Personal and Public Health

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Exercise, Fresh Air, Sunshine
Are Essential to
Health, Happiness, Success

UNIT I

THE MEANING AND VALUES OF HEALTH

Health is a word broad and far-reaching in its significance. It can be defined in many ways. It can be graded, or classified, into relative conditions of "good" health, "fair" health, or "poor" health, in accordance with accepted opinions or beliefs set up for each of them.

In a general way, good health is thought of as a condition of the body in which each part works in harmony with every other part. The activities of different parts of the body are interrelated. The best performances of each are dependent upon the proper functioning of other parts. A vigorous heart, together with strong, elastic arteries, is a condition quite favorable to good health. On the other hand, a vigorous heart combined with "hardened," or inelastic, weakened arteries, is a condition which would be dangerous to health. The weaker part handicaps or hinders the work of other parts.

A Healthy Body:

We have learned that the human body, like all other living things, is composed of countless numbers of tiny units, called *cells*. The individual cells are so small that a microscope is needed in order to see them. Different types of cells are grouped to make up the tissues and organs of the body. These cells grow and develop in ways that permit them to do the work for which they are intended. Epithelium cells, or those which are found in the skin and lining of the mouth, nose, throat, and other parts of the body, are arranged in layers. Bone cells contain substances that aid in giving strength and rigidity to the skeleton, or framework of the human body. Muscle cells make up the muscles of the body. Nerve cells form the brain, spinal cord, and nerves.

Each cell has a life existence of its own. It makes use of food materials in order to grow and develop. It rids itself of waste products. It reproduces by cell "division," resulting in the formation of other cells like itself. The drawing on page 3 illustrates this important characteristic of living cells.

Cells thrive under conditions of healthy living. Exercise and proper foods encourage their growth and development. Sunshine and fresh air are beneficial to them. Rest is an important aid in the proper elimination of waste materials and the repair of worn-out parts. Thus the activities which lead to the health of these cellular units of the body likewise promote the health of the tissues and organs of the entire body.

Good *physical health* is characterized by a lack of consciousness, or awareness, of the body and its parts.

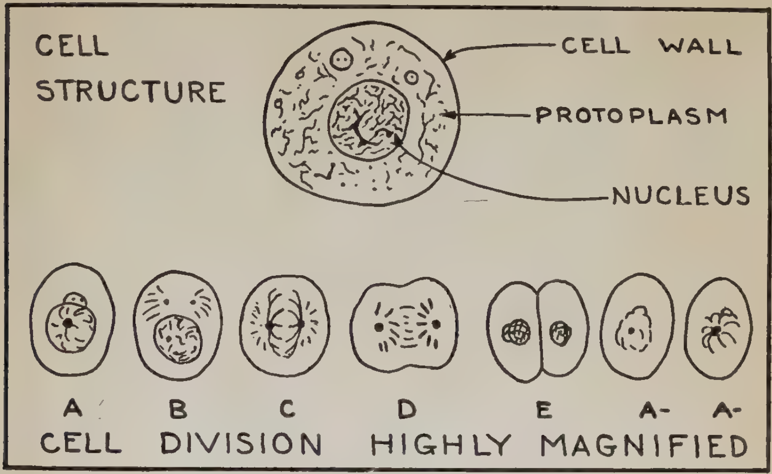


Diagram showing how new cells are formed by division of the parent cell (A) into two new cells (A-A-). Note that each new cell gets a part of the nucleus of the parent cell.

In good health, for example, the individual is not aware of the digestive system. It goes on about its business without his knowledge of it. It is when something goes wrong that he becomes aware of its parts.

Good physical health is likewise characterized by an abundance of vigor and vitality, together with a reserve supply of energy that is ample to meet a sudden emergency. In such a condition of health, the height and weight will be normal, the appetite good, and rest and sleep will leave the individual refreshed and strengthened.

A Healthy Mind:

The way one thinks or feels is important to health. Digestion, for example, is promoted by a happy, friendly atmosphere at mealtime, and handicapped by worry, grief, or anger. Rest is disturbed by excitement.

Good *mental health* is characterized by a cheerful, wholesome outlook upon life. It is a state of mind which enables one to become a good friend and neighbor, and a useful citizen of the community. Looking on the "bright side" of things is a mental habit which has a helpful influence upon the development of one's disposition and character.

Good mental health is an important asset in any trade or profession. Work that is approached in a spirit of confidence and carried on with perseverance and determination, will be accomplished more easily and with greater likelihood of success than if approached in a spirit of doubt as to one's ability to succeed.

Making the Most of Health:

To strive for health merely for the sake of a strong body, or for the mere absence of pain or deformity, is not as high or worthy a goal as that of seeking health as a way to greater services in personal, family, or community life. A healthy body, or a "perfect physique," is a proper and legitimate aim, but it should not be felt that this is the only goal, or even the principal goal of all the efforts that have been directed toward the pursuit of health. The real joys of living are realized when your good fortune in health has enabled you not only to make the most of your personal talents and abilities, but also to help make the world a happier, safer, and more enjoyable place in which to live. There are endless ways of realizing these higher goals.

PRACTICAL APPLICATIONS

For Effective Study:

1. How may the condition of health be defined?
2. What are some of the characteristics of good physical health?
3. What are some of the characteristics of good mental health?
4. How can a person make the most of one's good health?

For Observation or Investigation:

1. Look up dictionary definitions of "health." Frame a more complete definition of health, if desired, than the one given in the text.
2. Certain adjectives are used to describe normal, healthy conditions of the parts and organs of the body. How many of these can you list? (For example, *sound* teeth, etc.) List an adjective for each which describes an abnormal, unhealthy, or harmful condition of these parts or organs.
3. What are some of the personal, family, and community services that help to realize the most from good health?
4. What might be meant by fair health? What are some

of its handicaps? What might be meant by poor health? What are some of its handicaps?

For Health Habit Formation:

1. Welcome the physical examination given by the school medical inspector. Attend promptly to necessary corrections of defects.
2. Have your teeth examined regularly by a dentist.
3. Practice good health habits regularly.

UNIT II

DIRECTION AND CONTROL

THE NERVOUS SYSTEM

Health has been defined as a condition of the body in which all parts work harmoniously together. A "working together", or co-ordination of many different parts is made possible by a system of direction and control. In an industrial plant, for example, the officers, or executives, are responsible for the direction and control of the work. In doing this, they must communicate with their workers, receiving their reports, and issue the necessary instructions. Two essentials of such a system, therefore, are a *central control* and a *means of communication* which reaches out to all the different parts. In the human body, these duties are performed by the *nervous system.*

The Nervous System:

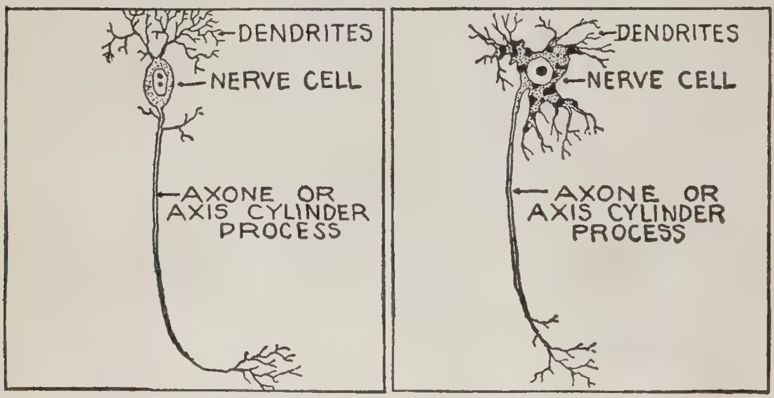
The nervous system is composed of cells. These develop and group themselves in ways that permit the direction and control of all our countless thoughts and actions.

The direction and control of most of our activities are the work of the brain and spinal cord.

These two organs form the principal parts of what is often called the *cerebro-spinal system.*

The direction and control of secretions of certain glands and some involuntary movements of vital organs are given over to the *ganglia* of the *autonomic,* or *sympathetic system.* See diagram on page 16, and the further description of this system on pages 16-17.

The paths of communication between the central, controlling units and other parts of the body are called the *nerves.*



Diagrams of Typical Neurones

The Structure of a Nerve Cell:

The basic unit of the nervous system is a nerve cell, or *neurone.* Examine the drawings of neurones on this page. Note that, in addition to the usual cell body and nucleus, there are hair-like extensions from them. The single, longer, process forms the nerve fiber. This may be very short or extend for several feet before it terminates in a number of tiny, root-like endings. Nerves are made up of bundles of these fibers. Additional processes extend from the cell body in other directions. Connections between nerve cells are made by contacts between these root-like branchings. This enables messages to be sent from one part of the body to another. It also makes it possible for one neurone to be in contact with many others.

The Work of Nerve Cells:

Just as the nervous system is really the total mass of the nerve cells which compose it, the work of the nervous system is the work of these cells. Each cell lives its own life, performs its own work, and joins with other cells in carrying on our life of thinking, feeling, and acting.

In some mysterious way, the nerve cells within the central nervous system receive and interpret the happenings in the world about us. Many, many experiences, like the dates of history, or the appearance of the face of a friend, become so firmly fixed in our minds by the work of these cells that they can be remembered, or recalled, when needed. Habits, acts of skill, and, in fact, all learning, result from developing and training nerve cells to act in the ways desired.

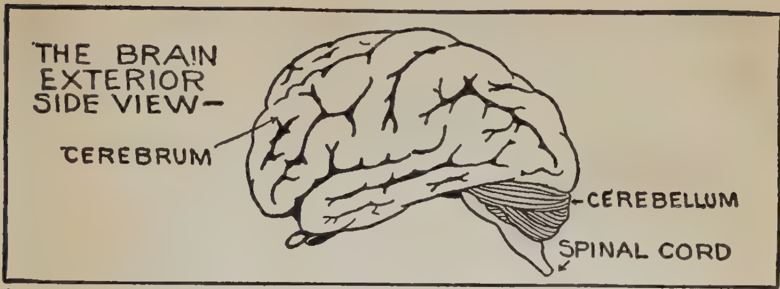
Nerve cells also stimulate muscles into action. In some unknown way, these cells supply the *nerve force* or *impulse* which goes out over the proper nerve fibers to cause the contraction of muscle tissue.

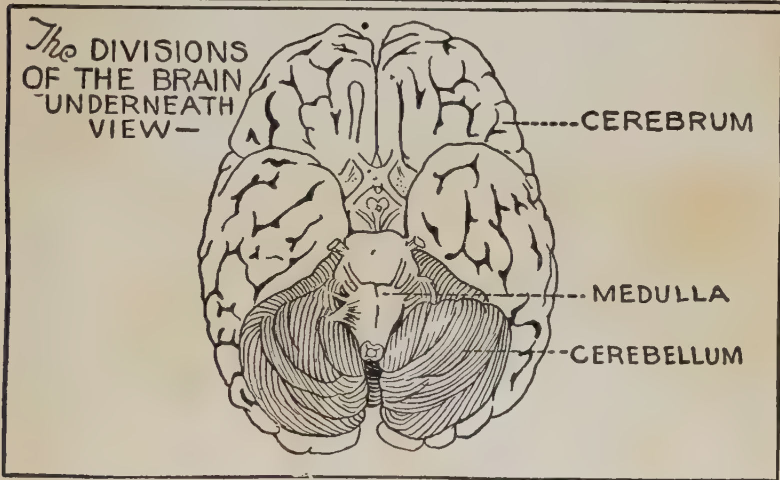
The Brain:

The brain is the principal center for direction, coordination, and control of the activities of the body. It is a soft, spongy mass located within the cavity of the skull, the bones of which surround it and protect it from injury. The brain is divided into two halves or hemispheres, connected by a little bridge of tissue. Its outside surface is broken up into ridges or furrows which extend in many directions. These *convolutions,* as they are called, give the exterior of the brain a very irregular appearance. The brain reaches its full growth in size at about the age of seven, weighing usually from two and a half to three pounds. Almost unlimited development is possible, however, in the number and quality of interconnections and associations among its neurones. This occurs as the product of education, training, and experience.

Parts of the Brain:

The brain is made up of three rather distinct divisions, called the *cerebrum, cerebellum,* and *medulla.* See diagram on opposite page.





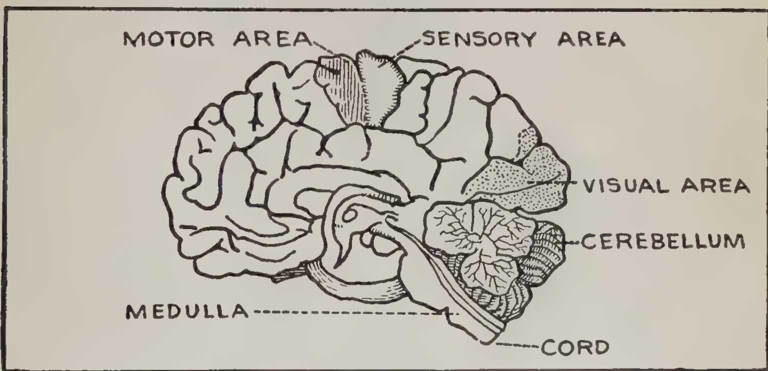
The cerebrum is the largest of these divisions and forms the center for thinking and voluntary control of the body. A cross section of the cerebrum shows that it is largely made up of *white matter* with a relatively thin outer covering of *gray matter.* The white matter of the cerebrum consists chiefly of nerve fibers. The outer surface of the cerebrum is covered with a thin layer of gray matter. The neurones in this gray matter are interlaced and interconnected in endless ways. This arrangement permits experiences and ideas to be combined and makes possible our memory, imagination, thinking, and will power.

The cerebellum is much smaller than the cerebrum, being usually about the size of the clenched fist. It is situated at the back of the brain, underneath the cerebrum. It assists in the coordination of muscular movements. This control is seriously disturbed whenever the cerebellum is damaged.

The medulla is the smallest division of the brain, but a very important one. It is situated below the cerebellum. In the medulla are found the nerve centers which control the action of the heart, lungs and other vital organs of the body. Injury to the medulla often leads to fatal results, but it is well protected from injury by its location at the base of the skull.

Division of Work in the Brain:

The work of the brain is divided up and centered in different areas. Each area does its own particular work. See diagram on page 13. The *front brain* is chiefly occupied with thinking. The small *optic, or visual area,* in the rear of the cerebrum governs sight. Injury to this optic area may destroy the sense of sight just as completely as if the optic nerves were cut. The *motor area* of the brain is subdivided, so that a certain portion controls the muscles of the arms, another portion the fingers, the foot, or the trunk. Additional areas of the brain are responsible for speech, and the senses of hearing, smell, taste, and touch. This division of work in the brain closely resembles the organization of modern industrial plants in which each worker or group of workers does only the particular work assigned.

