milk must be quickly cooled to about 50° or less and kept so until used.

All cows must be tested for tuberculosis by a properly qualified person.

There is no reason why we should not *demand pure milk*. We shall never get it until we make the demand.

The pure milk problem Never buy milk unless you know how it is handled. Many towns and small cities have already studied the milk problem and have succeeded in their demands for pure milk.[1] Any town, village, or city can have pure milk supplies just as soon as its residents become educated to the idea. Pure milk depots have been established in many cities, where the poor may always get clean, safe milk at a moderate price. We should not be unwilling to pay a fair price for pure milk. The demand for cheap milk is one cause of adulteration and of carelessness in the handling of milk. Cheap milk is never pure milk.

The dangers from using impure water have been mentioned in several chapters, but we may now sum up all these statements and add a few others.

River water is rarely pure, because towns and cities

[1] The city of Rochester, N.Y., recently made such a study, with wonderful results.

on the banks frequently empty their sewage into the rivers. Most cases of typhoid fever are caused in this way (see page 85).

Different kinds of water supplies

Well water is often impure, because sewage sometimes drains into the well. Wells should be located so that this cannot occur.

Lake water is frequently polluted with sewage. Even as far out as five miles from shore, Lake Michigan water was found polluted with Chicago sewage before the drainage canal was opened.

Spring water and *artesian wells* furnish the purest kinds of water, because the water comes from a depth where bacteria are not present.

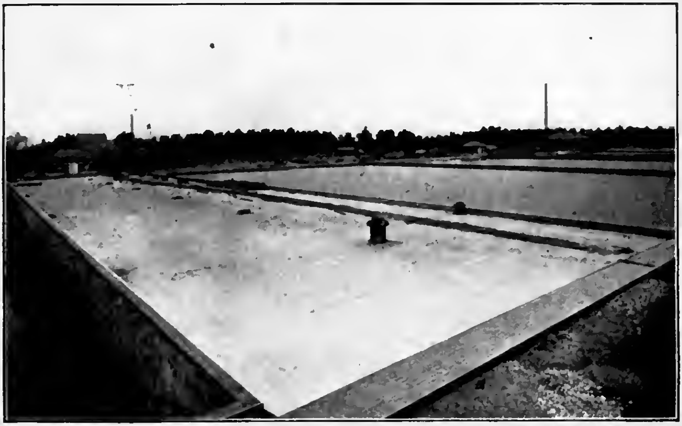
Sometimes mountain or other water is conducted into *reservoirs* for storage. Such reservoir water may be dangerous to health, in case it comes from streams which are polluted from slops dumped on the banks, from sewage draining into them from houses, from campers along the banks who may be sick with typhoid, or in other ways. One of the duties of the state boards of health is to protect streams and lakes from pollution.

Filters

Most of the filters in use are worthless. They take the dirt out of the water and make it look pure and clean, but they do not remove disease or other germs. It is far better not to use any filter than a poor one, for these actually serve to collect typhoid or other bacteria. The best filters for use are the Chamberlain, Pasteur, and Berkefeld. These, with proper care, are safe, and do remove all danger. The water in such filters has to pass through a cylinder of porcelain. But to insure safety even with these kinds of filters, they must be cleaned every day with a brush, and placed in boiling water for about ten minutes once or twice a week.

City filtration of water

Very large filters are sometimes used to filter the entire city water supply. These are sand filters which cover a large area of ground. The water is first allowed to settle; then it is filtered through many layers of sand and gravel, and stored in



Filter Beds of the Indianapolis Waterworks.

Here the water from White River is purified by filtering through layers of sand, gravel, and perforated tile.

great reservoirs. Since Philadelphia introduced such a system, typhoid fever has been nearly wiped out in the parts of the city receiving the filtered water, while in the sections where unfiltered river water is used, there is still much typhoid.

When we cannot be sure that water is pure it ought always to be *boiled* for twenty minutes.

THE CHICAGO DRAINAGE CANAL.

To avoid contamination of water supplies, this long canal was built to carry off the city's sewage. This section of the canal is cut through solid rock.

The disposal of sewage is a very difficult problem in large cities. Some places make use of *sewer farms*. Here the sewage is spread over the ground and serves as a fertilizer. The bacteria are exposed to the sunlight, which in time kills most of them. The sewage is decomposed, and soon changes to harmless gases which pass off in the air, and to chemical substances which mix with the earth and fertilize it.

Disposal of sewage

The only real danger in sewer farms is when garden truck, such as lettuce and radishes, is raised on them. Such foods may easily become polluted, and may carry typhoid germs. On the Pasadena (California) sewer farm they raise walnuts and alfalfa, which is profitable and perfectly safe.

When sewage is drained into rivers or lakes, such water is always dangerous to drink. Aside from this, who really wants to drink *diluted sewage?*

Some cities use what are called *septic tanks* for the collection of sewage. Here it is decomposed and becomes comparatively harmless.

CHAPTER XVII

STIMULANTS AND NARCOTICS

What a stimulus is

THE Latin word *stimulus* means *goad.* The goad was used in driving oxen from remote periods even down to the times of our grandfathers. It consisted of a long stick with a sharp metal brad in the end. The lazy or fatigued ox, when prodded with this stimulus, would quicken his pace, throwing the weight into the yoke, and would thus increase his work in a given time. *Stimulus* has also had for many years another but similar meaning. In this sense it is applied to *any influence which will cause a living thing — organ, tissue, or cell — to increase its work.*

Mechanical stimuli are all similar in action to the ox goad. Heat, light, and electricity are all forms of stimuli. Most of these stimuli act from the outside.

There is still another kind of stimulus that usually acts from the inside, though not necessarily so, — the *chemical stimulus.* These chemical stimuli cause increased activity or work when they come in contact with living tissues. Common salt is an example. A little salt applied to a fresh bit of nerve and muscle tissue from a frog's leg makes it twitch. Salt stimulates the heart, which is only a large, hollow muscle connected with nerves. Many chemical stimuli are always dissolved in the blood and lymph. Some also form part of the different secretions in the body.

There are many chemical stimuli which come from without, but which influence the body in much the same way. As examples, we have *strychnine*, which is used as a medicine and which stimulates action of the heart through the nervous system; and *caffein*, which is always present in coffee, and is also sometimes used as a medicine. Caffein is in constant use as a beverage. When a person drinks a morning cup of coffee, he is quite likely to think only of its delicious aroma, its amber color, and, if he adds sugar and cream to it, he may think of it as a food. But he should not lose sight of the fact that it also contains a drug which is certain to influence his nervous system as a stimulus. Tea also contains a drug, called tannic acid.

The stimulant in coffee

One cup of moderately strong coffee, well diluted with cream and sugar, will have only a slight drug action. But several cups of strong black coffee will have a decided influence upon the nervous system. If a person comes to depend upon his two or three cups of strong coffee at breakfast to keep him going until noon, and another cup or two at lunch to keep him stimulated during the afternoon, he is just as surely the victim of a *drug habit* as is the man who takes morphine or cocaine for the same purpose.

The coffee habit

Chocolate and cocoa, on the other hand, contain some nourishment and practically no drug. Whether a person ought ever to drink either coffee or tea is a question he must settle for himself. Although a moderately strong cup of coffee or tea does not contain much of the drug, one must remember that there is always the possibility of forming a coffee or tea habit.[1]

In an emergency strong coffee may be a valuable and necessary stimulant. It will not, however, generally act as a stimulus to the person who habitually drinks it.

When the ox is fatigued with several hours of work, and his driver begins to prod him with the goad, it is easy to see that the ox receives *no food* from this goad. His slackened pace probably means that he needs rest, but instead of rest he gets the stimulus. The ox will make renewed efforts and work beyond his strength. But the fatigue which follows will be much greater, and he will require more time for recovery than would have been required if he had been given rest. With rest and food the body stores up energy.

A stimulus gives no added strength.

It is just the same with all artificial stimuli of which many people make use. A man may *drive himself* to increased work by the use of coffee or tea or some other drug, but he will always be left more exhausted and will require more time to rest than if he had not overstimulated himself.

Enough has been said to explain what a stimulus (or stimulant) is, how it may be used and how abused. We see that it adds no strength to the body. It does sometimes enable the body to do an increased amount of work for a short time. From this overexertion there is always a reaction, and increased time must be allowed for rest. Stimuli such as coffee, tea, and strychnine are useful to the body only in *emergencies*. Coffee and tea

[1] The French avoid strong coffee in their common use of *café au lait* — a little coffee in a cup filled with hot milk.

are pleasant drinks, but are neither necessary nor even useful under ordinary conditions.

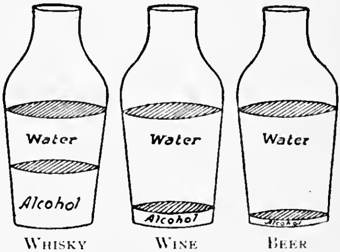
What a narcotic is

Narcotics are drugs which cause a dulling of the senses. They lessen the action and strength of the cells of the body. Examples of narcotics are *alcohol*, *opium*, *morphine*, *cocaine*, *chloroform*, and *ether*.

Alcohol is usually thought of as a stimulant, but the best physiologists now agree that it is not a stimulant even in small amounts.

Alcohol is not a stimulant

It is a true narcotic. It produces a dulling effect upon the cells and tissues of the body. Alcohol at first causes excitement and *seems* to act as a stimulus. Why, then, is it really a narcotic? We shall try to answer this question.



THE PROPORTION OF ALCOHOL IN WHISKY, WINE, AND BEER.

The effect of alcohol on the nervous system

The different actions of the body are under the control of the nervous system, in much the same way that a spirited team of horses is under the control of the driver. The driver may urge his horses forward with the whip and yet control them by keeping them in check with the reins. Or he may slacken his reins, and again the team rushes forward. Either method increases the work of the team; but in one case he keeps perfect control of the horses, and in the other he practically loses control. A careless bystander watching the team might easily see no difference in the increased spirit of the horses in the two cases. A more careful observer would realize that in the second case the driver had slackened his reins and released his control. Alcohol has the effect of slackening the reins of control which each person ought to hold upon himself.

At first, when a person drinks whisky or other strong alcoholic beverage, he *seems to be stimulated.* He thinks so himself, and it appears so to others. What he has really done is to loosen the reins; and finally the team runs away. As more and more of the drink is taken, the excitability passes off and the drinker becomes dull and stupid. At last, *control of the will is entirely lost*, and we say the person is drunk. A few more drinks are taken and the man loses control of his muscles; his gait has become unsteady; he staggers, falls, and drops off into a drunken stupor.

Such a man is as surely under the influence of a narcotic as if he had taken chloroform or ether. He may freeze to death or be run over by a train without knowing anything of his danger.

Alcohol and carbon dioxide in the body

We have learned in our study of physiology that carbon dioxide is always given off from the lungs in breathing in the same way that it is given off from a lighted lamp or candle. It is a waste product of combustion or burning, and is poisonous to man. A badly ventilated room containing many people soon becomes foul with this poisonous gas. When a person has taken large doses of alcohol or opium or other narcotics, he does not get rid of a sufficient amount of carbon dioxide from his body. He is poisoned, just as he would be in a close room filled with people.

The drinker's face always becomes flushed. This is only an indication of what is taking place all over his body. The minute blood vessels in the skin become dilated; much blood comes to the surface, and the individual has a pleasant sensation of warmth. But this is very misleading. His skin surface feels warm, but he is actually losing heat (see page 32). A man in this condition takes in less oxygen and gives out less carbon dioxide. So you see he is actually *making less heat than usual and losing more.* His temperature is less than that of a normal person. A drunken man easily freezes for this reason.

Alcohol makes the body lose heat

No one was ever made warmer by an alcoholic drink on a cold day.

Nansen, the great Arctic explorer, would not allow the use of alcoholic drinks among his men for just these reasons, and they endured exposure remarkably well. Dr. Grenfell has had the same experience in his work among the fishermen in Labrador. Experienced mountain climbers in high altitudes cannot be induced to take even a small dose of alcoholic drinks.

Any activity that requires strong muscles is hampered by the use of alcohol. Everybody knows that athletic coaches and trainers never permit their men to use any drinks containing alcohol. A football player in training is never allowed to take even a glass of beer. Many a man has been put off a team for violation of this rule. In a long-distance swimming race in Chicago, a man who was drowned was accustomed to moderate drinking, and drank just before entering the water. Experiments in laboratories prove absolutely that alcohol even in small amounts

Action of alcohol upon the muscles

causes a loss of muscular strength and leads to fatigue and to decreased quickness of action.

There are very good reasons to believe that alcohol decreases the body's powers to resist disease. If this is true, the practice of giving alcohol in such diseases as typhoid fever and tuberculosis would seem to be a great mistake. It is a well-known fact that people accustomed to heavy drinking nearly always die when stricken with pneumonia. Even moderate drinkers have less chance of recovery than those who never use alcohol. Surgeons know that people who do not use whisky or other alcoholic drinks usually rally better from operations than drinkers do.

The relation of alcohol to disease

Even men who believe in the moderate use of alcohol advise against it until the brain work of the day is over. The amount and quality of work which a man can do in six hours, for example, is never increased by the use of alcoholic drinks. Some recent experiments prove that the actual important substance of the nerve cells of the brain is exhausted by the use of alcohol.

The influence of alcohol on the brain

"Alcohol is probably the greatest of all breeders of crime, disease, degeneracy, and poverty. It not only robs the nation of an enormous amount of wealth, but in return it contributes nothing to its strength."

Alcohol and crime

If the abuse of alcohol merely resulted in a diseased stomach, a diseased liver, and some other diseased organs, it would not be a very terrible enemy of mankind. Dyspepsia does all this and more. But when one considers the unhappiness, cruelty, poverty, crime, and — last and worse than all else — the effect upon the innocent children of drinking parents, little more need be said about the drink evil.

When we stop to think of the misery which is caused in the world by the use of alcoholic drinks, it is clear that no one of us ought ever to put himself in the way of forming a habit which will add to that misery.

Tobacco

The use of tobacco in its various forms is, of course, an unnecessary habit. It does no good to any one, and often does much harm. It is really a *drug habit*.

Cigarette smoking

The use of cigarettes is increasing rapidly every year. They are harmful in many ways. They generally contain one, and only one, really injurious substance—*tobacco*. They are injurious principally because they furnish an easy smoke for a *beginner*, and because they are usually used to great excess. They are harmful also because cigarette smokers nearly always inhale the smoke and thus absorb much poison. One of the worst features about cigarette smoking is that their use often leads boys into bad company. Other bad habits are likely to go with cigarette smoking. The whole point is this: *if we wish to make our life and work as effective as possible, then we ought to avoid those things which are sure to lessen this efficiency.*

Some people smoke with little injury to themselves, but most people would be far better off without tobacco. *No boy should ever use tobacco in any form.* He is sure to be injured by its use. Employers very generally look with much suspicion upon a boy who uses tobacco. Frequently this habit indicates that the boy has a weak character. It is hard enough to meet life successfully, without assuming any habits which make it still harder.

CHAPTER XVIII

THE USE AND ABUSE OF DRUGS

We have already studied some of the causes of disease, and have considered the natural defenses of the body. We must now consider the uses of drugs and also some of their abuses. Thousands of medicines have gradually come into use, and many of them are either utterly useless or actually harmful to health.

Medicine and superstition

Early races of people believed many things about the cause and cure of disease which seem absurd to us to-day. Even many existing races practice superstitious rites in much the same way that the ancients did. The Indian medicine man, when he goes through his weird practices, his chants, and various strange antics, is only imitating the customs of more civilized races of ancient times. In some isolated parts of Japan, tigers' bones are ground up for medicine, with the idea that they will make a person strong. In some regions in China the people bore holes in the sick to let the Demon of Sickness out.

Even here in our own civilized America some people fancy that gum camphor carried in the pockets will ward off contagious diseases; that an aluminum ring on the finger will cure rheumatism; that "electric belts," in which there is no electricity, will give strength to the nerves. They think that a gold ring rubbed on a sty will cure it; that a piece of brown paper over the stomach will prevent seasickness; that medicines so diluted that a chemist could detect nothing in them cure disease; that medicines so strong that the digestion is seriously affected can be of service.

Some of our well-educated people believe in almost any remedy for sickness that is recommended by any one, or in an advertised drug about which they know nothing. All of this simply proves that we are not free, even to-day, from the ignorance and superstition of the past.

Every year we spend about *seventy-five millions of dollars* in the United States for patent medicines. These drugs are made to sell. They are usually handled by persons who have no knowledge of the science of medicine. Great fortunes have been made out of patent medicines which are quite worthless.[1] Investigation has shown that some of these remedies are composed largely of alcohol and are little better than taking a drink of strong whisky.

Patent medicines are to be distrusted

Most of the *testimonials* which appear in advertisements of patent medicines are "made up." Some of them are from people who imagine the medicine has cured them. Many of these testimonials are bought. No reputable doctor ever advertises. No reputable remedy is ever advertised in this way.

[1] Patent medicines must not be confused with proprietary medicines, which are drugs put up by wholesale dealers who state the ingredients upon the label. We do not know what patent medicines contain, but we do know the ingredients of proprietary drugs. Extravagant claims for the value of proprietary drugs are seldom made, as is always the case with patent medicines.

When a drug is advertised as a cure for tuberculosis (as many are), it is a fraud. There is no drug cure for tuberculosis. The cure comes mainly from a healthy out-of-door life, with rest and good food. Many poor people pay one dollar a bottle for tuberculosis cures which are composed mainly of alcohol and some narcotic like opium.

Aside from the use of worthless or harmful advertised drugs and patent medicines, many persons take too much medicine of the regular sort. The dosing habit is easily formed. It is a great mistake to suppose that every simple ailment needs to be dosed. Fresh air, sunlight, good food, exercise, and happy thoughts are often more useful than any medicine.