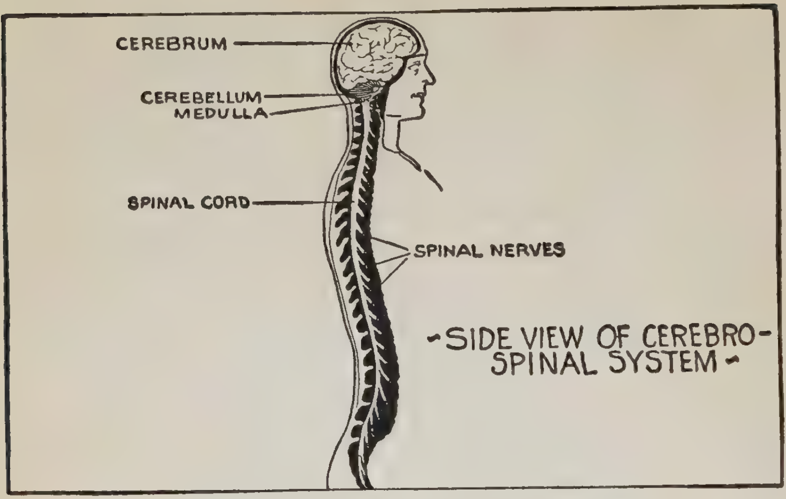


Areas of the Brain

There are many other specialized areas in the brain in addition to those shown in the drawing.

The Spinal Cord:

The spinal cord is the silvery-white collection of nerve cells and fibers that extends from the brain through the canal that is hollowed out for it in the backbone or spinal column. The cord is ordinarily about as thick as one's little finger.



Side-View of Cerebro-Spinal System

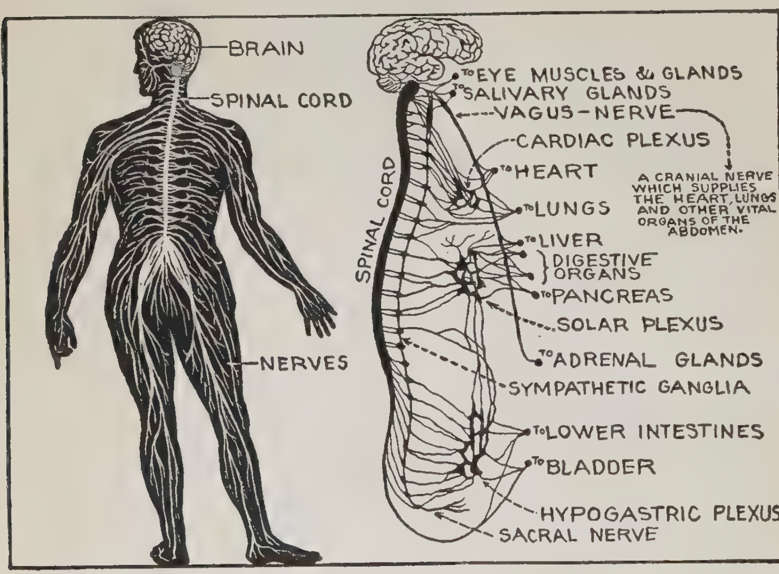
The spinal cord forms a "trunk line" of sensory and motor nerves. Thirty-one pairs of spinal nerves are bound up in the spinal cord during a part of their course between the brain and the parts of the body they supply.

The spinal cord also has the important power to act independently of the brain in the direction and control of *reflex actions.* The withdrawal of the hand from a hot surface is an example of reflex action. When a very hot surface is touched, sensory nerve endings are stimulated and messages are started off at once to warn the central nervous system of the danger. Quick action is necessary to prevent injury to the afflicted parts. Without waiting for the information to reach the brain, the reflex nerve centers in the spinal cord act independently and send the necessary commands back to the muscles. If only a warm surface is touched and a decision is needed regarding the withdrawal of the hand, the reflex centers in the spinal cord do not act in this way. The message travels to the brain where the decision is made and the necessary commands are issued.

The Nerves:

The nerves are glistening white bundles of nerve cells, bound together by a "sheath," or covering of connective tissue. In a telephone or telegraph system, a single wire can transmit messages in both directions. In the nervous system, two separate sets of nerves, the *sensory* and *motor,* are used for this purpose. The sensory nerves carry messages *in* to the central or controlling parts. By their connections with sense organs like the eye, ear, nose, mouth, and skin, they help to keep the central nervous system informed of happenings in the outside world. The motor nerves carry messages from the central nervous system *out* to the muscles, enabling them to act as directed.

Some forty-three pairs of nerves supply the entire body with sensory and motor pathways. These nerves divide and branch again and again until all parts are supplied. Twelve of these forty-three pairs branch directly from the brain, and are called the *cranial nerves.* Some of these are sensory in their nature, a number are motor, and others are



The Cerebro-Spinal Nervous System — *The Autonomic or Sympathetic Nervous System*

a combination of both sensory and motor. The cranial nerves supply the head and some of the organs of the abdomen. The remaining thirty-one pairs branch off from the spinal cord at various places along its course and are called the *spinal nerves.* The spinal nerves chiefly supply the trunk and limbs. Each spinal nerve consists of both sensory and motor neurones.

The Autonomic or Sympathetic System:

A number of involuntary activities within the body are controlled by the *autonomic* or *sympathetic system.* Its *ganglia,* or masses of nerve cells, are arranged like a chain on each side of the spinal cord. Nerve fibers extend from these ganglia to many parts of the body, passing through plexuses, or collections of nerve fibers, that serve to increase the number of inter-communications among them. The autonomic is not an entirely separate and distinct system of control, however, because of its connections with the spinal nerves. The autonomic system controls involuntary activities like the secretion of the saliva and gastric juice (often merely at the sight or smell of food), the contraction of the pupil of the eye, the slowing of the heart beat, and movements of the digestive and excretory organs. Strong emotions like joy, fear, or anger are believed to have an effect upon the ganglia of the autonomic system. This results in changes in the rate of heart beat, blood pressure, and secretions of glands at such times.

PROPER CARE OF THE NERVOUS SYSTEM

The brain is securely protected by the skull. Severe blows upon the head, however, may result in a *fractured skull* or *concussion of the brain.* These injuries are serious and should receive competent medical attention at once. The X-ray is valuable in determining the extent and severity of such conditions. First Aid for the condition of unconsciousness, which often accompanies severe injuries to the head, should be administered and a physician summoned at once. Fainting, which is a momentary loss of consciousness due to a lack of blood in the brain, should also be treated promptly.

The nervous system, in common with all living tissue in the body, is benefited by proper habits of living. Wholesome foods, exercise, fresh air and sunshine, rest and sleep, strengthen the nerve cells and help to keep them active and healthy.

Rest and Sleep Are Especially Beneficial:

The nervous system has especial need for adequate rest and sleep. During rest and sleep the worn out parts of nerve cells are repaired and their nervous energy restored. Sleep is one of the best forms of rest, and a good night's sleep is refreshing both to the body and the mind.

Over-excitement and late hours are very injurious to the nervous system. They overwork the nerves and interfere with their rest and recuperation. The habit of attending motion pictures too often may cause nervousness and eye-strain. Long periods of study should be relieved by play and other forms of muscular exercise. On the other hand, it is restful to read and relax quietly after vigorous muscular work or play.

Sleep Is Especially Beneficial to the Nervous System

Alcohol and Tobacco Injure the Nervous System: Alcohol injures the nerve cells and interferes with their work. The higher powers of the brain are among those which are affected first. Reason and judgment are disturbed. Self-restraint is weakened. Alcohol causes a person to become reckless and do things which would not be done at other times. As soon as the nerve cells which control the muscles are affected, walking grows unsteady and the speech becomes thick and uncontrolled. The final stage is a heavy stupor or unconsciousness which persists until the effects of the poisoning have disappeared.

The poisonous nicotine in tobacco also injures the nerve cells. It is especially harmful to young people, and at any age may result in nervousness and an irregularity in the beating of the heart. The smoker's heart is often called a "tobacco heart" because the nerve cells that control its beating have become affected. It is likely to disturb the regularity of the heart action.

THE ECONOMY OF HABITS

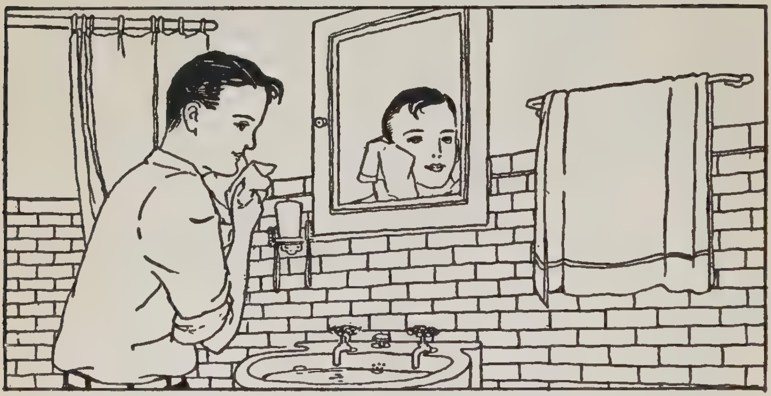
Habits are ways of doing things without thinking about them. Habits do not exist at birth, but must be formed or developed through our own efforts. *Habits of action* like walking, dressing, talking and others, begin as slow, painstaking, thoughtful movements. At first they are usually awkward, clumsy and wasteful in effort. As the habit develops, wasteful movements disappear and there is a marked increase in speed and skill. Little by little the nerve cells become accustomed to their work until finally the actions appear to "do themselves" whenever the proper stimulus is received. *Mental habits,* like those connected with the formation of one's disposition and character, training, and education, develop in the same slow, steady, thoughtful way. Cheerfulness can be made a mental habit by looking at the sunny side of things, even in the face of difficulties. Good study habits result from the persistent use of proper methods of mental work.

The economy of habits consists in their tendency to "do themselves" whenever the proper stimulus is received. As habits develop, less thought and attention need be given to them, and the lower centers of the brain take over their direction and control. This relieves the higher, or thinking centers of this responsibility and leaves them free to attend to matters that need careful thought and attention.

Life is largely habit. From the time we rise in the morning until we retire at night, nine-tenths of the tasks of the day are habitual. Things are repeated in the same way and often at the same time each day. Habits are great time savers and are very economical of our energy and effort.

Health Habits:

Most of the things that are connected with healthful or hygienic living should be reduced to the habit level. This insures economy of effort in their performance and is the best guarantee that they will not be forgotten or omitted. Without conscious effort, the hand automatically seeks the toothbrush after the morning wash if that order of things is kept up until the habit is formed. After the formation of the habit of washing the hands before eating, an interruption in this sequence of events is followed by an uncomfortable or restless feeling that something is wrong. If the habit is strong enough, such a feeling is likely to persist until the habitual chain of actions is properly completed.



Washing before Meals Is a Good Habit to Form

The development of health habits, like all similar responses, follows certain laws of habit formation. The first law calls for a *clear understanding* of the habit that is to be formed. This includes a knowledge of what to do, how to do it, and when to do it. The second is that of *repetition, or practice.* The thing that is to be made habitual should be repeated over and over again in the same way until the nerve cells are accustomed to act in that way each time. The greater the amount of attention that is given to the matter at hand the more quickly the habit is formed. The third law requires that *no exceptions* be allowed in the performance of the actions that are to be made habitual. Do not allow yourself to do the things in different ways. Each exception tends to break up the habit and make its development less sure and certain.

Bad Habits Are Hard to Break: It takes time and effort to break a habit just as it does to form one. We have learned that conscious attention is needed in forming a habit. The same kind of careful thought must be paid to the breaking of a bad habit. Think about the thing that is to be discontinued and keep thinking about it and preventing it until the habit is broken. Sometimes the easiest way to break a bad habit is to substitute a good one for it. Habits of proper posture can readily be formed to take the place of improper ones; the practice of eating slowly and chewing food thoroughly should replace rapid and careless habits of eating.

Mental Habits:

In mental as well as in physical activities, we form habitual ways of doing things. Our mental processes can be developed so that they will react in regular ways to the same situations wherever they may be encountered.

Just as certain habits connected with exercise, nutrition, rest, and sleep have important influences upon our physical or bodily health, so mental habits have important effects upon our mental health. The way one meets a difficult problem at school, on the playground, or in the home is largely dependent upon the mental habits that have been developed in connection with such situations. One person attacks the problem confidently and wholeheartedly, enjoying the conflict and the joys of success. Another person may run to some one for help and is satisfied to shirk the responsibility and shift the burden to another. A third tries halfheartedly, soon gives up, and suffers from needless disappointment and discouragement. Repeated reactions like these soon result in mental habits which influence both mental and physical health.

At times it may be necessary for a parent or teacher to deny someone a thing that is eagerly desired. One person accepts the deprivation good naturedly, and seeks another and possibly better suited outlet for the energy that must be expended. Another may take the deprivation in bad grace, brood or sulk, or even fly into a rage or fit of temper. If the parent relents because of the temper tantrum, the young person soon finds out that this is the means by which denied privileges can be secured. This reaction soon develops into a mental habit and it becomes easier and easier to display the rage or temper. These methods, so often successful at home and among youthful companions, are destined to meet with failure when these persons come in contact with the outside world. Serious mental disturbances often occur because persons have not been trained to meet the trials of disappointment or denial. Mental breakdowns can often be traced to the failure of individuals to solve the problems of life in the way the world and nature insist that they should be solved.

Some Good Mental Habits to Form:

One should be *interested* in the world round about and be curious to understand it. This interest should include persons as well as things. Interest in *persons* leads to the formation of new friendships. It provides companionship for one's own age and opens many opportunities for the fullest development of one's personality. The shy, easily embarrassed youth is under a handicap. Unable to respond in a friendly, normal manner to the invitations of his friends, he soon finds himself neglected and ignored. This condition is likely to result in a brooding, or sulking disposition.

Interest in *things* should be varied. Junior and Senior High Schools afford many advantages for the development of interests. Their regular and special subjects, their shops and clubs, all combine to offer so many different kinds of activities that a wide variety of interests can be suited. Different interests can be tried out in succession until some are found that are more permanent and satisfying than others.