The dosing habit

People ought never to dose themselves or their friends with medicine or drugs. They should consult a reliable doctor when medicine is needed. Medicine, to be useful, must be given by some one trained to apply it to particular conditions.

Many of our disorders are largely or entirely imaginary. They come from too much dwelling upon ourselves. Some people can *think* themselves into all sorts of sickness. If all of the imaginary troubles of the human race could be abolished, hundreds of our doctors would find themselves out of practice.

The influence of the mind upon health

It is never right to neglect a real physical trouble, but the practice of right living and right thinking would relieve most of us of the majority of our ailments. People overeat, drink tea and coffee to excess, use tobacco and alcohol, take insuf-

Right living cures many ailments

ficient sleep, sleep in poorly ventilated bedrooms, fail to exercise in the open air, and indulge in many bad habits, and then either take a patent medicine or run to their doctor to be cured. It is a great mistake to get into the habit of running to a doctor for every slight ailment.

When the doctor is needed

If any one has diphtheria, he needs immediate treatment from the best doctor he can find. If he has tuberculosis, or if he is "all run down," he needs the best obtainable medical advice at once. And we might mention many other troubles which can be successfully treated by the skillful, honest physician.

But what we want to remember is this: *Nature furnishes us with sufficient protection against most diseases. It is only when we live unnatural and unhealthy lives that we become susceptible to most disorders.*

Tobacco and whisky

The evil of using tobacco or whisky is not because it is tobacco or whisky, but because these things usually weaken the body's power to resist disease, and injure the moral nature at the same time.

Other excesses

Tobacco or alcohol are not the only things which have this weakening effect. Many men and women have wrecked their health by the excessive use of tea or coffee, and never realized that they were doing anything wrong. Such people break down nervously or become dyspeptics, and then begin their dosing and doctoring habits. An excessive eater may be just as great a sinner against himself as an excessive drinker.

It is the duty of us all to keep our bodies and minds strong and vigorous. In one sense disease is a sin or a vice. It is an excusable wrong only when it has come through lack of knowledge or by accident.

When people learn the real causes of disease and also learn what right methods of living are, they will cease patronizing the makers of patent medicines and dosing themselves for every little ailment. They will also learn to respect the medical man who teaches right ways of living and moderate use of medicines as much as they do the one who largely prescribes drugs.

CHAPTER XIX

ATHLETICS. EXERCISE, AND OUTDOOR LIFE

Nearly all boys and many girls are much interested in athletic games. Baseball, football, basket-ball, and the field meets are sports that most pupils are enthusiastic over.

Nothing can be better for a boy or girl who wants to be healthy and to succeed in the world, than plenty of outdoor exercise. *Sensible athletics* are most useful in aiding a boy or girl to develop a strong, healthy body, but when athletics are abused, more harm than good will result. Exercise is like food; it is for use, but not for abuse.

The need of physical examination

It is a great mistake to enter athletic games without special preparation and direction. No young person ought ever to enter a field meet or other very active sport, until he has first had a careful physical examination from the school doctor or some other reliable person. Some boys have weak hearts which would be injured by violent exercise, but which would be much improved by mild, well-directed exercise of other kinds. Many boys fail to play a good game of baseball or football because, unknown to themselves, they have imperfect eyesight or poor hearing. Girls ought not to play basket-ball until they have been carefully examined to make sure that their organs can endure severe physical exertion.

One of the greatest harms from athletics comes from failure to enter into proper training. Pupils often enter running races with no preparation for them. Developing boys are not physically toughened, and often do serious injury to themselves in this way. Such races should always be short and never of the kind to place a heavy strain on the heart. It is a serious mistake for boys in the grammar school, or the average boy in the high school, to attempt to play the heavy game of football which college men play. They are seldom physically strong enough for this.

The need of training

The best way to learn how to exercise properly is to attend a well-directed gymnasium. Most towns and cities now have excellent Y.M.C.A. gymnasia, where such instruction can be received.

The following rules should be followed in athletic sports:

1. Never enter violent athletic contests without first knowing that you are physically sound.

2. Never go into such contests suddenly, but always train up to them very gradually.

3. Never enter contests which require long, hard runs. These surely do much harm to developing boys.

4. Young pupils ought never to enter violent contests of any sort.

5. Always secure some competent person to direct your athletics.

The danger of over-exercising

Many pupils develop an enlarged heart (the athletic heart) from too severe muscular exercise. Such hearts are never strong, and may cause serious trouble later in life. Those people who carry athletics too far are rarely healthy in later life. Many athletes strain their hearts and overdevelop their lungs. For this reason many of them die of heart and lung disease (consumption). The only

WELL-TRAINED BODIES AND WHOLESOME MINDS GO TOGETHER.

By permission of the Pasadena Y.M.C.A.

real benefit of any exercise is to make us stronger — not weaker.

For those who cannot take the rougher forms of exercise and sports, there are still many other pleasant kinds. Some can play tennis; others ride horseback; others take tramps in the country or hills; others can use the light clubs and other apparatus in a gymnasium. Walking is one of the best forms of exercise, and when one learns how to observe things about him, it is never tedious. An

The variety of choice in exercise

observant walker in the country learns many things which books cannot teach him.

Learn to like out-of-door life, even if you do not naturally enjoy it. It is the natural life for a natural person. Camp life, walking trips, rowing, swimming,

OUTDOOR LIFE IS THE NATURAL LIFE.

horseback riding — any such outdoor activities improve our health, broaden our minds, and fit us better for the serious duties of life.

Exercise that is taken just from duty is never very useful. To be of much value it must be *enjoyed*. Play is as important as work, and exercise should usually be in the form of play. Try to find the thing you like to do, and then cultivate it until you acquire skill.

Exercise and athletic games properly taken and well directed do a great deal of good. They keep us out-of-doors in the pure air and sunlight; we are forced to faster breathing so that we get a constant fresh supply of oxygen; the appetite is improved; the muscles grow firm and hard; an excess of fat in the body is prevented. And perhaps best of all, boys and girls learn how to be fair and

The real value of exercise

Swimming and Sailing develop Alertness of Mind as well as Strong Bodies.

square with each other, how to accept defeat gracefully, and to forget themselves in happy activity.

Much of the benefit from out-of-door sport results from the exact training of the hand, eye, ear, and other parts of the body which comes with it. Almost any good sport makes a person more alert and more graceful. It is a mistake to suppose that the right sort of exercise trains only the muscles.

A well-trained muscle must be guided by a well-trained mind. Anything which trains the muscles also trains the mind. A stupid person is almost always an awkward person also. Many rather stupid pupils have been made bright and active by muscular training. The boy or girl coming back to the classroom after a well-directed period of sport returns with a mind just as much improved as it would have been with a lesson in algebra or history. A boy or girl who learns to play a fine game of baseball, or tennis, or basket-ball, has improved his or her mind a great deal. The bookworm who does not care for exercise is outstripped in the end by the less studious boy or girl who builds up a strong, vigorous body.

Exercise helps in training the mind

Exercises ought to be thought of as something more than fun. They are as useful in educating us to meet life as anything else. Sometime our public schools will include directed sports as part of the school studies.

CHAPTER XX

PUBLIC HEALTH

A PERSON may guard his own health fairly well if he has the proper knowledge and is not exposed to the carelessness of others. But however carefully he may apply the principles of health to his own habits of life, he may not be able to resist the results of his neighbor's carelessness or ignorance. For this reason much attention is now given to the protection of the health of the public.

The necessity for public health protection

A family may be careful to drink only pure water and clean milk at home, but often its members cannot be certain that the water or the milk in a hotel or restaurant in a neighboring town or city is wholesome. When we purchase meat, we must either depend upon the producer's honesty as a guarantee of its healthful condition, or else some public official must place his guarantee upon it.

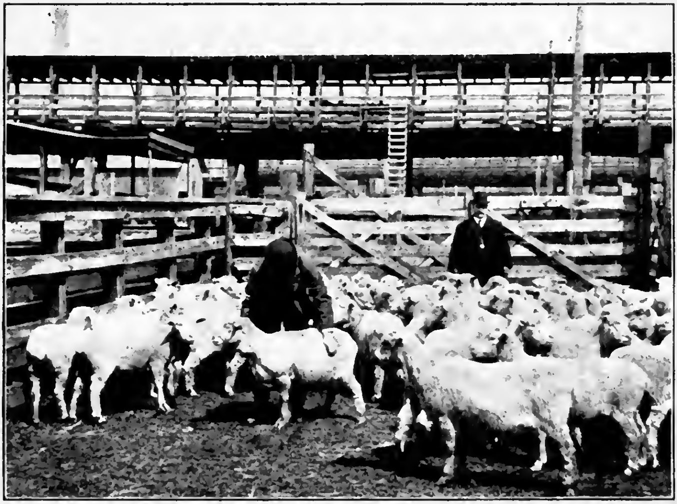
It is only within recent years that either the United States government, or state and city governments, have paid much attention to meat or any other food inspection. The Pure Food Law was passed by Congress as recently as 1907. Before this, although there was some government inspection of meat, little was done to compel producers to furnish pure and wholesome foods of other kinds. Even now we must depend largely upon local laws to guarantee

Regulation by law

wholesome food. Some places have good food regulations; others have no regulations, or very poor ones.

Duties of boards of health

Does the reader know whether his bread comes from a clean or dirty bakery; does he know whether the dairy which furnishes his milk supply is run in a wholesome, sanitary way, or in an unsanitary manner; does he know that the water he drinks so frequently is pure and free from sewage?



Inspection of Sheep before Killing.

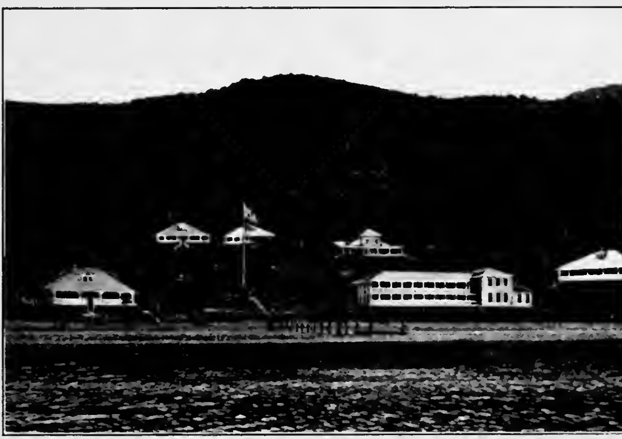
Does he know that his vegetables and fruits have not been exposed to contamination in front of stores or in dusty, open markets, or that they have not been raised on an unwholesome truck farm, perhaps fertilized with public or private sewage, as is often the case on Chinese farms? Does he know that his oysters have not been grown in beds contaminated with sewage from a near-by city, as has often happened? These are some of the questions which every person ought to ask himself. But as he cannot always answer them satisfactorily and can seldom control his food supplies, most states, cities, and towns appoint *boards of health*, whose duty is to attend to such matters.

It is more important to employ officers to guard us against disease than it is to employ policemen to guard us against crime. This is true because disease is harder to locate, harder to avoid, and more difficult to conquer than crime. Disease kills far more people than crime does. Disease costs us far more money than crime does. Our country has only made a start in the protection of the public against avoidable disease. The government at Washington spends much more money every year for the discovery and prevention of animal and plant diseases than it does for the investigation and prevention of human diseases. Sometime we shall have a national Department of Health at Washington which will save us from "*preventable death, preventable sickness, preventable conditions of inefficiency, and preventable ignorance.*"

Quarantine protection

Boards of health not only protect us from impure water and food supplies and provide for the disposal of garbage, but they also try to protect us from contagious diseases. Such diseases as measles, diphtheria, scarlet fever, smallpox, and plague are very contagious, and most places isolate, or quarantine, people who are sick with any of these diseases. A house which is in quarantine has tacked upon it a large colored card showing the name of the disease, so as to warn people to keep away. Sometimes it is necessary to quarantine an entire family, even when only one member of it is sick. If quarantine were strictly practiced, we could soon wipe out most contagious diseases.

Contagious diseases are spread in schools more than in any other way. This is the reason why school children who have any contagious disease ought always to

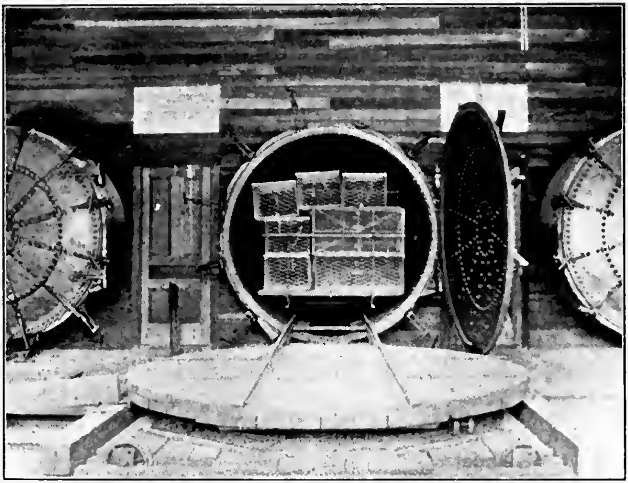


THE QUARANTINE STATION IN SAN FRANCISCO BAY.

be kept away from all other children until they are well. Some diseases are contagious for a number of weeks, and it is the duty of health officers to decide when the patient may safely mingle again with others.

Many seaport cities have quarantine stations. If a ship comes to San Francisco, for example, with smallpox or plague on board, it is necessary to place the vessel in quarantine, and hold her until there is no danger of new cases breaking out. Sometimes the entire crew and all the passengers are taken to the quarantine station and held there until all danger is passed. In such cases the quarantine officers disinfect the ship and the baggage of the crew and passengers.

Quarantine stations are under the control of the Public Health and Marine Hospital Service, an organization of the national government.



THE DISINFECTION OF CLOTHING AT A QUARANTINE STATION.

Steam or formaldehyde gas is turned into the great steel tubes where the wire cases of clothing are put.

The value of antitoxin

For at least one of our common contagious diseases, a quick and almost certain cure has been discovered. This disease is diphtheria. The cure is found in *antitoxin*. When this is given early in the disease, it practically always stops it. Antitoxin treatment also protects those who have been exposed to diphtheria from taking the disease. It is not dangerous to health and should always be given promptly.

At one time smallpox was a very disastrous disease. Now, owing to our knowledge of the nature of this disease and the general practice of *vaccination*, it is rapidly disappearing. Vaccination is an almost perfect protection against smallpox, which would soon become a common disease if vaccination were abandoned. Vaccination is never dangerous when properly done. The stories about the bad effects of vaccination are either invented for the purpose of attacking the practice or are due to some misunderstanding of the real conditions.

Vaccination is a valuable protection

Here is a *vaccination creed:*

1. True vaccination — repeated until it no longer "takes" — always prevents smallpox. Nothing else does.

2. True vaccination — that is, vaccination properly done on a clean arm with pure, potent lymph, and kept perfectly clean and unbroken afterwards until the scab falls off naturally — never did and never will make a serious sore.

3. Such a vaccination leaves a characteristic scar, unlike that from any other cause, which is recognizable during life, and is the only conclusive evidence of a successful vaccination.

4. Serious results never follow such vaccination. On the other hand, thousands of lives are usually sacrificed through the neglect to vaccinate — a neglect which results from lack of knowledge.

The Smallpox Record in Chicago, 1899–1908

Year	Cases of Smallpox	Died	Number never Vaccinated	Number Vaccinated
1899	25	1	24	1
1900	52	2	48	4
1901	276	4	237	39
1902	339	5	318	21
1903	389	47	339	50
1904	358	28	311	47
1905	546	61	402	144
1906	23	0	21	2
1907	94	0	82	12
1908 (Oct. 1) .	80	0	72	8
Total . . .	2182	148	1854	328

None died who were vaccinated. None of the 328 who were vaccinated had ever been revaccinated.

Organizations which protect the public health

The health of the public is protected by public health boards and health officers. States are under the control of a state board of health, and the secretary of the board acts as the health officer of the state. Counties provide a county health officer. Cities usually maintain a local board of health and a health officer, or a commissioner of health. In some large cities, as New York, Boston, Philadelphia, and Chicago, there are many bureaus in the health department. The most important of these are:

The Bureau of Vital Statistics.

The Bureau of Medical Inspection.

The Bureau of Disinfection.

The Bureau of Food, Milk, and Water Supplies.

The Bureau of Sanitation.

1. *The Bureau of Vital Statistics* keeps a record of all births and deaths, and grants burial permits. A study of the number and the causes of deaths in a community furnishes an exact index of the health conditions in that community. The number of deaths in every thousand of population is called the *death rate.*

The death rate in London in the seventeenth century was about 80 per thousand. To-day it is only 24. In 1665 the death rate in London was 430 per thousand. This was due to the plague which raged there almost unchecked.

The death rate in Boston during the last one hundred and fifty years has been reduced from 37 to 25 per thousand. In 1908 this rate was only 19.10 per thousand.

In 1893 water filtration was introduced into Lawrence, Mass. This reduced the death rate from typhoid to one sixth the previous number.

In 1908 the death rate in Chicago from typhoid fever was only 1.56 for each 10,000 inhabitants. This was a reduction of 33 per cent over the average of the ten years preceding 1908, and 91 per cent below the high mark of 1891, when Chicago's record was the highest of any city in the civilized world. This wonderful reduction in the number of deaths from typhoid in Chicago is largely due to sanitary improvements and the education which the work of the Public Health Department has accomplished.

In 1854 the death rate in Chicago was 64 per one thousand of population. In 1908 it was only 14.10.

In Stockholm, in the middle of the eighteenth century, the average duration of life was sixteen years, while to-day it is about forty-eight years.

The lessons to be drawn from such *vital statistics* are many, but the chief one is this: much of the suffering, poverty, and death of the world is caused by preventable ignorance.