A Useful Hobby

Interest in things leads to the very desirable development of "hobbies." A hobby is something outside of one's regular work. It helps to throw off the cares and worries of work for a while. As a result, one returns to the regular tasks with renewed interest and energy. A suitable hobby is needed by an athlete who is preparing strenuously for a contest. It often helps to keep him from "over-training" or going "stale." A hobby likewise gives needed relief to a pupil who is compelled to study for long periods at a time. It helps the business man or busy housekeeper by affording a beneficial change of occupation. A hobby makes a vacation more helpful. Nothing to do on a vacation often results merely in over-eating and over-sleeping. During a vacation, a hobby helps to keep the body and mind toned up by the pursuit of some especial interest that is different from the regular employment. Hobbies should be pursued by scattering their enjoyment throughout the year, indulging in them a little each day or each week. The annual vacation then becomes merely an expansion of the daily or weekly program.

Hobbies cover a wide range of interests. They include gardening, and the study of plants, insects, birds, animals, or rocks. Included also are games like baseball, tennis, or golf, collecting stamps or coins, literary travels into history and biography, adventures in chemistry or astronomy, and many, many other things as well. No elaborate equipment or expense is needed for many hobbies. Some may be found to suit all pocketbooks.

Concentration of attention is a valuable mental achievement. It consists in being able to apply one's mind to the accomplishment of something and, at the same time, shut out other distracting or disturbing things. The ability to concentrate the attention has both a mental and physical basis. Interest in the thing at hand is one of the most successful means of obtaining the greatest amount of attention In the wide variety of activities of the upper grades, everyone should be able to discover many interests which make a strong appeal, and which form an approach to almost any subject of study.

Concentration of attention is impossible when the body or mind is fatigued. Muscular fatigue is due to the excess of the waste products of metabolism in the muscle cells and in the blood. These fatigue poisons circulate about the body in the blood and when they reach the brain, they disturb mental activity as well. Mental fatigue, like physical fatigue, may be caused by over-study, or study in an unhygienic environment. Fatigue effects often result from disagreeable tasks that one is inclined to give up too easily. Distractions lead to mental fatigue. The ability to concentrate upon a problem in arithmetic or algebra is lessened when thoughts of a much more desirable game of ball compete for the center of attention. The outside distraction causes a scattering of the attention and consequently a lessened ability to work.

When applied to study, concentration of attention is aided by the methods that are used in the work. *Good study habits* include a knowledge of the use of books, indexes, and reference works; the making of outlines; the ability to get quickly at the heart of the matter in question; how to memorize, summarize, and so on. Good light and a quiet environment are likewise helpful in getting the best results.

Happy and Cheery People Are Companionable

Happiness and *cheerfulness* form desirable mental habits. We all have some friends who possess a sunny, cheerful disposition. They always seem to have a cheery smile and kindly greeting for every one. Good nature and cheerfulness have become habitual with them. They are "companionable" and mix easily with other people. Friendships are easily formed and retained. On the other hand, we occasionally meet people for whom everything seems to have gone wrong. They appear unhappy and usually are cross and irritable. We give them the label of "grouch" and avoid them whenever possible. It is hard for them to make friends and still harder to keep them. They usually lead very unhappy lives. Such persons should definitely plan to overcome their unfortunate disposition. It is helpful to begin the day right. Upon rising, stretch and exercise to limber up the muscles, drink a glass of cold water, take a cold bath and a brisk rub-down with a coarse towel, and then sit down to a wholesome nourishing breakfast. This should result in such a good physical and mental tone that the world can be met with a smile rather than a frown.

Self-confidence is a valuable mental habit to develop. Learn to face the problems of life squarely whenever they are encountered. Do not shirk disagreeable tasks, or responsibilities just because they are unpleasant. In the illustration used in an earlier paragraph, the person who attacks a problem confidently and whole-heartedly strengthens the habit of self-confidence. Those who run immediately for help or try to shift the burden to others or give up entirely after a half-hearted attempt, are forming harmful mental habits. It has been found from experience that persons can run away from problems of life for a while, but sooner or later they meet conditions which cannot be pushed aside. Failures at such times may lead to "mental breakdowns" and other nervous disorders. The problems that are met in the early years of life afford good training for the solution of the problems of life in later years.

The challenge of problems should be met with activity and not idle dreaming. "Day dreaming" is worth while only when it results in something constructive and helps in the development of the individual. Sir Walter Raleigh and other explorers dreamed of the far off lands in the new world and then turned their dreams into activities which advanced the progress of the world. It is not the dreams that lead to action that are harmful. It is rather those "idle" day-dreams, which turn the attention and interests of the dreamer away from the real things of life, that should be avoided. Idle day-dreaming is sometimes a form of escape from mental activity. In this condition, the dreamers no longer act, but just sit and think. A tendency to day-dreaming often results from a lack of companionship with persons of one's own age. An antidote to it is the formation of congenial friendships and the development of a variety of interests or hobbies.

Character is built upon a foundation of good mental habits. The habits of *truthfulness, honesty, fair play, thoughtfulness, courage, persistence,* and all the others that make up character are developed by acting the same way upon every occasion. The nerve cells which direct and control these actions grow ac-

Young "Sir" Walter Raleigh Dreams of a New World.

customed to their work by use. Persons who have developed these mental habits do not have to stop every time to think whether an action is right or wrong. They act correctly from habit.

The *emotional life* should be one of moderation. Extremes should be avoided. Fits of anger and rage have harmful effects upon mental development. They also interfere with physical processes like digestion, breathing, and heart action. Anger and rage result from a lack of ability to control the temper. They are of slow growth and can be controlled if desired.

Overcome Your Fears—Do Not Let Them Overcome You

Fear is disturbing to one's peace of mind. There is an old saying that a "brave man dies only once, but a coward dies a thousand deaths." Many fears could be overcome by meeting the problem boldly. In most cases they will be conquered so successfully that one is often quite ashamed of the earlier fears. The fear of water handicaps many people in learning to swim. Make up your mind to conquer the fear and swimming is soon learned.

Youth Is the Best Time for Training the Nervous System:

The brain practically reaches its full growth in size and weight at the age of seven years. The nerve cells go on developing for years and years beyond this age. Some people excel others in mental ability, not because their brains are larger or heavier, but because their neurones, or nerve cells, are better trained and developed.

While it is possible to learn new things at almost any age, it has been found that things are most easily learned in youth. During these years it is easiest to memorize, acquire foreign languages, learn to play the piano, develop habits and skills of all kinds. New connections between the neurones are made most easily at this time. The comparative ease with which things are learned during these early years of life is an important reason for attending school as long as possible and making the most of the opportunities that are offered for these purposes.

PRACTICAL APPLICATIONS

For Effective Study:

1. Name the parts of the nervous system.
2. What is a neurone? Of what uses are its different parts?
3. Name the three main parts or divisions of the brain and give the use of each.
4. What are convolutions (in the brain)?
5. Name the kinds of nerves according to their uses.

For Observation or Investigation:

1. What kind of actions are controlled by the spinal cord?
2. What kind of actions are controlled by the brain?
3. Name a voluntary action; an involuntary action, also.
4. What are some advantages, or disadvantages, of "habits"?
5. What are the rules for the formation of good habits?
6. Why are health habits particularly valuable?
7. Judge yourself on the basis of good mental habits suggested in this chapter. Strengthen weak ones, break bad ones, form new ones as needed.

For Health Habit Formation:

1. Observe all the general rules of health—fresh air and sunshine, wholesome food, exercise and rest, and, *in particular:* Get plenty of rest and sleep.
2. Avoid over-excitement, too intensive study, eye-strain.
3. Learn to relax. Avoid hurry or worry.
4. Avoid the use of alcohol and tobacco.
5. Convert health rules into habits.
6. Be active, confident, cheerful.
7. Cultivate worth-while interests and hobbies.
8. Practice concentration, truthfulness, honesty, fair play, thoughtfulness, courage, persistence — the elements of character.
9. Remember: "The child is father to the man."

THE SENSES

THE "REPORTERS" AND "SENTRIES" OF THE BODY

The senses are the "news gatherers" of the body. They inform the central nervous system of many things. Like "outposts" or "sentries," they help to protect the body by warning us of dangers and injuries.

Separate Senses Are Provided:

The work of news gathering for the body has been compared to the specialized organization of a newspaper office. In such an organization, the work of news gathering is divided among different groups, like the political news specialists, sports writers, society reporters, dramatic critics, and others. On a smaller scale, this specialized form of organization is duplicated in the preparation of a school magazine. School publications often have separate literary editors, sports writers, club reporters, exchange readers, jokes and school humor departments, and class and section representatives. The members of each department are expected to become expert in the discovery and reporting of the special kind of "news" that is assigned to them.

In the body, the work of news gathering is also divided among a number of different departments, or *senses.* Each sense collects and reports only a certain kind of information. The sense of sight, for example, reports only those sensations we know as light, while the sense of hearing informs us solely of sounds.

The Keen Sight of the Indian—
The Signal Fire

For convenience, our senses can be divided naturally into two groups, the *External Senses* and the *Internal Senses.*

The External Senses:

The *external senses* are those which keep us informed of conditions and events in the world round about us, and include:

1. *Sight,* which enables us to see things
2. *Hearing,* through which we learn of sounds
3. *Taste,* which gives us information about things we eat
4. *Smell,* through which we learn of odors
5. *Touch,* through which we gain a wealth of information about the qualities of things, such as hard or soft, rough or smooth, and so on
6. *Temperature,* through which we learn of varying conditions of heat and cold

The Internal Senses:

The internal senses are those which keep us informed of conditions that we feel within the body. They include:

1. The sense of *hunger and thirst,* through which we become aware of needs for food and drink;
2. The sense of *movement and strain.* This sense is felt in the muscles, tendons, and ligaments, and helps us to guide and control our movements. It is through these sensations of movement and strain that we can tell the position or location of parts of our body when the eyes are closed, or we are in the dark. In order to test the value of these sensations, close the eyes and try some setting-up exercises. "Raise arms forward upward!" You feel the correct position of the arms by reason of the sensations

of movement and strain in the muscles, in the tendons which attach the muscles to the bones, and in ligaments which bind the bones together. It is this sense which becomes highly developed in finely coordinated movements like writing, piano playing, typewriting, and other muscular skills;

3. The sense of *equilibrium and balance,* through which we are able to keep the body balanced in different positions of motion and rest. It is aided by the action of the semi-circular canals of the ear, and the cerebellum of the brain;
4. The sense of *pain.* This sense informs us of conditions inside the body as well as dangers from without.

Sense Reception and Radio Reception:

There are several points of similarity between the general principles of *sense reception* and *radio reception.* The discussions in Radio Clubs and elsewhere will prove helpful in understanding them.

Four basic elements of radio transmission and reception are duplicated in sensory transmission and reception by the body. These are as follows:

1. A broadcasting, or sending device;
2. An antennae, or receiving apparatus;
3. A lead-in;
4. A transforming, amplifying, or interpreting mechanism.

We are all somewhat familiar with the application of these principles to radio. The broadcasting station sends out electric "radio impulses" into the air, regulating their strength and wave length according to the directions of the governing radio authorities. These impulses are picked up by an antenna and conducted through the "lead-in" to the set, where there they are transformed, amplified, and interpreted. In some types of sets the antennae and lead-in are built within the cabinet and no outside wires are used. The basic principles are the same, however, in either case.

Radio Transmission and Reception

In sensory "broadcasting," or transmission, we find that corresponding to an "impulse" in radio, there is a *stimulus* for a special sense. Each sense has its own particular form of stimulus. The sun, electric light bulb, or any other light producing object sends out rays of light which form the stimuli for the sense of sight. Sound waves from a ringing bell or other sound-producing object are the stimuli for the sense of hearing. Substances dissolved in liquids stimulate the sense of taste, while tiny particles in the air form the stimuli of the sense of smell. Actual pressure stimulates the sense of touch.

The receiving or "antennae" part of our sensory mechanism consists of the *sense organs* and the tiny *endings of the sensory nerves.* The nerve endings of several of the senses are rather widely scattered throughout the body, like those for receiving sensations of touch, temperature, and pain in the skin, and those for detecting movement and strain in the muscles and joints. The nerve endings for some other senses are closely grouped in certain places, like those for smell in the nose, and taste in the tongue. The endings for two of the senses are enclosed within parts especially constructed to contain them, like the eye for sight and the ear for hearing. The parts of the body that contain the nerve endings or receiving apparatus for the senses are often spoken of as the sense organs, and include the eye, ear, nose, tongue, and skin.

Sense reception is further promoted by the sensory nerves which act as the "lead-in" and conduct the stimuli to the brain. Sense reception is completed in the brain where the different stimuli are received and properly interpreted. When stimuli from rays of light are carried by the optic nerve into the visual area of the brain, we see the object before the eyes. When stimuli from sound waves reach the auditory area of the brain, we hear the sound. Thus, for each of the senses, the interpretation of the stimuli takes place within the brain.

Importance of Proper Care of the Sense Organs:

Our sense organs are so valuable that we should take every precaution to prevent their abuse and injury. If radio impulses come in too weak, there are usually a number of ways by which we can increase their strength, depending upon the type of set. We might even add a few tubes to increase their strength. Unfortunately, the improvement of sensory reception is not so easily accomplished. There are very few satisfactory artificial aids to overcome the handicap of failing eyesight or approaching deafness. It is especially important, therefore, to preserve the greatest efficiency of all the sense organs as long as possible.

Even a temporary loss of the use of one of the sense organs results in much inconvenience and discomfort. It is only with great patience and effort that a different sense can be trained to take over some of the duties of another. You may recall the wonderful story of Helen Keller. Miss Keller lost the senses of both sight and hearing before she was two years old. She grew up to school age without being able to speak, and without knowledge of the most common objects around her. Some years later, still unable to see or hear, she had been graduated from college, knew several foreign languages, and had written a number of books.

Miss Helen Keller and "Phiz."

In her book, *The Story of My Life,* Miss Keller tells how she trained the sense of touch to supply her with much of the information that ordinarily comes to others through the senses of sight and hearing. She also learned to put her own lips, teeth, and tongue in proper positions to form words so that she could speak aloud. She could not hear her own speech, but she spoke so well that she often lectured to audiences on many subjects. Such training took years and years of patient effort on the part of both pupil and teacher. Those of us who do not suffer such handicaps should be thankful and do our best to protect the senses from injury.

THE SENSE OF SIGHT

It would be impossible to arrange all the senses in an order of importance that would be acceptable to everyone. A famous surgeon declared the order of the value of the senses in his work was sight, touch, hearing, smell, and taste. A telephone operator would very likely head the list with hearing. A "tea-taster" would place smell and taste well up in front, and so on. When specialized occupations like these are not considered, most people would probably give first place to the sense of *sight*. We call upon this accurate and highly developed sense to aid us in most of the things we do.