2. *The Bureau of Medical Inspection* attends to all cases of contagious diseases, and in some places inspects schools.

3. *The Bureau of Disinfection* has charge of the disinfection of all places which have been under quarantine for contagious diseases.

4. *The Bureau of Milk, Food, and Water Inspection* takes charge of everything that has to do with the furnishing of healthful milk, food, and water to the citizens of the community.

A Tenement-house Inspector.

5. *The Bureau of Sanitation* inspects houses, premises, public buildings, and tenements. It looks after everything in general that might prove a menace to public health.

Nothing can add more to the health, happiness, and efficiency of a town, city, or country than careful attention and education in matters of public health. Health is the greatest asset any person or any country can possess. We owe far more to our public health officers than we do even to our bankers, lawyers, and family doctors. Mr. Roosevelt has said, "Our national health is physically our greatest asset. To prevent any possible deterioration of the American stock should be a national ambition."

Here are a few sentences from men who are to-day trying to save the nation from unnecessary sickness and death. They are worth memorizing.

"Knowledge has value in proportion as it benefits the human race." — PROFESSOR CHITTENDEN.

"The death rate might be cut in two were we to *apply* the existing knowledge of hygiene to present living conditions." — DR. WELCH.

"Sickness is going out of fashion. Well organized, civilized society will not stand for it." — DR. CRANDON.

CHAPTER XXI

MAKING THE MOST OF LIFE

Very few people ever learn the lesson of living so as to get the most out of life. By getting the most out of life we mean keeping well, being happy, and learning how to be as useful as possible. In this book we have tried to show that health, happiness, and usefulness are all dependent upon one another.

Without useful knowledge of our physical machinery we can never hope to obtain the best success in life. If we are ignorant of the human machine, how it does its work, and how it should be adjusted to its surroundings, we fail to make the most of life.

The efficient life depends on knowledge

We do not study physiology and hygiene in order to remember some facts about bones and muscles, or about digestive juices and reflex actions. We study these subjects in order to learn how to live healthful, happy, useful lives. Already such knowledge has added twenty years to the length of the average human life.

In the army and the navy soldiers and sailors are trained to meet conditions which we call warfare, but in civil life almost no training is given to prepare boys and girls, or men and women, for a more certain and a more dangerous and disastrous battle — the struggle for existence.

We are never truly educated until we learn how to meet successfully the surroundings of life, or what is called our *environment.* The person who becomes ill with typhoid fever, malaria, tuberculosis, or even indigestion, is either ignorant or the victim of his neighbor's ignorance. He has not learned how to meet his environment.

A man's or a woman's efficiency in this world is largely dependent upon his or her degree of health

Efficiency depends on health

Good health is the best investment that any one can possibly make. It will bring in more money than any other one thing in the world. Employers do not want boys with poor eyesight or poor hearing, or girls with round shoulders or crooked backs. Bright minds cannot make up for weak bodies, and minds will not long remain bright in such bodies.

The earning power of any pupil who leaves school early in the grades is reduced at least fifty per cent. It is a fact — and not a theory — that the chief cause of leaving school is not poverty, but defective health.

We must also remember that a healthy mind nearly always goes with a healthy body. It is seldom that a physically sound person is a very bad person. On the other hand, it has been found that about eighty-five per cent of the children who come before the juvenile courts have physically defective bodies.

Good health will bring more happiness than any other

Happiness depends on health

one thing in the world. Healthy people are nearly always happy; unhealthy people are rarely so. The world wants happy people.

The practice of health principles ought to be a part of every one's religion. One can never harm his own mind or body alone. Every man must be his brother's keeper whether he desires to be so or not. Not one of us can live to himself alone.

Knowledge of healthful living is already saving the world millions of dollars and years of suffering. Since 1907 we have learned that nearly two millions of people in the South, called the "poor white trash," are suffering from a preventable and easily curable disease. These people are shiftless, lazy, ignorant, and worthless. They have been in this condition for at least one hundred years, although they come from good English stock. Is it not a sad sight to see all these human beings enduring the contempt of their healthier and happier neighbors, suffering from sickness, and incapable of succeeding at anything, when a little knowledge could prevent all this?

Healthful living prevents disease

They are the victims of an unequal struggle against an unseen foe. That foe is a parasite called the hookworm, which makes its way into their bodies and saps their vitality.

But thanks to the knowledge given to us by one of our government experts at Washington, Dr. Stiles, it now seems possible to raise these unfortunates from misery and inefficiency to happiness and usefulness. All that is required is that they shall learn and practice a few simple health principles.

Dr. Grenfell tells us that one out of every three deaths in Labrador is caused by tuberculosis, and in the United States we have learned that one person dies of this disease about every four minutes. It is ignorance which results in the loss of so many people in Labrador, for they live all winter long in crowded, ill-ventilated houses.

Missionaries of health are needed there, and they are needed also here at home.

Two million people in the South might be taught how to save themselves. Two hundred thousand people who are now sick with tuberculosis in the United States might be taught the same simple lesson. Such knowledge must also be learned by every growing boy and girl, if the men and women of to-morrow are to lead useful, efficient lives.

Louis Agassiz once said that *a natural law is as sacred as a moral principle. The laws of health are natural laws*, and they are therefore sacred.

Warfare against disease

Great wars between nations are now almost things of the past. President Jordan of Stanford University has shown that such wars really destroy the country's choicest men, for only strong men can go to war. The wars of the future will be those directed not against men, but against disease. It will be a warfare waged for the good of all and to the injury of none.

A great teacher has said: "For each of us it is possible to increase the duration of his best moments, and to render them more frequent. It is also possible for us to reduce the number and length of those periods of depression and low vitality when our work miscarries and our lives lack snap and enthusiasm.

"If we succeed in bringing about such a change, we shall have raised the whole plane of our living to something higher and more admirable. There are conditions for each individual under which he does the most and best work. It is his business to ascertain those conditions and to comply with them."

TOPICS FOR DISCUSSION AND REVIEW

PART I. GENERAL PHYSIOLOGY

Chapter I (Pages 5–11)

These questions are given as suggestive reviews. The pupil must not be expected to answer all of them without the aid of the teacher.

1. Describe the framework of the body.
2. Describe the main divisions of the body.
3. How is the spinal cord protected?
4. What are bones for?
5. What is a muscle?
6. What is the relation between bones and muscles?
7. What is a lever?
8. Mention some muscles which do not act on bones.
9. What are nerves?
10. What is meant by the nervous system?

Chapter II (Pages 12–14)

1. Compare the cells of the body to the bricks of a house.
2. Why may the stomach be called merely a *receptacle* for food?
3. When is the body fed?
4. Why may the lungs be called *reservoirs* for air?
5. Where do food and air finally go in the body?
6. How are food and air carried in the body?
7. Compare the cells of the body to an army.
8. Compare the cells of the body to a community of people.
9. In what ways are cells dependent upon one another?

Chapter III (Pages 15–23)

1. What is an organ? Name several.
2. Why do organs differ?
3. What is meant by *function?*
4. Mention the principal function of the following organs: brain, nerves, kidneys, lungs, liver, stomach, intestines.
5. What are organs of excretion?
6. What are secreting organs?
7. What is a gland?
8. What is a duct?
9. What is the digestive tract?
10. What work does the heart do?
11. What happens if any organ gets out of order?
12. What is meant by a *system?*
13. What is meant by a *tissue?*
14. What is meant by a *cell?*

Chapter IV (Pages 24–29)

1. Compare the circulatory system with a waterworks system.
2. Why do the smallest blood vessels have thin walls?
3. What is the work of the heart and blood vessels?
4. What is lymph?
5. Why may the blood be called the *common carrier* of the body?
6. Where does the blood dispose of waste substances?
7. Name all the substances you know which the blood carries.
8. How does food reach the cells of the body?
9. Explain why food in the stomach does not feed the body.
10. What are arteries?
11. What are veins?

12. What are capillaries?

13. What is plasma?

14. What solid bodies are there in the blood?

Chapter V (Pages 30–43)

1. What is food?

2. Compare food with fuel.

3. Why is the body warm?

4. What is combustion?

5. What is the temperature of the healthy body?

6. What kinds of animals have the highest temperature? Explain.

7. What animals have low temperatures?

8. Do you think the temperature of an animal which sleeps all winter is high or low? Explain.

9. Why is it that the temperature of the body does not rise during exercise?

10. How is the temperature of the body regulated?

11. Why does it keep the same temperature on a hot and a cold day?

12. For what do we need food?

13. Name the food *principles*.

14. Name several starch foods.

15. Name several sugar foods.

16. What is a nitrogen food? Give examples.

17. What foods are needed for heat and work?

18. What foods are needed for growth and repair?

19. What is proteid?

20. What is peptone?

21. What food principles are found in milk?

22. Why cannot an adult live on a diet of milk alone?

23. What is cheese?

24. Name an albumen food.
25. Name the principal fat foods.
26. What are the organic foods?
27. What are the inorganic foods?
28. How much water does a person need daily?
29. What are food flavors? Name some.
30. Are coffee and tea foods?
31. Is alcohol a food?

32. What is the purpose of digestion?
33. In what ways must starch, proteids, and fats be changed by digestion?
34. What is saliva? What is its function?
35. What is an emulsion? Give an illustration.
36. What is bile? What work does it do?
37. Describe the work of the pancreatic juice.
38. What organ secretes pepsin and hydrochloric acid?
39. What food is changed by pepsin and hydrochloric acid, and what is the change? Why is this change necessary?

Chapter VI (Pages 44–52)

1. How may the nervous system be compared with a foreman or superintendent?
2. What is meant by coördination?
3. What are the controlling parts of the nervous system?
4. What is the cerebrum?
5. What is the cerebellum?
6. What is the medulla?
7. In what part of the brain does consciousness arise?
8. What work does the cerebellum do?
9. What do you mean by centers in the brain? Illustrate.
10. What is the spinal cord?
11. How is it protected?
12. How is it connected with the brain?

13. What is a reflex action? Illustrate.

14. Is there ever consciousness with a reflex action?

15. What is the sympathetic nervous system?

16. What work does it do?

17. What parts of the nervous system control breathing, swallowing, the beat of the heart, and regulation of the blood supply?

18. What happens if the spinal cord is badly injured?

19. What happens if the medulla is badly injured?

20. What is paralysis?

21. What is apoplexy?

22. What do you mean by automatic actions?

23. What are nerves?

24. Compare the nerves of the body to the wires of a telegraph or telephone system.

25. Compare the will power to the telegraph operator.

26. Compare the nerve cells of the brain to batteries in a telegraph office.

27. How are the different parts of the spinal cord and the brain brought into communication with each other?

28. What is the difference between a nerve cell and a nerve?

29. What is education as applied to the brain?

30. What parts of the brain keep on developing until at least sixty years of age?

31. Explain habit.

32. What do you mean by the physical basis for habits?

33. Why is it hard to break a habit?

34. What do you mean by false messages received and sent by the brain? What things produce these false messages?

35. In what way does one become a victim to his habits?

36. In what way does the use of alcohol, tobacco, coffee, drugs, form a fixed habit?

37. What sorts of things make the nervous machinery wear out?

Chapter VII (Pages 53–55)

1. Compare the human body with a machine.
2. What is energy?
3. Name several forms of energy.
4. Compare food and fuel.
5. Why is a steam engine wasteful?
6. Why is the body less wasteful than a steam engine?
7. What is a machine?
8. What do you mean by changing the form of energy?
9. What do you mean by combustion?
10. Compare the waste products of the human body with the waste products of a machine.
11. How can you get the most work out of a machine?
12. How can you get the most work out of the human body?
13. Why is it necessary to understand the working of the human body?
14. Compare this sort of knowledge with the knowledge of an engineer.

PART II. HYGIENE

Chapter VIII (Pages 59–66)

1. What is meant by *resistance?* When is one *susceptible* to a disease?
2. What is meant by a *natural defense* in the body? Name several.
3. Mention an important work of the white blood corpuscles.
4. Explain the struggle that occurs at times between the white cells and bacteria.
5. How are bacteria sometimes reduced in strength after they gain a foothold in the body?
6. If bacteria produce poisons in the body, how may nature aid the body to overcome the poison?

7. Mention one use of lymph glands.

8. Explain how the temperature of the body is regulated. What is the temperature of the body?

9. What uses has *pain?*

10. Explain the difference between the cause of a trouble and its *symptom* or *symptoms*.

11. Why must one discover the *cause* before treating a trouble?

12. Can you mention any other defenses of the body not named in the chapter?

Chapter IX (Pages 67–71)

1. What does health depend upon?

2. What is meant by division of labor among the cells of the body?

3. Compare the workmen in a factory with cell workers of the body.

4. Why does the human body get out of order rather easily?

5. Compare the body to a complicated piece of machinery.

6. What kind of cells in the body can never be replaced if once destroyed?

7. What kinds of cells are easily replaced?

8. What does the seriousness of sickness depend upon?

Chapter X (Pages 72–80)

1. What are some of the things that make a person susceptible to disease?

2. Name some of the most healthful occupations.

3. Name some of the most unhealthful occupations.

4. Give your explanation of the reasons in both cases.

5. What kinds of work have a tendency to lead to tuberculosis?

6. Why are the Jews a healthy race of people?

7. What are some of the effects of child labor?

8. What are some of the evil effects of intemperance upon the children of intemperate parents?

9. Which do you think are worse, the *physical* or the *moral* effects of intemperance?

10. What common things may a person use to excess besides alcohol?

11. What is the relation between intemperance and resistance to disease?

12. Does a child of drinking parents necessarily inherit a taste for alcohol?

13. What qualities is he pretty sure to inherit?

14. What are some of the *direct* causes of disease?

15. What is meant by the terms *bacteria* and *parasites?*

16. What conditions are favorable to their growth?

17. What can you say about their multiplication?

18. How long have we known about bacteria?

19. What benefit has this knowledge been to mankind?

20. What are some of the uses of bacteria?

21. What is the relation between bacteria and decay?

22. Name some methods used to prevent fermentation and decay.

23. Explain how the food for animals and plants originally comes from the earth, air, and water, and how all animals and plants are at last reduced to this source.

Chapter XI (Pages 81–91)

1. What is a contagious disease?

2. Are bacteria animals or plants?

3. Name the common contagious diseases.

4. What did people formerly think was the cause of contagious disease?

5. What were their conditions of life?

6. What is the relation between sanitary surroundings and health?

7. What superstitions about disease still exist among people to-day?

8. Why should one not take patent or other advertised medicines?

9. What is the objection to "street doctors" and those who practice with mysterious methods?

10. What ought the public to demand of a doctor?

11. Is there anything *mysterious* about disease?

12. In what countries is bubonic plague the worst? Why?

13. What is the relation between rats and the plague?

14. How does our government prevent the plague from gaining a foothold in this country?

15. Explain the relation between swamps and other wet places and malaria. How can a malarial district be made healthful?

16. How did our government stamp out yellow fever in Cuba?

17. Why did not the Cubans succeed in doing so years before?

18. What work of our government is making the digging of the Panama Canal possible?

19. Why did not the French succeed in this work?

20. What two dangerous diseases still rage in this country, and why?

21. Why is tuberculosis a dangerous disease?

22. How could tuberculosis be controlled better than it is at present?

23. Why is the public so careless about tuberculosis?

24. How do you think the public could be aroused on this subject?

25. Tell what you know about the way typhoid fever and tuberculosis are spread.

26. What is meant by *quarantining a house?*

27. What is meant by *isolating* a sick person?

28. How may a room be disinfected?

29. What are the best disinfectants?

30. How can the public be educated best about health and disease?

31. How do you think an epidemic of diphtheria, scarlet fever, or measles in a school could best be controlled?

32. Mention some of the work of a board of health.

33. How could contagious diseases be wiped out of existence?

34. What conditions favor the growth of bacteria?

35. What conditions are necessary in the home for protection against disease germs?

36. What is the relation between bad ventilation and disease?

37. Why is pneumonia so common in large cities?

38. Compare the air of mountains and the sea with that of cities.

39. What may be the danger from expectorations in the street?

40. What diseases may be carried in water, milk, meat?

41. What is a *filth disease?*

42. Explain how insects may carry disease.

43. How may animals carry disease?

CHAPTER XII (Pages 92–97)

1. What is a cold?

2. What is meant by "taking cold"?

3. What is meant by an *infection?*

4. In what sort of places do we most often take colds? Why?

5. Why do not people take cold in the polar regions, on mountains, and far out at sea?

6. What has chilling to do with colds?

7. Why is a direct draft dangerous? Is it always dangerous?

8. What things predispose a person to colds?

9. How may indigestion cause a cold?
10. Is there any relation between colds and tuberculosis?
11. What is meant by *catarrh?*
12. How may colds be avoided?
13. How should a cold be treated when it first comes on?

CHAPTER XIII (Pages 98–114)

1. What is meant by personal hygiene?
2. What is eye strain?
3. What are some of the causes?
4. What are some of the indications of eye troubles?
5. Tell what you know about the care of the eyes.
6. What sort of light is best for close eye work?
7. Why ought not young pupils to do much close eye work?
8. What objection is there to going to an optician, instead of to an oculist?
9. What is the difference between the two?
10. What are adenoids?
11. What harm may they do to the health?
12. What is the usual cause of crooked teeth?
13. When are tonsils dangerous to health?
14. What relation is there between nose and throat troubles and ear trouble?
15. What are the common causes of deafness?
16. What is catarrh?
17. What are some of the causes of catarrh?
18. How may indigestion be avoided?
19. What are some of the causes of headache?
20. Why should advertised headache remedies be avoided?
21. How often should a young person see a dentist?
22. Do the first teeth need dental care?
23. Why are decayed teeth injurious to health?
24. What should one do about crooked teeth?