Seeing:

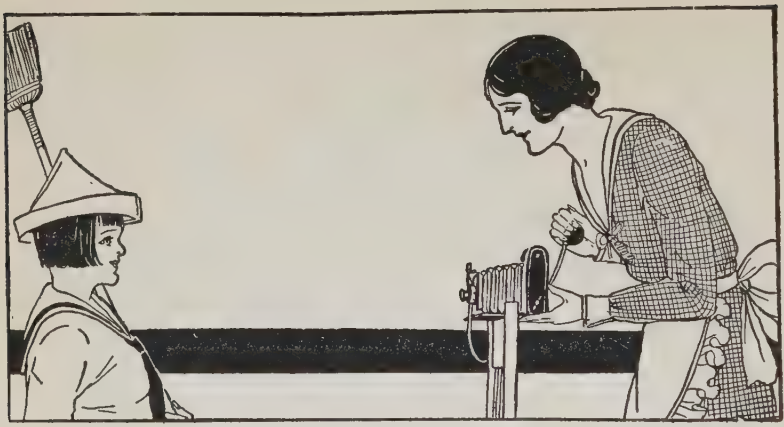
"Seeing" a thing that comes before the eyes is the combined result of two rather different processes. The first is the more easily understood mechanical process of focusing the rays of light upon the retina of the eye. The other is the more complex mental process of interpretation in the brain of the nervous impulses that have been transmitted to it from the eyes. Suppose that two people look at the same scene, one an engineer, and the other an artist. The engineer "sees" the landscape as an excellent location for a bridge and the artist "sees" it as a masterpiece of artistic composition. The lights and shadows of the scene were the same for both, yet each saw what he had trained himself to see by past experiences.

The mechanical processes of seeing resemble the action of a camera in the taking of a picture. They are largely automatic and unvarying in their operations. By providing certain kinds of eyeglasses, we can do a little to improve the mechanical processes of the sense of sight. Our chief concern with this part of the seeing process is the proper care of the eyes and their protection from injury.

The mental interpretation of what we see depends upon the number and kinds of associations and connections among the nerve cells in the brain. It varies widely among different people because of the differences in their mental development. There are almost endless opportunities for the improvement of the interpretative side of seeing. This is best accomplished by the development of the mental powers and capacities to their fullest extent. The mental interpretation of the sensations from all the senses is likewise capable of improvement and development as the result of education and experience.

The Eye Is the Sense Organ of Sight:

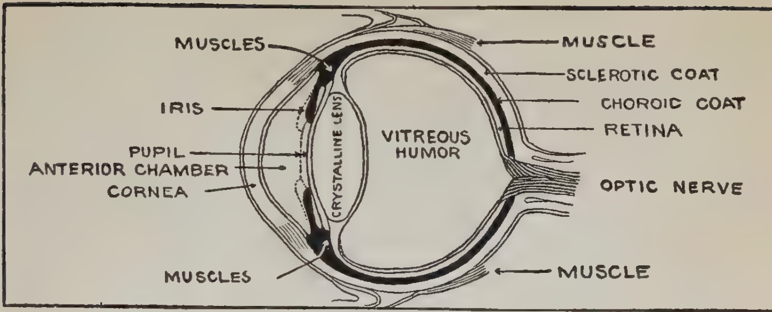
The structure of the eye and the construction of a camera have many parts in common. Both are



Taking Pictures

mechanisms for taking pictures. We can learn from the Camera Club, if we do not already know it, that the shutter admits the light into the camera box. As the rays of light pass through the lens, they are properly bent or brought to a focus upon the sensitive film or plate. This film or plate is later developed and the imprint of the lights and shadows upon it are permanently recorded. The better the focus, the sharper or clearer will be the picture.

The *eyeball* is the camera-box of the eye. It is a rounded, spherical, or ball-shaped body about an inch in diameter, fitting snugly in a hollow socket in the bones of the skull. It is held in place and moved about in its sockets by six different sets of muscles which are attached to it.



The Eye

The eyeball is made up of three coats or layers of tissue, each of which has an important part in the "taking of the picture." The outer, or *sclerotic coat,* is a relatively thick, tough membrane which gives protection to the eye. It is white in color and is the part we call the "white of the eye." In the front, this protective layer bulges outward to form the *cornea.* The cornea is transparent and admits light into the eye. By reason of its rounded surface, it helps in the bending of the rays of the light to make a proper focus. The middle, or *choroid coat* of the eye is black. It prevents light from entering the eye at any place except through the *pupil,* or tiny opening in the front of the eye that is provided for the purpose. The inner lining, or the *retina,* contains the nerve endings of the *optic nerve,* or nerve of sight. The optic nerve, coming from the brain, enters the eyeball from the back. It branches out until its endings spread themselves over the entire back half of the interior of the eyeball. It is these nerve endings that are sensitive to light and transmit their stimulations to the brain.

Stretched across the interior of the eyeball, not far behind the cornea, is a little curtain of tissue called the *iris*. The iris contains muscle fibers, nerves, and blood vessels. It also contains little particles of pigment or coloring matter. Our eyes are blue, brown, or gray according to the coloring materials in the iris. In the center of the iris is a little opening called the *pupil* of the eye. As the muscles in the iris contract or relax, the size of the pupil changes. In a very bright light, the opening becomes smaller so that too much light will not be admitted. In a dim light, the iris contracts, thus enlarging the size of the pupil so that as much light as possible will be admitted. It is easy to observe the changes in the size of the pupil by standing before a mirror and suddenly varying the amount of light which comes before the eye. The pupil of the eye always appears black because of the black choroid lining of the eyeball which shows through it.

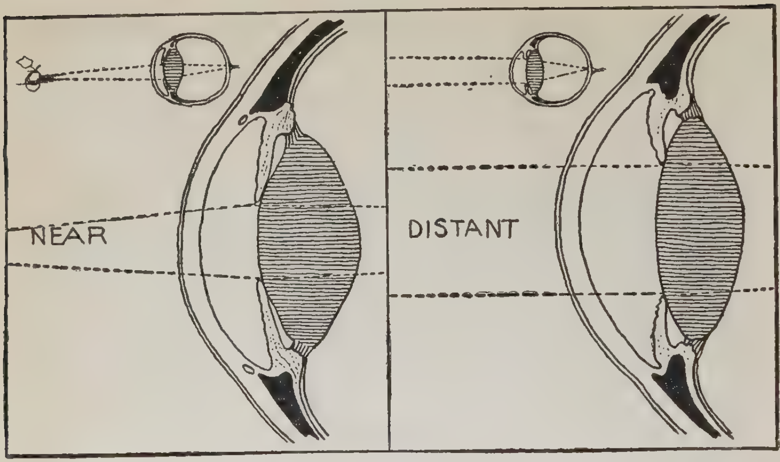
Just behind the iris is the exceedingly important structure called the *lens*. This is a very clear, transparent, oval, or convex little body, held in place by tiny tendons and muscles. Through the action of these muscles, the lens changes in convexity or thickness according to the amount of bending that must be done to the rays of light in order to bring them to a focus upon the retina.

The lens divides the eye into two compartments, a smaller one in front and a larger one in back. The larger compartment is filled with a jelly-like substance called the *vitreous humor*. The front, smaller compartment, or chamber, is filled with a watery fluid called the *aqueous humor*. The aqueous humor is slowly secreted and drained away so that the pressure within the eyeball is always constant.

"Seeing" Clearly and Distinctly:

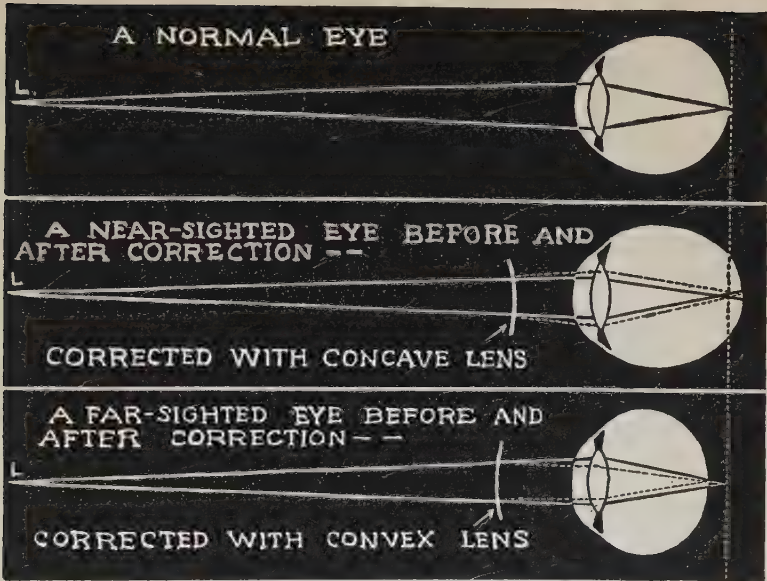
Good pictures, whether taken by a camera or imprinted upon the retina of the eye, are clear and distinct. They result from a proper focus of rays of light upon the sensitive film or retina. As we look at an object, the light rays enter the eye through the cornea, pass on through the pupil and the lens, and thence to the retina. The nerve endings in the retina transmit their stimulations to the brain where the image is formed, and we *see* the object before the eyes.

In a camera, light rays are bent to a focus upon the film by the curved or rounded surfaces of the lens. In order to focus objects at different distances from the camera, the distance between the lens and the film is changed as needed. In the eye, light rays are bent to a focus upon the retina by the curved surfaces of the cornea and the lens. When the eye



Focusing

is at rest, light rays from objects twenty feet or more away will be brought to a focus upon the retina by the normal curvatures of the cornea and the lens. In focusing objects nearer than twenty feet, the lens automatically becomes more curved and rounded in order that the light rays will be bent to a point upon the retina. When we look at more distant objects again, the lens automatically becomes less curved and flatter. See diagram on this page. This change in the shape of the lens is called *accommodation*. It is obtained by the action of muscles that are attached to the lens. Long continued close work like sewing and reading fatigues these muscles. Relief can be obtained by looking at a distant object from time to time.



Why Some People Need Glasses:

The shape of the eyeball, or the structure of the lens, often prevents perfect focusing for near and distant objects. If the eyeball is too long from front to back or the lens too rounded, far-off objects will be blurred and indistinct, while near-by objects can be clearly seen. Such persons are termed *near-sighted.* Concave glasses remedy this defect by bending the rays of light so that the image of the object is focussed directly upon the retina rather than in front of it. See diagram above.

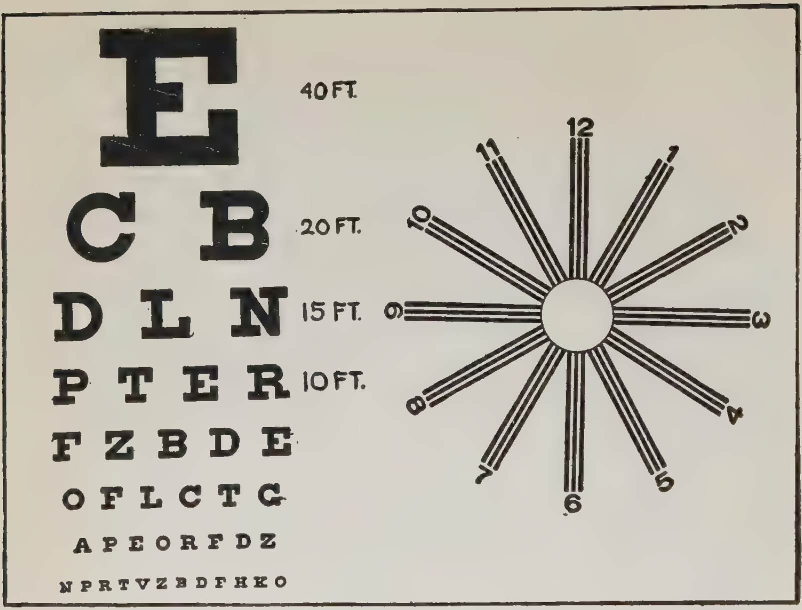
If the eyeball is too short from front to back, or the lens too flat, nearby objects will be blurred and indistinct, while far-off objects can be clearly seen. Such persons are termed *far-sighted.* Convex glasses remedy this defect by bending the rays of light so that the image of the object is focussed directly upon the retina instead of a position which lies beyond it. See diagram on page 51. Far-sightedness is a common eye defect among older people. With advancing years, the tone of the muscles that change the shape of the lens is weakened and the elasticity of the lens itself is lessened. For these reasons, older people usually need the aid of glasses for all forms of close work like reading and sewing. If the optic nerve is still unaffected, these people can still see distant objects quite as well as in the earlier years of life.

Another defect in vision is called *astigmatism.* This condition occurs when the refracting, or bending surfaces, of the eye are uneven or unequal in their curvature. This results in a focus of certain parts of the image upon the retina and a blurring of other parts. Astigmatism can be corrected by glasses. Each lens is ground in such a way that the improper curvature of any part of the eye will be corrected by the curvature in that portion of the lens that is placed before it.

Testing for Eye Defects:

Tests for near-sightedness and far-sightedness usually consist in measuring the ability to read letters and figures of different sizes at a specified distance, usually twenty feet. See chart on page 54. Each eye is tested separately. The eye that is not being tested should be covered. The test proceeds until the subject reaches the smallest sized letters that can be read accurately at the distance used. The result is usually expressed in the form of a fraction, the numerator expressing the distance used, and the denominator representing the distance at which a normal eye should be able to read the smallest letters the subject was able to read. Thus $^{20}/_{20}$ths or $^{15}/_{15}$ths represents normal vision, but a result of $^{20}/_{40}$ means that at a distance of twenty feet, the subject was only able to read letters that the normal eye should see clearly and distinctly forty feet away, or twice the distance used in the test. Cases of defective vision should be corrected by the proper glasses. Pupils with extremely defective vision are sometimes placed in special "sight-saving" classes. Books and material with extra large type are used in such classes.

The test chart for astigmatism contains lines that radiate in all directions from a central point. See chart on page 54. The variations in the distinctness of the vision indicate to the expert just how to grind the lens in order to make up for the defective curvatures in the eye that cause these peculiar results. As astigmatism affects the focusing of lines at all distances, the glasses that correct these defects should be worn at all times that the eyes are used.



EYE TESTING CHARTS

Influence of Eye Defects Upon the Health:

Long continued use of the eyes often results in a condition known as *eye-strain.* Eye-strain results from overworking the muscles of the eye in focussing light rays upon the retina. The presence of uncorrected eye defects greatly increases the frequency and severity of this affliction. Eye-strain affects the body in a number of ways. The eyes may burn, or smart, or feel "strained" after being used for a while. The eyelids and eyeballs become reddened or inflamed. The letters of a book may look blurred or dance about and spots appear before the eyes. Headache usually occurs. Astigmatism is especially tiring to the eyes. Eye-strain from astigmatism is very likely to be accompanied by nausea, dizziness, and even a nervous irritability as well as the usual headache. Whenever these warning signals of eye-strain, or any other unusual symptoms occur, an expert should be consulted at once. The sight is too precious to be endangered by carelessness or neglect.

Protect the Eyes From Injury:

The eye is a delicate structure and should be carefully protected from injury. The eye is naturally protected in a number of ways. Its position within a socket in the bones of the skull greatly lessens the area of its surface that is exposed to injury. The eyelids protect the eyes by closing over them. A part of the eyeball is always covered by the eyelids, and in case of approaching dangers, they shut tightly and completely cover its delicate surface. The eyebrows and eyelashes give additional protection by helping to keep foreign substances out of the eye. A watery liquid is secreted by glands in the corners of the eye and is spread over the outer surface of the eyeball by the opening and closing of the lids. This liquid moistens and cleans the eye surface. The excess moisture passes off through a tiny canal leading from the inner corner of the eye into the nose. When it is secreted too fast, the drops run over and form tears.

We can add to these natural protections of the eye by taking suitable precautions in our work and play. Many cases of blindness have resulted from the careless throwing of objects. Carelessness in handling knives, scissors, and other sharp-pointed instruments have caused serious injuries to the eye. Grinding operations are especially dangerous in industry. Protective devices are often required by law to safeguard the eyesight of such workers.

Use the Eyes Properly:

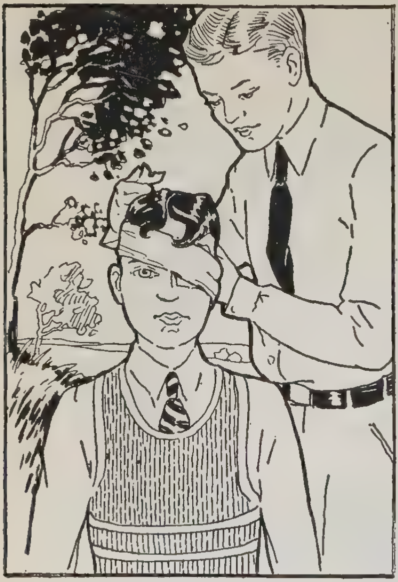
The eyesight can be protected by proper use of the eyes. The amount of the light which strikes the eyes should be carefully regulated. It should be neither too bright nor too dim. More light is needed for work upon dark surfaces or dark materials than upon light ones, because dark surfaces absorb more light than others. When reading or writing, it is best to have the light shine over the left shoulder to avoid shadows upon the page from the right hand or arm. Light should never be reflected directly into the eyes from the pages of a book or from any shining or highly polished surface.

Close work of any kind requires continual action by the muscles that assist in the focussing of the image upon the retina. During such work, the eyes should be rested occasionally by *looking away* from the work before them. This changes the focus and rests the eye muscles.

Light over Left Shoulder—No Shadow—No Glare

Do not read in moving cars. The jolting makes it difficult to keep the focus. Do not read while lying down or with the head bent forward.

General health has an influence upon the eyes. The eyes should not be used for reading or close work during any illness that is accompanied by fever. They should be used but little during the period of convalescence. Certain diseases, like measles and scarlet fever, have a weakening action upon the eyes and especial care should be taken to protect them during such times.



Great care should be taken in removing a foreign body from the eye . . . the services of a physician or nurse should be obtained whenever possible . . . a light gauze bandage and cotton compress over the eye will prevent the lid from moving, and the particle from scratching the cornea, while expert medical attention is being secured.

First Aid for a Foreign Body in the Eye

To Remove a Foreign Body from the Eye:

Do not rub the eye. This may press the particle into the delicate surface of the eye and make it harder to remove.

Close the eye for a few moments and the tears may wash out the piece of cinder, dust, sand, or other substance that has come in contact with it. If this procedure is not successful, pull the upper lid down over the lower one and hold it there for a few moments. When the lid is released, the particle often has been removed.

If the foreign body still remains, get a capable person to examine the surface of the eyeball and the inner sides of the lids. This is done by turning the lids back over a toothpick or matchstick and then wiping the foreign body off with the folded tip of a clean handkerchief. If the particle cannot be removed by such ordinary first aid measures, a competent physician should be consulted.

THE EARS AND THE SENSE OF HEARING

It is through the sense of hearing that we become aware of sounds. Hearing is a very useful sense, for through it we increase our knowledge of the world, learn of certain kinds of dangers, and secure the joys of conversation and of music.

Sound Waves and Their Detection:

Sound is produced by vibrations in the air. In the same manner that waves spread out in ever-increasing circles when a stone is thrown into a pool, sound waves travel out into the air in all directions from a ringing bell or other sound-producing object.

The problem of sound detection in the body requires a mechanism that is sensitive enough to respond to the faintest sounds. In order to be sensitive, it must be very delicately constructed. It must be carefully guarded against injury and yet be placed so that it has a close connection with the outer world. The human ear, with its three different parts, is so constructed that these exacting requirements are perfectly fulfilled. The delicate *inner ear,* in which the nerve endings of hearing are found, is located in the bones of the skull. The *middle ear* bridges the gap between the outer and the inner parts of the ear by a finely adjusted system of membranes and bony levers. The *outer ear* is constructed so that sound waves are gathered up from the air and conducted inwards with little loss of strength.

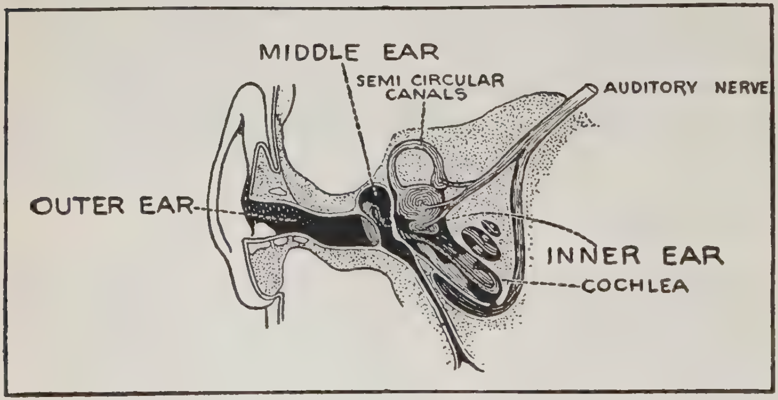


Diagram of the Ear

The Outer Ear:

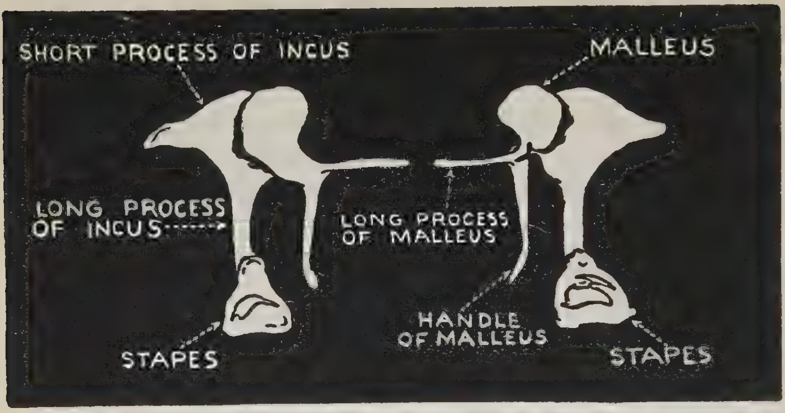
The part of the outer ear that we see is composed of cartilage and shaped so that it will gather in and collect the sound waves. An opening or canal leads to a membrane which divides the outer from the middle ear. The sound waves set this membrane in motion and thus start off the process of hearing. The canal in the outer ear helps to protect the ear from injury. It is slightly narrowed in the middle. The walls of the canal are lined with hair. These hairs, together with the thick, yellow wax, that forms in the canal, help to discourage the entrance of insects into the ear.

The Middle Ear:

The outer membrane of the middle ear, called the "tympanum," or eardrum, is in direct contact with the outside world. Sound waves strike upon it and cause it to vibrate. These vibrations are transmitted to the inner membrane of the middle ear through a system of tiny bones that act as levers. These little bones are known as the *malleus,* or hammer, the *incus,* or anvil, and the *stapes,* or stirrup. The handle of the malleus, or hammer, is attached to the tympanum and its head to the body of the incus, or anvil. The opposite end of the anvil joins one end of the stapes, or stirrup. The other end of the stapes is fastened to the membrane which separates the middle ear from the inner ear. This completes the chain of connections which transmit the vibrations across the middle ear. See diagram on page 62.

The Inner Ear and Hearing:

A thin membrane separates the inner from the middle ear. The inner ear consists of a canal in the



Bones of Middle Ear

bone of the skull. Part of it is carved out in a way that resembles the curves and windings of a snail's shell. It is often referred to as the *cochlea,* or snail shell. See diagram on page 60. The cochlea is filled with lymph. It also contains the delicate endings of the *auditory nerve,* or nerve of hearing. Thus, when the liquid in the cochlea is set in motion by the vibrations received from the middle ear, the auditory nerve endings are stimulated. The resulting nervous impulses are carried to the "hearing" area of the brain, where they are received and interpreted as sounds.

The inner ear also contains the structures known as the *semi-circular canals.* See diagram on page 60. They aid us in our sense of balance or equilibrium. Each semi-circular canal is filled with lymph and is equipped with tiny hairs and nerve endings which are in communication with nerve centers in the cerebellum. The canals are so placed that the head cannot be turned in any direction without affecting or exciting one of them. Injury to the semicircular canals causes one to stagger and lose the balance.

Care of the Ear and Prevention of Deafness:

The sensitive and delicate mechanism of the ear is often injured by blows upon it or by pulling the ears. Excess wax that may collect in the canal of the outer ear can be removed by covering the end of the little finger with a single thickness of a handkerchief and cleaning gently. The rolled up end of a handkerchief or towel will also serve for the purpose. Do not use hard instruments of any kind for removing this wax because the eardrum can be easily punctured by them. If an insect should get into the ear, it sometimes can be enticed out by holding a light before the opening. If this fails, a little "sweet oil," or water heated to body temperature should be poured into the ear and the insect drowned and floated out.

Deafness is a condition that varies in severity from a slight defect up to a condition of total loss of hearing. It may be only temporary or it may be permanent.

Most of the causes of deafness are connected with defects or injuries to the middle ear. The middle ear is connected with the throat by means of the Eustachian tube. The germs of colds, grippe, or other diseases sometimes extend up this tube and infect the middle ear. Infection of the middle ear is always a serious condition and should never be neglected. One of the frequent causes of deafness is a stiffening of the little system of bony levers that extends across the middle ear. This interference with the freedom of action of the tiny hammer, anvil, and stirrup bones, that make up this system of levers, is usually the result of infection of the middle ear. As infection progresses, pus develops and ruptures the eardrum in order to find a way out. Physicians often are forced to pierce the tympanum or eardrum in order to provide an opening for the drainage of the pus. Sometimes the infection of the middle ear spreads into the *mastoid bone* which lies directly behind the outer portion of the ear. When this occurs, a delicate surgical operation is necessary to open an outlet for the pus that collects.

Tests of Hearing:

Several methods can be used in testing hearing. All tests should be conducted in a quiet room. Test each ear separately. In the *voice test,* the ear not to be examined is closed off by a finger. The examiner takes a position twenty feet from the person to be tested and, in a natural tone of voice, states num-

Testing Hearing with Audiometer

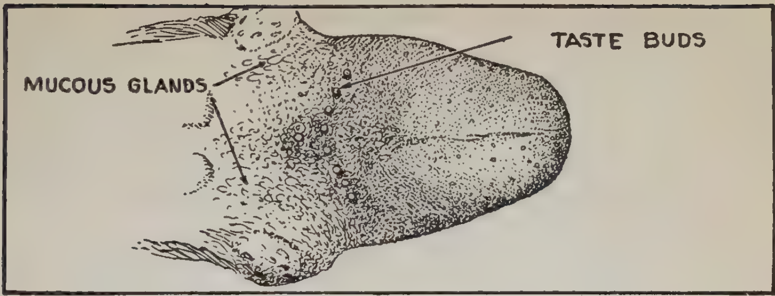
bers which the subject is to repeat. The normal ear should hear the numbers clearly at this distance. In the *whisper test,* the examiner stands about ten feet away. He whispers numbers or words, gradually approaching nearer to the person tested. The normal ear should hear the whispered voice without difficulty at a distance of about six feet. The *watch test* is conducted the same as the whisper test. Use a loud ticking watch. Start about ten feet away and gradually approach the subject. The normal ear should hear the ticking at about a distance of six feet.

These three methods of testing hearing are very slow and but one person can be tested at a time. In order to speed up the testing of hearing and to provide a more accurate test than either the watch or voice method, a device called an *audiometer* has been developed in the laboratories of the Bell Telephone Company. This machine enables a whole class to be tested at once and as many as one hundred persons an hour can be tested. Ear phones are used to detect the sounds of numbers which come from a phonograph record made especially for this purpose. The sounds produced by the record vary in degree, from loud and distinct, to those that are very faint and indistinct. The degree of sensitivity of the hearing of each person can be accurately and automatically determined by this device.

THE SENSES OF TASTE AND SMELL

Through the sense of *taste* we become aware of certain differences among the fluids and solids that are taken into the mouth. The nerve endings of the sense of taste are located in the *taste buds* on the tongue. There are really only four different kinds of "tastes" that can be distinguished from each other by the sense of taste alone. These are the qualities of *sweet, sour, bitter,* and *salty.* All other tastes than these are due to the sense of smell rather than the sense of taste. The sense of taste cannot distinguish between a piece of onion and a piece of apple without the aid of the sense of smell.

Through the sense of *smell* we become aware of odors. The nerve endings of smell are located in the upper part of the nasal passages. These nerve endings are stimulated by tiny particles in the air and



Location of Taste Buds on the Tongue

then transmit the stimulation to the "olfactory area" in the brain, where they are properly received and interpreted.

The continued action of an odor dulls the sense of smell for that particular odor. This is often noticed in poorly ventilated rooms. The occupants of the room are not aware of the odors that are immediately noticed by a person who comes into the room from the outside. The senses of smell and taste are dulled whenever the nasal passages are congested by the inflammation of a cold. Animals usually have a keener sense of smell than human beings. It is a very valuable aid in protecting them from approaching dangers.