25. Discuss sleep: why it is important; how much is needed; the best time for sleep.

26. Explain the uses of cool bathing.

27. Discuss bathing in general.

28. Name the dangers of sea bathing.

29. Why is the Japanese army healthier than any other?

Chapter XIV (Pages 115–129)

1. What is the best kind of location for a home?

2. What are the objections to dark, damp rooms?

3. What is the value of sunlight and fresh air in a home?

4. What is the value of an open fireplace?

5. How may a room heated by a stove be best ventilated?

6. Explain a good method of ventilation, when a home is heated by a hot-air furnace.

7. What is the objection to oil and gas stoves?

8. What kinds of heating systems make the air too dry?

9. What is the effect of dry air?

10. What conditions are likely to cause too much humidity in a room?

11. What effect does the burning of lamps have on the air in a room?

12. Discuss the ventilation of bedrooms.

13. Is there any danger in night air?

14. Describe an out-door sleeping room.

15. Tell one reason why tuberculosis is a common disease in the country.

16. What are some of the consequences of poor ventilation?

17. Why is dust dangerous?

18. Describe the best methods for dusting a room.

19. What are the best floor coverings?

20. What are the objections to heavy upholstery and hangings in a room?

21. What are the dangers from bad plumbing in a house?

22. What are cesspools?

23. How may they cause trouble?

24. Describe a modern hygienic kitchen.

25. Discuss sanitary stores, bakeries, meat shops, milk supplies.

26. How should a sick-room be cared for?

27. Tell something about the care of a sick person in the home.

Chapter XV (Pages 130–136)

1. Compare food and the body to fuel and an engine.

2. What are the uses of food to the body?

3. What kinds of food are needed by people in cold countries?

4. Why does not a grown person require as much food as a boy?

5. What foods are used principally for growth and repair?

6. What foods are used principally for heat and work?

7. Give examples of foods containing starch.

8. Name several kinds of sugar and explain where they come from.

9. Name several kinds of fats and oils.

10. What is a nitrogen food? Give examples.

11. What do you mean by a mixed diet?

12. What is the objection to a diet of starchy foods?

13. What is an unnatural food habit?

14. What is the object of the process of digestion?

15. What is the relation between health and digestion?

16. What has indigestion to do with weakening the defenses of the body?

17. What foods are apt to ferment in the stomach or intestines?

18. How may a person poison himself with healthful food?

19. What is the commonest cause of decayed teeth?

20. What has the mind to do with digestion?

21. When is candy harmful?

22. What can you say of tea and coffee as food?

23. Make a series of rules for correct habits in eating.

24. Explain several methods by which foods may be preserved.

25. Why do foods spoil?

26. How may foods be kept from spoiling?

27. Why do foods from cold storage and canned goods need special care?

Chapter XVI (Pages 137–147)

1. Why is milk so frequently contaminated with bacteria?

2. Why is city milk usually worse than that from a private dairy?

3. Are all the germs in milk of the disease-producing kind?

4. What kind of milk contains the greatest number of germs?

5. What kind contains the least number?

6. How can you tell when milk has been carelessly handled?

7. How do germs get into milk?

8. What is the relation between the water supplies at the dairy and the milk?

9. What very common disease affects cattle?

10. How may this disease be detected?

11. How may a clean, wholesome milk supply be obtained?

12. If you could not discover the reliability of the milk supply at once, what would you do to make the milk safe to drink?

13. Does Pasteurizing milk injure it? What is the effect?

14. Mention some of the rules for a clean dairy.

15. Why should a town or city undertake to obtain a pure milk supply?

16. What is the condition of the milk supplies in your town or city?

17. Visit a large dairy, if possible, and report what you observe.

18. Visit a private dairy, if you can, and see if it is a clean one. If it is not, tell how it could be made so.

19. Why is river water seldom pure?

20. How may a well be contaminated?

21. Why is spring water usually pure?

22. Explain why filters are usually worthless.

23. What sort of filter is useful?

24. How should a filter be cared for?

25. Does removal of dirt from drinking water by means of a filter always mean that the water is pure? Explain.

26. Explain some of the methods for disposing of sewage.

27. Explain some of the dangers from leaking sewer pipes.

28. When may cesspools be a source of danger?

Chapter XVII (Pages 148–155)

1. What is a stimulus?

2. What is a narcotic?

3. Why is alcohol not a stimulus?

4. Why is it a narcotic?

5. What effect has alcohol upon the muscles?

6. What effect has it upon the brain?

7. What effect has it upon the morals?

8. Do you think the moral or physical effects of alcohol are worse?

9. What effect has alcohol upon the temperature of the body?

10. Explain this effect upon temperature.

11. Why does a person at first feel stimulated by alcoholic drinks?

12. What change occurs in the nerve cells of the brain from the use of alcohol?

13. What do you think is the strongest argument against the use of alcohol?

14. Is "alcoholism" a habit or a disease?

15. What is the relation between the resistance of the body to disease and the use of alcohol?

16. What is the effect of the habitual use of alcohol upon the children of parents who so use it?

17. What is the relation between disease, poverty, crime, and the use of alcohol?

18. Does alcohol increase the power for work?

19. If you were going out for a long drive on a very cold day, would a drink of whisky warm you?

20. Why do mountain climbers and Arctic explorers avoid alcoholic drinks?

21. Why do those in training for athletic contests avoid alcohol?

22. Why is the use of tobacco injurious?

23. What are the dangers from the use of cigarettes?

24. Is the use of coffee and tea injurious?

25. If you think so, explain why.

26. Under what conditions may the use of good food be as injurious as coffee, tea, or tobacco?

27. How may a person poison himself with ordinary food?

Chapter XVIII (Pages 156–160)

1. How much is spent every year in the United States for patent medicines?

2. Why should every one avoid patent medicines?

3. What can you say about tuberculosis "cures"?

4. What can you say about cures in general that are advertised in the papers and magazines?

5. Explain the evil of the dosing practice with regular drugs.

6. How can one avoid most disorders?

7. When should a person consult a physician?

8. What sort of physician ought one to go to?

9. Mention some of the superstitions about disease to-day.

10. Do you know of any not mentioned in the book?

11. What has the mind to do with the health of the body?

12. What do you mean by right ways of living?

13. Mention some of the habits which break down the health.

14. What habits may be just as vicious as the excessive use of alcohol or tobacco?

Chapter XIX (Pages 161–166)

1. Why is a physical examination necessary for any one who enters athletic work?

2. Why is gradual training necessary in athletics?

3. How may violent exercise harm a boy or girl?

4. What is the danger from sudden strains?

5. From what diseases do many athletes die? Why is this?

6. What is the real use of exercise?

7. Name the advantages of out-of-door exercises.

8. What are some of the milder forms of exercise?

9. In what way do exercises aid in the training of the eye, ear, and hand?

10. Do exercises improve the mind? If so, how?

11. Can exercise be compared in value with an ordinary school study? If so, how must it be directed?

12. Explain why out-of-door life is the natural life for a natural person.

13. What is the relation between a bright, clear mind and a healthy body, and what has exercise to do with this?

14. Tell what you know about public playgrounds.

Chapter XX (Pages 167–176)

1. What are some of the government organizations that protect public health?

2. Explain why such protection is needed.

3. Tell what you know about the Pure Food Law.

4. What are some of the duties of the board of health regarding food and water supplies?

5. How do health officers protect us from contagious diseases?

6. Tell what you know of the quarantining of ships coming from foreign ports.

7. What is antitoxin?

8. What is vaccination?

9. Explain the importance of vaccination.

10. Tell as much as you can of the work done by the various bureaus in the health department of a big city.

11. Discuss some of the ways in which general good health promotes the success and happiness of a nation.

APPENDIX

WHY A WORLD WARFARE IS BEING WAGED AGAINST TUBERCULOSIS

Important Facts concerning Tuberculosis[1]

Tuberculosis, or consumption, is a disease which robs the mothers of the world of one out of every ten children. The causes of this disease are known, likewise the means whereby it may be prevented.

The cost of tuberculosis

In the United States more than 150,000 persons die every year from tuberculosis, and 200,000 are constantly sick with this disease. The great majority of these persons are in the prime of life. Many of them are married, and by their untimely deaths leave dependent families to be cared for by the state. The loss in money to the United States from these preventable deaths every year amounts to more than $300,000,000. The suffering caused by the disease it is impossible to estimate.

Two important facts

1. Tuberculosis is preventable.
2. Tuberculosis is curable.

These are most important facts worthy of widest circulation, especially as contrary ideas prevail. Universal prevention and cure of this disease will result only when there is universal effort against it.

The direct cause of tuberculosis is a germ. There can be no tuberculosis unless this germ is present in the body. A second-

[1] Adapted from "Gold Medal Leaflet," International Tuberculosis Congress, 1908.

ary cause is that the body of the person who takes this disease is favorable to the growth of the germ. Any person whose health and strength are run down is predisposed to tuberculosis, because in such a person there is not much resistance. The two things necessary, then, for tuberculosis, are the presence of a certain germ and a lack of resistance to it.