SENSES IN THE SKIN

The nerve endings of several senses are located in the skin. These include the senses of touch, temperature, and pain. Some of these nerve endings respond only to *pressure* and give us information regarding such qualities as hard and soft, rough and smooth. Certain other nerve endings respond only to *heat* or *cold,* thus making possible our sensations of temperature. Still others react to *pain* and warn us of impending dangers.

The Purpose of Pain: Pain is a warning signal of danger. A hand too near the fire feels pain and can be withdrawn before it is seriously burned. The pain of a broken bone acts as a hindrance to further movement of the injured parts and thus prevents the additional damage that such movement might produce.

Pain is an aid to a doctor in his diagnosis. Some forms of pain are characteristic of particular disorders, such as the pain of appendicitis, diphtheria, or stones in the gall-bladder, or kidneys. On the other hand, the same type of pain may accompany a number of different body ills and a skilled physician is needed to diagnose or interpret its cause. Headaches, for example, are often protests against the faulty habits of eating that lead to indigestion. They may also be due to eye-strain, or to improper circulation of blood in the brain. Some diseases are not announced by pain or do not cause pain as they progress. It is for this reason that the early detection of diseases like cancer, diabetes, certain forms of heart trouble, and tuberculosis is so difficult. The absence of the warning signal of pain in diseases as serious as these is one of the strongest arguments for a yearly physical examination by a competent physician.

PRACTICAL APPLICATIONS

For Effective Study:

1. Name the external senses. Explain their uses.
2. Name the internal senses. Explain their uses.
3. Explain what is meant by a stimulus.
4. Name (and give the uses of) some of the important parts of the eye.
5. What is the cause of near-sightedness? Of far-sightedness? Of astigmatism? How can these defects be corrected?
6. What are the parts of the ear, and what are the uses of each part?
7. What is the value of the Eustachian tube? What dangers to hearing are connected with it?
8. What are the semi-circular canals in the ear? What is their use?
9. Name the senses that have nerve endings in the skin.

For Observation or Investigation:

1. Compare the sensory transmission and reception to radio transmission and reception.
2. Explain the values of the different sense organs.
3. In what respects is the eye like a camera?
4. List the ways in which eye-strain may express itself within the body.
5. Name some of the ways in which the eyes are (or may be) protected from injury.
6. What is the best way of having a foreign substance removed from the eye?

7. How may the senses of smell and taste protect us from danger?
8. What is the purpose of pain? How do the senses in the skin help to protect us from harm?

For Health Habit Formation:

1. Have your eyes tested occasionally.
2. Protect the eyes when reading, working or playing:
    - (a) light—over left shoulder
    - (b) glasses (or goggles)—wear them
    - (c) close work—look away occasionally
    - (d) avoid danger.
3. If you must use an eye-wash, be sure you have "the right bottle."
4. If glasses have been prescribed, be sure to wear them.
5. Consult a physician for ear-ache. Infections of the ear should never be neglected.

UNIT III

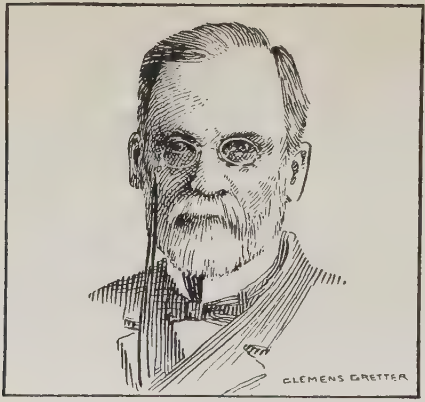
THE CONQUEST OF DISEASE

For unknown centuries peoples have struggled against the ravages of disease. Until recent years, however, the weapons used against disease have been pitifully weak and inadequate, and but little progress had been made against it.

Turning Points in the Conquest of Disease:

The invention of the microscope, in the 17th century, forms an important landmark in the conquest of disease. The microscope consists of an arrangement of glass lenses which makes things seem larger than they really are. Its use led to the discovery of a world of tiny germ life that cannot be seen without it. See page 75 for drawing of a microscope.

For some two hundred years after the invention of the microscope, scientists observed many different forms of microscopic life. Numerous explanations were offered and many wild guesses were made concerning them. Debates and controversies arose and were bitterly contested by the learned men. It remained for the great French scientist, Louis Pasteur, to point out the true nature and effects of these tiny forms of germ life.



LOUIS PASTEUR

The French scientist whose discoveries broke through the great cloud of darkness and ignorance that had obscured the causes of disease for untold centuries. His work marked the beginning of scientific preventive measures in the conquest of disease.

The discoveries of Louis Pasteur, in the latter half of the nineteenth century, mark another great turning point in the conquest of disease. Pasteur's work covered a wide range of interests. He discovered the presence of germs in the dust of the air, and proved them to be the cause of fermentation, putrefaction, and decay. He continued his experiments and showed germs to be a cause of disease. The results of Pasteur's discoveries broke through the great cloud of darkness and ignorance that had long obscured the causes of disease. His work marked the beginning of scientific preventive measures in the conquest of disease.

A few years after Pasteur's announcements concerning the dangerous nature of certain forms of germ life, an English surgeon, Sir Joseph Lister, pointed out a way to prevent the infections that usually followed surgical operations up to that time. Dr. Lister suspected that these infections were caused by germs that found their way into the wound at the time of the operation. In 1867, using carbolic acid, he sterilized the atmosphere of the room and everything that came in contact with the wound. As a result, the usual infections were prevented and another great forward step was taken in the conquest of disease.

About twenty years before Dr. Lister's discovery of antiseptic methods in surgery, an American dentist, Dr. W. T. Morton, had conducted the first public demonstration of the value of ether in producing anesthesia, or insensibility to pain. This momentous event occurred in 1846 in the Massachusetts General Hospital, in Boston. Thus, in close succession, the development of *painless* and *antiseptic* methods in surgery paved the way for the great advances that have taken place in the surgical treatment of disordered and diseased conditions of the body, and the relief of suffering.

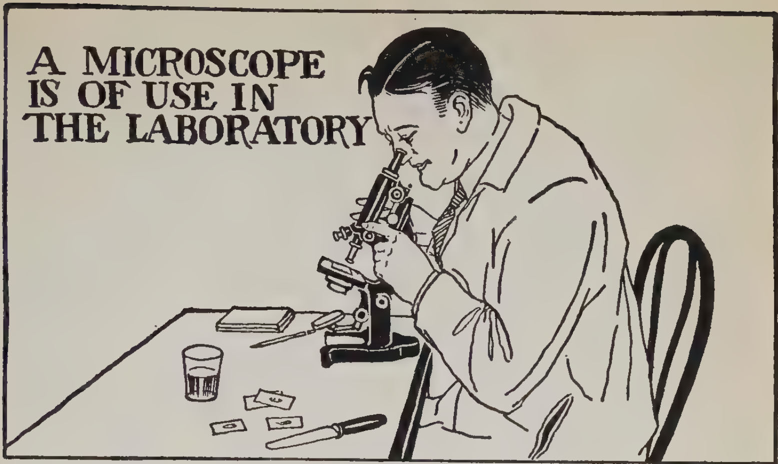
GERMS AND THEIR WORK

There is a world of tiny, living plant and animal forms all about us, known as *germs,* or *microbes.*

Germs that grow as plants are called bacteria and animal forms are called protozoa. They live by the millions in the air, water, and soil. They blow around on the dust in the air. They float along in the rivers and streams. They grow and multiply in dirt, or soil, and are carried from place to place on many things.

Germs are so small that a powerful microscope must be used in order to see them. Some are so tiny that they appear merely as specks when magnified two or three thousand times their actual size. In shape, only three distinct general forms have been observed among the hundreds of different kinds or species, that have been discovered. These are the spherical or globular, the rod or pencil-like, and the spiral or corkscrew type. Many variations of these general forms are found. The spheres may be large or small, or arrange themselves in different ways. The rods may be long or short, or thick or thin. The spirals may have few or many turns or coils, and the coils may be open and loose, or close and tightly wound. It is by some characteristic variation from one of these three basic forms that the different kinds are identified. See diagrams on page 75.

Each germ is a single cell. As a living organism, it can grow and multiply, or reproduce. Most germs grow best in warmth, moisture, and darkness. After a germ has increased in size up to a certain point, it divides in half and two complete cells exist where



DISEASE GERMS AS VIEWED THRU A MICROSCOPE

SOME USEFUL TYPES OF BACTERIA-AS VIEWED THRU MICROSCOPE

there was only one before. Each of these two cells in turn divides in half, and so on for generation after generation until something checks the growth. Germs multiply rapidly, two or three generations being produced in an hour under especially favorable conditions. If such a method of reproduction took place but once an hour and continued unchecked, the number of the descendants of a single cell would soon be enormous. In one day it would amount to about 16,500,000 individuals, and in two or three days, the number would be too large for us to comprehend. No such multiplication of germs is possible, however, because their food supply would be inadequate, and the waste products of their own growth would prove poisonous to them and reduce their numbers.

Sunlight kills germs quickly. Heat will destroy them. It should be remembered, however, that germs vary in their ability to resist heat. Some can withstand much higher temperatures than others. Cold is fatal to some kinds, but others merely remain quiet or "dormant" when frozen, and are restored to activity when warmed again.

Helpful Aids and Harmful Enemies:

The discoveries of Pasteur directed attention to two kinds of microscopic life, the *helpful* ones and the *harmful* ones. The helpful species of germs are very numerous. Tiny bacteria are responsible for the processes of fermentation, causing bread to rise, cider to change to vinegar, milk to sour, and cheese to "ripen." Bacteria also cause the decay of dead leaves, fallen trees, and other forms of vegetable and animal matter.

Harmful microscopic life, or *disease germs,* are among the worst enemies of mankind. They grow and multiply in many places, spread from place to place in different ways, and use various means to gain an entrance to our bodies.

How Germs Cause Disease:

The conditions of warmth, moisture, and darkness inside the body are favorable to the growth of germs. Unless body resistance is strong, disease germs are very likely to grow and multiply there.

The harmful effects of some disease germs result from the poisonous *toxins* that are produced as they grow. These toxins find their way into the blood stream and often interfere with the work of the heart, brain, and other important organs, causing weakness, discomfort, pain, and often, death. Other disease germs damage the tissues by their growth and development. The germs of tuberculosis destroy the tissue of the lungs or that of any other organ that they attack. Pneumonia germs multiply rapidly in the lungs and promote a congested condition that interferes seriously with the proper working of these important organs.

DEFENSES AGAINST GERMS

Up to the time of Pasteur, the conquest of disease was waged against an invisible and *unknown* foe. Thanks to Pasteur and other scientists that have followed his lead, much of the mysterious origin of disease has been removed and many different disease germs have been identified. New and better weapons have been devised to combat them and more effective methods have been found to prevent their spread. Great progress has been made in the prevention and cure of many diseases, and the future holds great hope that others will be added to the list of known and conquerable foes.

Personal and Public Responsibility for the Warfare against Disease:

In the warfare against the unseen but ever-present germs of disease, everyone must do his rightful share. Some of the responsibility is taken over by "Boards of Health" and other community health organizations. A large part, however, must be assumed directly by every person within the community. The individual needs the protection that a community can give through its powers of compelling obedience to the regulations of its health officials. The community is strongest in its warfare against disease when its members are intelligent in health matters and practice the principles of prevention in a cooperative way. It is especially helpful in work of this type for everyone in the community to know:

1. Where disease germs ordinarily live and grow
2. How germs are spread
3. How resistance to disease can be developed

Disease germs find the best growing conditions of warmth, moisture, and darkness in the bodies of human beings and some of the lower animals. Outside the body, their span of life is variable. Some germs die quickly. Others may live for weeks or months, and a few very hardy ones may survive for years. The disease germs from a typhoid fever patient, for example, often find their way into a well, or stream of water. The water is not favorable to their growth and as a rule they die within a few weeks. In epidemics of typhoid fever from a contaminated water supply, new cases may continue to develop over a period of several months. This is due to the fact that the water constantly receives a fresh supply of the deadly germs from persons in whom they have found favorable conditions for growth Disease germs usually come from a person who is ill. For this reason, human beings have been called their own greatest enemies in so far as the *spread* of disease is concerned.

CHECK THE SPREAD OF DISEASE GERMS

The "travel routes" of disease germs from one person to another are many and varied. For purposes of convenience, these routes can be arranged into three different methods of transmission, as follows:

1. Transmission by *contact,* or coming in touch with something that has disease germs upon it
2. Transmission by *foods,* like milk, meat, and water
3. Transmission by *insects* and *animals*

CONTACT TRANSMISSION OF DISEASE GERMS

Touching things, or coming in contact with things that may contain disease germs, can be made in so many ways that it would be impossible to mention all of them.

The *hands* and *fingers* are frequent offenders in spreading germs. Fingers easily become soiled with germ-containing secretions and excretions of the body. Such germs may then be transmitted to other persons or things that are touched. The fingers and hands are continually picking up dirt and germs from things like door-knobs, car straps, books, money, and articles of clothing. The fingers should not be placed in the mouth. The hands should always be washed thoroughly before eating. Frequent washing of the hands is a sanitary precaution that will help to prevent the spread of disease. The contact of the hands in the friendly handclasp may be the means of spreading germs from person to person, and in times of epidemics of colds or influenza, may constitute a dangerous practice.

CHECK THE SPREAD OF DISEASE GERMS
Wash the hands frequently,—always before eating. Use only individual towels and cups in public places

Articles like drinking cups, towels, and combs that are used by many people favor the transmission of disease germs by contact. Communities often seek to control the dangers that lurk in these articles by forbidding their use in public places. The increasing popular use of individual drinking cups, "bubblers," and paper towels, in schools, stores, and other public places is a sanitary practice with great hygienic benefits.

Do not exchange partly eaten fruits or candies. The secretions of the mouth often contains germs of dangerous diseases which can be carelessly spread in this way.

Be Careful in Coughing, Sneezing, and Spitting:

Coughing and sneezing force little droplets of moisture out of the mouth and nose and spread them over a considerable area. This spray often contains the germs of disease. It settles upon persons, particles of dust, and other objects that come within its range. Form the habit of covering the nose and mouth with a handkerchief when coughing or sneezing.

Spitting carries germs outside the body in the sputum. When the moisture evaporates, the germs are free to blow about on particles of dust, and be picked up by shoes, or anything that comes in contact with them. The only safe way is to deposit the sputum in something that can be burned, or sterilized. Spitting in public places is usually prohibited by law. Posted notices call attention to the dangers of this practice and announce the penalties for violations.

In times of epidemics of respiratory diseases like colds, influenza, or grippe, public health authorities warn people against gathering in crowded and congested places. When conditions become especially serious, as happened in the influenza epidemic of 1918, the authorities compel the temporary closing of theatres, halls, schools, and churches to lessen public contacts.

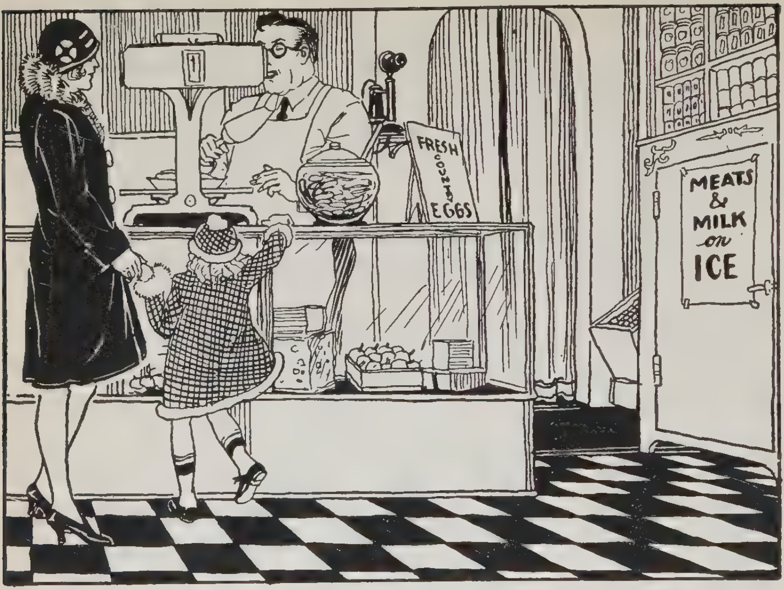
FOODS MAY TRANSMIT THE GERMS OF DISEASE

Many foods are transported long distances and are handled many times in the course of their journey from farm or factory to our tables. Care must be taken to keep them pure and clean at each stage of the journey. Public health departments help greatly in safeguarding the food supply of the community.

Foods should be protected from dust and flies. Disease germs float about on the dust in the air. Flies carry germs on their bodies and feet and leave them on the things they touch.

Milk Needs Especial Care:

Milk is one of our best and most commonly used foods. If produced under unsanitary conditions, it may become a carrier for the germs that cause typhoid fever, diphtheria, scarlet fever, dysentery, tuberculosis, and septic sore throat. The fact that milk is used so much in its raw state makes it especially important to produce, handle, and transport it in a sanitary way. See pages 134-137 for a more detailed discussion of these important topics.



Food should always be protected from dust and flies. Milk and meats need especial care

Pure Water Prevents Disease:

Water is a necessary part of the diet. Several glasses a day in addition to that taken into the body with foods are usually required to replace the fluid which is eliminated by the regular body processes. The fact that water is ordinarily taken into the body in the raw state makes its purity an important factor in the prevention of disease. The matter of a pure water supply in farm and in city homes is presented in Unit IV, pages 125-131.

Other Foods as Carriers of Diseases:

Meat may occasionally transmit disease. One of the infections that can be transmitted to human beings in this way is a tiny worm that is sometimes found in pork. These worms find their way into our intestinal tract and grow and develop there, producing a disease known as "trichinosis." Pork should always be very thoroughly cooked in order to kill any of these animals parasites that may be in it.

If oysters and clams grow in contaminated water, they become sources of infection. Cases of typhoid fever have been traced to shellfish that have been taken from waters polluted with sewage. It is an important duty of State and Federal Health Officials to inspect and test the purity of waters from which these foodstuffs are taken.

Most canned goods are sterilized during some part of their preparation. If the sterilization is not complete, bacteria may grow and render the food unfit for use. The gases that form as the bacteria grow cannot escape and press the ends of the cans outward. Foods from cans in which the ends are rounded outward should not be used.

Careless preparation of foods is sometimes responsible for the germs of "botulism," or "food poisoning," getting into them. This infection is very dangerous. The natural home of these germs is in the soil. Careful sterilizing will render foods safe from this disease. Records show that more cases of botulism come from home prepared meats and home canned vegetables and fruits than from those that are commercially prepared. Great care should be taken in cleaning and sterilizing such foods.

INSECT CARRIERS OF DISEASE

Flies pick up disease germs and leave them on things they touch. Other insects like mosquitoes, fleas, and lice transmit germs by their bite.

The Fly Is a Carrier of Disease:

Flies spread diseases like typhoid fever, diarrhœa, cholera, dysentery, tuberculosis, and scarlet fever. They feed upon waste materials in stables, out-door toilets, and garbage piles, as well as upon the foods in stores, kitchens, and dining rooms. They may pass back and forth between these feeding grounds many times during their busy, active lives, unless precautions are taken to prevent it. Flies carry the germs upon their body, wings, legs, feet, and in their saliva and excretions. Their body and legs are covered with tiny hairs which aid in picking up germs and filth. Their feet are moistened with a sticky substance which enables them to cling to walls and ceilings, but which favors a contact method of transmitting the germs of disease.

Protection Against Flies:

Effective protection against flies includes the elimination of their breeding places, screening of doors and windows, and unceasing destruction of all that succeed in getting past these barriers into our homes. In the spring, "Swat the Fly" campaigns are especially valuable, for each female fly destroyed early in the season prevents many generations of flies before the summer is over.

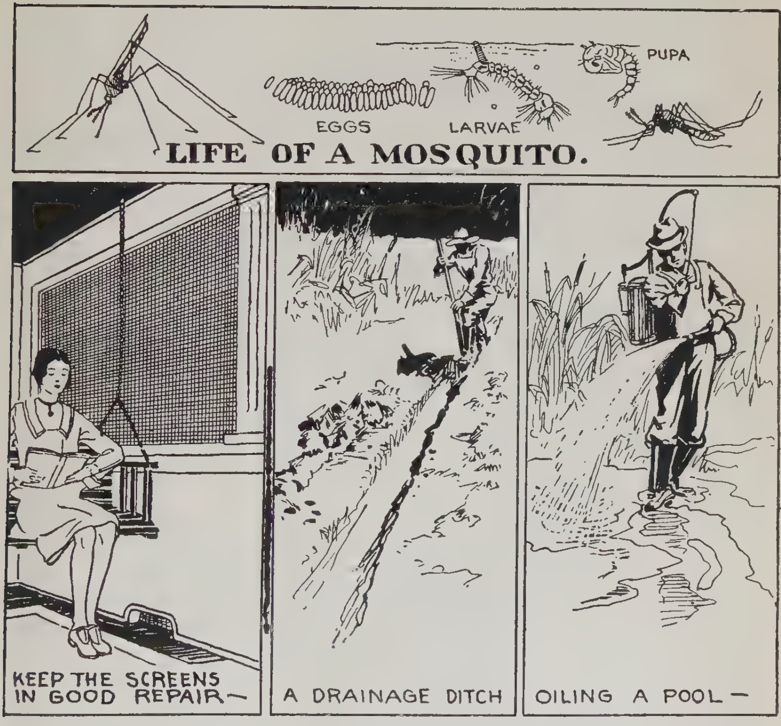
One of the most effective means of keeping flies away is to prevent their breeding. The female fly lays a hundred or more eggs at a time in stable manure, human excreta, garbage, or decaying vegetable matter of almost any kind. In a day or so after the eggs are laid, they hatch into white, worm-like creatures called "maggots." These maggots live and grow in the manure or other substance from four to eight days, when they come to the surface, and a hard, dark case forms about them. This "pupa-case" or chrysalis stage of development lasts from five to seven days longer, when a full-grown, adult, winged fly emerges. Within a couple of weeks, the female fly is old enough to lay eggs for another generation. If conditions are favorable, it can repeat the egg-laying process eight or nine times a season.

Cleanliness helps to prevent the breeding of flies. Keep the premises free from open accumulations of garbage, manure, decaying vegetation, and other substances that might be selected by the female fly as a place for her eggs. Out-door toilets should be carefully screened to prevent flies from using them as breeding-places and as a source of food. The disposal of stable manure is a difficult problem. Manure bins should be fly proof. Manure that is stored for several weeks in tight bins, or containers, will change into a form that is not attractive to flies for egg-laying purposes. The value of the manure as fertilizer is not injured by this process.

PROTECTION AGAINST FLIES

Keep the house well screened. Prevent the breeding of flies—no collections of rubbish or wastes; a tightly covered garbage can

All doors and windows should be screened to keep out flies, mosquitoes, and other insects that annoy and spread the germs of disease. Screens should be kept in good repair and properly used by all occupants of the house.



PROTECTION AGAINST MOSQUITOES
The most effective control measures are directed against the insects while they are still in the water in the larvae, or wiggler stage

Mosquitoes as Carriers of Disease:

The discovery that certain species of mosquitoes transmit the germs of yellow fever and malaria was another landmark in the conquest of disease. These mosquitoes take the disease germs into their bodies when they feed upon the blood of an infected person. The germs pass a part of their own life cycle in the mosquitoes, and are then injected into the blood of other persons that the mosquitoes bite.

Conquest of Malaria and Yellow Fever: Historical records show that people suffered from the chills and fever of malaria in ancient times. Many guesses were made regarding its cause. These included such things as swamps, marshes, and "night air." In fact, the word malaria means "bad air," or "night air." Its cause remained unsolved until the closing years of the 19th Century when the "anopheles" mosquito was clearly shown to be the sole culprit in spreading malaria.

Yellow fever is an extremely fatal disease that can be traced back for several hundred years. Cases were constantly found in the West Indies and other tropical regions of Central and South America. It spread occasionally far up the coast of North America and was carried in sailing vessels to coast cities in Europe. Many causes were suggested and remedies proposed to check it, but without success. Even the mosquito was suspected. It remained, however, for Major Walter Reed, an American medical officer, and his associates, to prove conclusively that the "stegomyia", or "aedes calopus" mosquito was the carrier of yellow fever. The epoch-making experiments that led to this discovery were made in Cuba in 1901, shortly after the Island came under the control of the United States at the close of the Spanish-American War.

The life cycle of mosquitoes is a guide in planning a campaign for their extermination. Mosquitoes lay their eggs in water. In about thirty-six hours, the eggs hatch into larvae, called "wigglers". The wigglers move about freely in the water and breathe air through a little tube that is thrust up through the surface of the water. In six or seven days they change to "pupae" or "tumblers", and after another day or so, full-formed, winged mosquitoes emerge.

The most effective control measures are directed against the insects while they are still in the water in the larvae, or wiggler stage. They include the screening of open water barrels, and other water-containing receptacles, the removal of cans, flower pots, and things in which water collects. Roof gutters should be repaired so that rain water cannot remain in them. In addition to these precautions, stagnant pools and swampy places should be drained, and ditches dug to carry off water that would provide a suitable breeding place. When draining is not possible, oiling the surface of the water is effective. The oil spreads out thinly over the surface of the water and prevents the wigglers from getting the air that is necessary to their life at this stage of their existence.

It was by such measures as these that another American Army officer, Colonel Gorgas, exterminated yellow fever and greatly reduced malaria in Havana, Cuba, shortly after the mosquitoes had been shown to be carriers of these diseases. A few years later, Colonel Gorgas repeated his successes in controlling yellow fever and malaria in the Panama Canal Zone. The sanitary "clean-up" in the Canal Zone made it possible for the white race to live and work there without the ever present danger of yellow fever infection. This contributed largely to the construction and operation of the Panama Canal.

Other Insect Pests That Spread Disease:

Body lice transmit the deadly "typhus fever" by their bites. Typhus fever is a different disease from typhoid fever. It is sometimes called "jail fever", "camp fever", or "ship fever". It spreads rapidly in dirty and overcrowded places. In some of the countries of southeastern Europe during the World War, the overcrowded conditions of refugees and soldiers resulted in outbreaks of this disease. In combating typhus fever, clothing is disinfected and living conditions made more sanitary. The United States and other nations maintain a strict quarantine against the introduction of the germs of typhus fever on ships that come from parts of the world in which the disease exists.

Fleas are wingless insects that live on the bodies of cats, dogs, squirrels, and rats. The rat-flea is the principal carrier of "bubonic plague". Bubonic Plague or the "Black Death" is the terrible disease that swept through Europe in the Middle Ages, destroying approximately one-fourth of the population. It is still found in some parts of the world where crowded, unsanitary conditions of living favor the breeding of the rats that spread the disease.

Hookworm Disease Can Be Prevented:

The *hookworm disease* affects large numbers of people in the tropical and semi-tropical regions of the world. It often stunts or retards the growth of children, makes people feel tired or lazy, and unfits them for work. It is caused by a tiny worm that gets into the body through the skin and lives in the small intestine. The female hookworm lays large numbers of eggs in the intestine. These eggs pass out of the body in the excretions. They hatch in the soil, and the larvae or worms that come from them bore through the skin in order to get into the body of their host. A favorite place for this entrance is through the tender skin between the toes.

Hookworm disease can easily be cured and prevented. First rid the body of the worms by the very simple and effective medical treatment prescribed by public health officers and other medical experts. Prevent infection of the soil by careful disposal of body excretions in sanitary toilets. Avoid going barefoot wherever the hookworm is likely to be found so that it cannot attach itself to the skin.

Rats Are Dangerous Pests:

The rat is associated particularly with the spread of the bubonic plague. The germs of this disease live in the fleas that are found on rats.

Rats are great destroyers of property, the losses running up to hundreds of millions of dollars each year. They annoy the farmer by destroying his crops in the fields and after they are harvested. They destroy things in stores and homes, biting their way through wooden partitions and boxes.

The fight against rats should include a number of protective measures, such as:

1. Extermination of the rats by poisoning, fumigation, flooding, and trapping
2. Shutting out the rats by rat-proofing of homes, out-houses, and business buildings
3. Removing piles of refuse and garbage. Elevating piles of lumber
4. Exterminating rats on ships, and using rat guards to keep rats from coming ashore, and from going from the land to the ships
5. Extensive rat trapping in an area where the bubonic plague exists or wherever infected rats are found

RESISTANCE TO DISEASE

The Body Defends Itself Against Disease:

The conditions of warmth, moisture, and darkness inside the body are favorable to the growth of disease germs. Fortunately for us, the body has a number of ways of resisting germ attacks. This resistance, or *immunity* to disease, as it is often called, varies greatly with individuals. It may be strong or weak, temporary or permanent, natural or acquired.