The causes of tuberculosis

When the germ gets into the body of a person who is run down in health, it finds conditions suitable for its growth, and it produces the disease called tuberculosis. Poisons thrown out by the germs get into the blood, and these poisons cause most of the symptoms of the disease.

The germ

The symptoms of tuberculosis vary according to the stage which the disease has reached. The symptoms or the early stages particularly should be learned, for it is then that cure can be brought about and lives can be saved.

The symptoms of tuberculosis

This disease usually comes on in very slow and mild fashion. That is what throws the persons infected off their guard. There may be nothing more than a tired feeling, especially after work, a lessened appetite, some loss of weight, and perhaps an occasional cough.

As the disease grows worse, these symptoms likewise increase. The loss of weight may be very noticeable ; there may be fever and night sweats. With the more frequent cough much sputum may be expectorated.

In the advanced stages some of these symptoms, like cough, loss of weight, and fever, may be very pronounced. Then we have the picture of the "consumptive."

Tuberculosis is prevented by doing two things:

How tuberculosis may be prevented

1. Killing the germs that cause the disease.
2. Having people become healthy, so that they will not be predisposed to the disease.

The germs are scattered far and wide in the sputum coughed up by consumptives. One consumptive can cough up in a single day several billion of these germs. When this sputum dries as dust, the germs are blown about; they get into the air we breathe and on the food we eat and things we handle. In this way every person at

How the germs are destroyed

OUTDOOR LIFE CURES TUBERCULOSIS.

This patient is regaining health by living on a leaky porch.[1]

some time in life probably gets the germs into his body, but if he is in good health they do him no harm.

To destroy these germs, all that is necessary is to destroy the sputum. If it is coughed into paper cups or napkins, these can be burned and the germs destroyed. For spittoons, disinfectant solutions like lye should be used. Spitting on the streets, and especially on floors, is dangerous.

[1] This picture and those on page 96 are used by courtesy of the Emmanuel Church Tuberculosis Class.

Bodily weakness, that is, the predisposition to tuberculosis, may be overcome by right living, particularly by breathing pure air, eating nourishing food, and getting the proper proportion of rest and exercise.

How the tendency to tuberculosis may be overcome

A child weak at birth should be guarded, and as he grows older he should spend much time out of doors.

Children weak from diseases like measles or whooping cough should not be neglected. These and kindred diseases are often responsible for tuberculosis being contracted later in life.

Children should not be made to work at too early an age, nor allowed to study so hard as to interfere with health.

Food should be eaten slowly, and should always be nourishing. If cow's milk is used, it should be obtained from a dairy having no tuberculous cattle.

The living and sleeping rooms of the family should always be well ventilated. The human body, if it is to be in a healthy state, must have pure air. Bedrooms should not be overcrowded, and single beds are a necessity.

How tuberculosis may be cured

Tuberculosis may be cured by the same measures which prevent it, namely, by making the body stronger, so that it will be able to kill the germs that have entered the tissues. Pure air, good food, and plenty of rest constitute a treatment which cures more people of tuberculosis than all the medicines that are known. Tent life, or the use of a sleeping porch or tent room, has aided in the cure of thousands.

The patient should avoid patent medicines for tuberculosis, particularly cough medicines, as these usually contain alcohol and opiates, which, though they make the patient feel better, usually allow the disease to grow worse.

These methods of treatment should be carried out under the advice of a private or dispensary physician who has made a study of the disease.

Some Rules for the Study and Prevention of Tuberculosis[1]

Tuberculosis is a communicable disease.

Tuberculosis is a preventable disease.

Tuberculosis is a curable disease.

Tuberculosis is communicated by means of the tubercle bacilli, small plants which are thrown off frequently from the lungs in the expectoration.

The patient is not dangerous to others if this expectorated matter is properly destroyed.

Tuberculous discharges should be received in a receptacle of such nature that the matter can be burned, or otherwise destroyed, and the receptacle boiled.

Expectorations should never be swallowed.

When coughing or sneezing, patients should cover their mouths with the hand or handkerchief.

Several forms of spit cups are on the market: some of pasteboard, which can be burned; others of metal, which can be boiled; others of metal form, holding a papier maché cup, which can be replaced at nominal expense. Whatever form is used, the cup should be covered to prevent flies from coming in contact with the sputum.

Disinfectant solutions may be used in these cups: carbolic acid solution, five parts to one hundred of water; concentrated lye, one tablespoonful to a glass of water; or formalin, five parts to one hundred of water.

Expectorating into cloths which are carried in the pocket or placed about the bedding, is a dangerous practice. It may cause further infection of the patient and the infection of others. If circumstances are such that cloths must be used temporarily, they should be burned, never washed. After the

[1] Southern California Association for the Study and Prevention of Tuberculosis.

sputum has become dry, such cloths are dangerous to persons who handle them.

Expectoration should be destroyed before it dries.

Expectoration should be kept away from flies.

Never expectorate in dark corners.

Tuberculosis patients should always wash their teeth, mouth, and hands before meals and frequently during the day.

Apartments used by consumptives should not contain carpets, unnecessary upholstering, curtains, or tapestry.

Apartments which have been used by tubercular patients should be thoroughly disinfected under the direction of the health authorities or a competent physician.

Cases of tuberculosis should be reported to the proper health authorities, not for the purpose of quarantine, but for general instruction.

Those afflicted with tuberculosis should not play or associate intimately with children.

Remember that tuberculosis is curable, if the case comes early under the guidance of an intelligent physician.

Remember that tuberculosis is rarely, if ever, inherited.

Remember that the hereditary *tendency toward tuberculosis* can always be overcome if one has the proper knowledge.

SUGGESTIONS FOR TEACHERS

In order that the study of health may be made really profitable, it is necessary to interest pupils, and older readers as well, in things outside of book studies.

Pupils may be readily started upon a little original investigation. For example, certain of them may be asked to study the dairy conditions of their town or city and report upon them; others may be given the problem of mosquito extermination; some pupils can be interested to look up the health ordinances of their town, city, or state; many will be glad to investigate the local water supply and the methods for the disposal of sewage and garbage; the question of tenement house improvements will interest city pupils; any pupil can be interested in the subjects of public playgrounds, summer health camps, and outdoor life. The health conditions of its own school and grounds will serve as profitable topics for any class. Encourage pupils to tell what they know from actual experience about contagious diseases and their control. Let some pupils investigate the conditions of the streets, public buildings, back yards, etc., in their own locality. Interest certain members of the class in the sanitary conditions of the local grocery stores, meat shops, bakeries, and candy stores. Assign such topics as drainage, meat inspection, pure food laws, patent medicines, flies, preparation of food, ventilation at home, the care of the teeth, adenoids, diseased tonsils, defective eyesight, and causes of poor nutrition. In a word, try to induce the pupils to apply to life what they learn, from the day of the very first lesson.

Make out a list of questions dealing with daily life to be answered in writing by each member of the class without signing any name, and from the answers lay out a course in *practical hygiene.* The following questions are suggested :

1. Do you have one or more windows open in your bedroom at night?
2. Is your house screened in summer?
3. Do you take cold easily?
4. Do you eat lunch every day?
5. If you do not eat every day at noon, how often do you take lunch?
6. Do you drink coffee?
7. If you do, how often each day?
8. Do you drink tea?
9. If you do, how often each day?
10. What do you usually eat for breakfast?
11. How often do you bathe all over?
12. How many hours do you sleep?
13. What time do you go to bed?
14. What time do you get up?
15. Do you work outside of school hours?
16. If you do, at what kind of work?
17. Do you have headache often?
18. Do your eyes hurt often?
19. Can you read writing on the board easily?
20. Do you use a toothbrush?
21. If you do, how often?
22. Have you any bad teeth?
23. Have you ever been to a dentist?
24. Do you smoke?
25. If you do, how often?

Many special problems of local interest will suggest themselves. Physiology and hygiene taught in this way will soon cease to be a bore and become a pleasant diversion as well as a profitable duty.

TOPICS ON HEALTH SUBJECTS

Alcohol.
Antitoxin.
Bacteria: use; harmful.
Boards of Health.
Canning Industry.
Care of Milk.
Cereal Breakfast Foods.
Certified Milk.
Child Labor.
City Health Ordinances.
Cuba: health conditions.
Dairy Investigation.
Destruction of Mosquitoes.
Disinfection.
Dust.
Field Meets.
Garbage Disposal.
Health Camps.
Health of Various Countries.
Ice.
Japanese Army Sanitation.
Malaria.
Medical Supervision of Schools.
Milk Ordinances.
Model Dairies.
Municipal Playgrounds.
Open Air Sanatoria.
Panama.
Patent Medicines.
Plague.
Preparation of Food.
Preservation of Food.
Pure Food Legislation.
Quarantine.
School Hygiene.
Sewage Disposal.
Summer Camps for Children.
Sweat Shops.
Tenements.
The Teeth.
Tobacco.
Tuberculosis.
Typhoid.
Unhealthful Occupations.
Vaccination.
Water Filtration and Water Supplies.
Yellow Fever.

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