Sentries of the Body:

Most germs gain an entrance to the body through the mouth and nose. Standing guard at these ports of entry are the moist secretions and cilia of the mucous membrances which line them. Many germs are trapped by them and destroyed by their mild germicidal, or germ-killing power.

Some germs that find their way into the digestive tract are killed by the germicidal action of the digestive juices. Especially destructive to germs is the hydrochloric acid that forms a part of the gastric juice in the stomach.

NATURAL IMMUNITY

The growth of germs is resisted by substances normally found in the blood. These include *white corpuscles, anti-bodies,* and *antitoxins.* If the resistance is strong, the germs are usually overcome and the person is *immune* to the disease. If resistance is weak, the germs may start to grow and multiply.

The White Corpuscles Destroy Germs:

The white corpuscles of the blood are important natural defenders against disease germs. They seek out and attack the germs wherever they are found, passing right through the walls of the blood vessels into the tissues, if necessary. The white corpuscles destroy germs by absorbing them and digesting them. White corpuscles often unite in groups and attack and absorb a number of germs at a time.

In the course of the battle, some of the white corpuscles are killed by the germs. A large part of the pus, or "matter", that forms in and around infected cuts, or sores, is made up of the bodies of white corpuscles that have been overcome in their efforts to defeat the germs. Proper habits of living help to insure a plentiful supply of white corpuscles in the blood stream.

Anti-bodies in the Blood:

The blood also contains substances which have been termed *anti-bodies.* These have been found to aid resistance to disease in a number of ways. Experiments have shown that anti-bodies prepare germs in some way for an easier attack by white corpuscles. They also seem to provide a substance which makes it difficult or impossble for the germs to grow. As long as anti-bodies are present, the growth of the germs is held in check and they remain harmlessly inactive. When they are deficient, the opposition to germ growth is so slight that the germs often multiply very rapidly. In other cases, the anti-bodies are directly responsible for killing dangerous disease germs that have gained an entrance to the body.

Antitoxins in the Blood:

When germs grow, they produce poisons or "toxins" which are circulated about the body in the blood stream. As soon as the toxins appear, the body begins the manufacture of *antitoxins*. These have the power of neutralizing or checking the poisoning effects of the toxins.

The manner in which the body defends itself against disease germs is very complex and is not thoroughly understood. Experimentation is gradually clearing up many of the mysteries which have been connected with this phase of the conquest of disease. The results of these experiments often point out ways by which we can strengthen the natural defenses of the body.

ACQUIRED IMMUNITY TO DISEASE

It had been observed many years ago that persons who once had certain diseases were immune, or protected from a second attack from them. A great advance was made in the conquest of disease when it was discovered that the supply of anti-bodies and anti-toxins for certain diseases could be artificially increased. This is accomplished by the use of specially prepared substances called *vaccines, antitoxins,* and *serums.* One of the first of these to be developed was vaccination against smallpox.

Vaccination against Smallpox:

Before vaccination was discovered, smallpox was one of the terrible scourges of the world. It traveled rapidly from person to person, attacking the rich as well as the poor. Kings and princes were as liable to it as their humblest servants. It is estimated that sixty million people in Europe died from smallpox in the eighteenth century.

The credit for conquering smallpox belongs to an English physician, Dr. Edward Jenner. It had been noticed that dairy-maids who contracted a relatively mild disease called cowpox never seemed to develop the much more dangerous smallpox. In 1796, Dr. Jenner inoculated an eight year old boy with some cowpox virus. Sores developed on the boy's arms and healed with scars like the vaccination-marks on our arms today. This vaccination successfully protected the boy against smallpox.

In a short time, the idea of vaccination spread over Europe and crossed the ocean to America. The first to use vaccination against smallpox in the United States was Dr. Waterhouse of Boston. In 1800, he vaccinated his little five year old son and other members of his family. They resisted smallpox, although cases of it were developing all around them. President Jefferson had his family vaccinated in 1801 and gave great impetus to the spread of this practice in the United States. With this discovery, smallpox took its place among the conquerable diseases. Much of the fear of it had been dispelled.

Dr. Jenner received high honors from the nations of the world for his wonderful discovery. A very interesting expression of gratitude came to him from the American Indians. Along with their gifts, they sent the following message: "Brother! Our Father has delivered to us the book you sent to instruct us how to use the discovery which the Great Spirit made to you whereby the smallpox, the fatal enemy of our tribe, may be driven from the earth. We have deposited your book in the hands of a man of skill whom our Great Father employs to attend us when sick or wounded. We shall not fail to teach our children to speak the name of Jenner and to thank the Great Spirit for bestowing upon him so much wisdom and so much benevolence. We send with this a belt and string of wampum in token of our acceptance of your precious gift, and we beseech the Great Spirit to take care of you in this world, and in the land of spirits."

Everyone Should Be Vaccinated:

Wherever the use of vaccination against smallpox is widely used, the disease seldom occurs. When the United States took possession of the Philippine Islands at the close of the Spanish-American War, there were usually about 40,000 deaths per year from smallpox. Protective measures were begun at once. Over a million persons were vaccinated and the disease was practically eliminated. As the years went by, however, people grew careless about vaccination. By 1918 there were so many unvaccinated persons on the Islands that a severe epidemic took place. It was estimated that 250,000 cases developed and 50,000 deaths occurred before it was checked. Since this epidemic, vaccination has been rigidly enforced and smallpox is practically unknown. It is interesting to note that there were 5,000 vaccinated American soldiers in the Philippine Islands during this epidemic and but one case of smallpox occurred among them, although it raged all around them.

There have been a great many cases of smallpox in the United States within recent years. For the five-year period ending 1928, an average of about 41,500 smallpox cases were reported each year. This large number of cases of a disease that could be entirely prevented is due to carelessness regarding vaccination. Smallpox is often so rare in communities that people fail to recognize its great danger and do not take precautionary measures unless compelled to do so by law. The protection afforded by vaccination may not last a lifetime. If more than seven years have passed since the last vaccination, it should be renewed whenever there is any danger of contracting the disease.

Vaccination against smallpox is compulsory in some places. Many states require it before admitting children to school. Vaccination is neither painful nor dangerous. The scratch of a needle is all that is needed to introduce the vaccine into the body. Great care is taken in producing the vaccine so that there is little danger of any subsequent infection, if the proper precautions regarding cleanliness are taken at the time of the vaccination and during the healing period.

Pasteur Discovers the Principle of Vaccination:

Protection against smallpox by inoculating persons with cowpox virus had been used successfully for many years before Louis Pasteur discovered the reasons that underlie the development of this immunity. In studying a disease of fowls called chicken-cholera, Pasteur found that the germs could be weakened in their power to cause disease. When these weakened germs were introduced into another fowl, they stimulated the manufacture in the blood of substances which protected the fowl against later attacks of more powerful, or virulent germs. Vaccination against smallpox can be explained on this basis. Cowpox is really the form of smallpox that is found among cattle. The cattle resist smallpox so vigorously that the germs become weakened in their struggle for existence. The weakened germs, therefore, cause our bodies to prepare substances which successfully protect us against later attacks of smallpox.

Pasteur also developed vaccines for anthrax and rabies, or hydrophobia. Anthrax is a disease which is generally very fatal to sheep. Rabies, or hydrophobia is transmitted to human beings by the bites of mad dogs and wolves. Its death rate is very high and the disease is accompanied with terrible suffering. In his experiments with rabies, Pasteur succeeded in vaccinating dogs so that they would not contract the disease when bitten by mad or rabid animals. The treatment consisted of a series of about twelve injections, beginning with greatly weakened virus and then gradually increasing the strength of the virus day by day, as the body resistance developed. Pasteur hesitated to try the treatment on human beings because he feared it might cause the disease. It was not long, however, before an opportunity presented itself. A nine year old boy, named Joseph Meister, was attacked on the way to school by a mad dog and bitten many times. Joseph's mother brought him to Pasteur for treatment. Upon the advice of friends, Pasteur consented to try it for the first time upon a human being. He first injected some of the harmless, weakened virus. Day by day, he increased the virulence or strength of the inoculation. Little Joseph continued to play happily among the rooms of Pasteur's laboratory. As the time approached for the last injection of fresh, extremely dangerous virus, Pasteur was much more worried than his little patient. He became so anxious that he could not work. He dreamed many times that the little fellow would die. A letter written by Madame Pasteur at this time gives us an interesting picture of his state of mind. She wrote: "My dear children, your father has had another bad night; he is dreading the last inoculations on the child. And yet there can be no drawing back now! The boy continues in perfect health." There was no drawing back. The last inoculation was given and all of Pasteur's fears proved groundless. Little Joseph Meister remained in perfect health. Rabies, or hydrophobia, had been conquered.

Another case was soon brought to Pasteur for treatment. A fourteen year old shepherd boy named Jupille had bravely protected several smaller companions from a mad dog that attacked them. Jupille overcame the dog and killed him, but was severely bitten in the struggle. Six days after the attack, Pasteur commenced his treatments. They proved wholly successful, in spite of the fact that almost a week had elapsed before they were begun.

The news that a remedy had at last been found for rabies soon spread to all parts of the world. People began to flock to Paris for the protective treatments. Funds were collected and the world-famous Pasteur Institute was erected. Pasteur was greatly touched when little Joseph Meister sent a contribution toward it. Since the Institute has been in operation, thousands of cases of hydrophobia have been treated with very few unsuccessful results.

The protective treatment for rabies has been perfected, but it is essentially the same in principle as when Pasteur discovered it. Vaccines are available almost everywhere and should be used whenever there is any likelihood that rabies might develop.

Statue of Jupille before the Pasteur Institute in Paris, France

Pasteur died in 1895 at the age of seventy-three. He received the highest honors from the nations of the world during his life and as the years go by is increasingly revered as one of the world's greatest benefactors.

Vaccination against Other Diseases:

Since Pasteur's time, vaccines have been developed for additional diseases like typhoid fever, cholera, and the "plague".

Typhoid fever is a germ disease frequently spread in impure water, or milk. The vaccine causes the body to develop protective substances in the blood which resist attacks of the disease. The immunity lasts for only a few years, however, so that it should be repeated whenever necessary.

The practice of vaccination against typhoid fever is increasing as more people realize its value. Soldiers and sailors are vaccinated against it as a routine precaution and typhoid fever among them is rare. During the Spanish-American War in 1898, one American soldier in every twelve contracted typhoid fever. Fifteen years later, typhoid vaccination was begun, and by the time of the World War it was a routine matter in the army. As a result only one in every thirty-seven hundred (3700) American soldiers acquired the disease, although they were often forced to live under conditions that were favorable to its development.

few drops of toxin under the skin. After about twenty-four hours, a competent physician can tell from the appearance of the skin whether the protective toxin-antitoxin treatment is needed.

The regular practice of health habits is one of the best methods of increasing body resistance to disease

STRONG BODY RESISTANCE AND HEALTH

The regular practice of health habits is one of the best methods of keeping body resistance as strong as possible. Exercise, sunshine, and fresh air are valuable. Proper food and regularity in elimination of body wastes are extremely important. Personal cleanliness is a valuable safeguard against the entrance of disease germs into the body. Rest and sleep are needed for the growth and repair of the tissues.

How Resistance to Disease Becomes Lowered:

Neglect of health habits lowers resistance to disease. Worry, unhappiness, and discontent interfere with the strength of the body's defenses against disease. Such conditions often produce nervousness, make one cross and irritable, and interfere with digestion, rest, and sleep.

Worry over becoming sick, or getting well, is a great handicap to the doctor and the patient, and may lessen the chances of recovery.

Overwork causes a drain upon the strength and energy. It usually leaves the body weak and poorly prepared to offer a strong fight against disease.

Avoid wet feet and continued exposure to cold. The rapid loss of body heat at such times often gives the germs a chance to grow, and with the body in a weakened condition, they may develop faster than the natural defenses of the body can overcome them. The use of alcohol and tobacco lowers resistance to disease. These substances interfere with many of the processes of the body, and often permanently injure important organs.

PRACTICAL APPLICATIONS

For Effective Study:

1. Name two great turning points in the conquest of disease.
2. What are germs? Describe some of the characteristics of germs.
3. Describe three common means of transmission of disease germs.
4. What precautions should be taken to check the spread of disease germs?
5. How do germs cause disease?
6. Name some insects that transmit disease.
7. Name the germ-enemies that are normally found in the blood.
8. What are toxins? What are antitoxins?
9. What is meant by immunity to disease? How may it be acquired?
10. How may body resistance to disease be strengthened? What things tend to lower it?

For Observation or Investigation:

1. Describe Louis Pasteur's contributions toward the discovery of the true nature and effects of germ life?
2. What conditions favor the growth of germs?
3. What conditions will destroy germs?
4. How do germs reproduce, or multiply?
5. Explain the dangers from common drinking cups and towels in public places. How may these dangers be avoided?

6. What is meant by the statement on page 79, that "Human beings have been called their own greatest enemies in so far as the spread of disease is concerned"?
7. Describe the life cycle of flies and mosquitoes and explain how a knowledge of this is an aid in the control of these pests.
8. Describe an effective program for the elimination of hookworm disease from a community.
9. Investigate the benefits that have been derived in communities from which this disease has been eliminated. Public Health Reports often contain such material.
10. What is the difference in meaning between *natural* and *acquired* immunity?

For Health Habit Formation:

1. Avoid placing the fingers in the mouth.
2. Wash the hands before eating or preparing food.
3. Use only your own cup, comb, brush, towel, and wash cloths.
4. Cover the nose or mouth when coughing or sneezing.
5. Observe the law against spitting.
6. Avoid crowds in times of epidemics.
7. Buy clean food from clean stores where the people who handle it are clean and observe the laws of cleanliness.
8. Be sure that home prepared meats and home-canned vegetables and fruits are properly sterilized.
9. In rural districts—
   Store manure in fly-proof bins.
   Protect garbage and waste from flies.
   Screen out-door toilets.
10. In the city—
    Keep the back-yard clean.
    Keep the garbage can covered.
11. Keep the house well screened in summer and kill all flies and mosquitoes that get inside.
12. "Swat the Fly" (especially in the spring).
13. Protect the home from rats and other vermin.

14. Practice regularly health habits connected with:
   (a) Exercise, sunshine, fresh air
   (b) Proper food and proper elimination of body wastes
   (c) Rest and sleep
   (d) Personal cleanliness

15. Avoid—
   (a) Worry, unhappiness, or discontent
   (b) Overwork, or other excesses
   (c) Alcohol and tobacco
   (d) Wet feet, or continued exposure to cold

16. Consult your doctor regarding vaccination and inoculation for yourself and others.

17. All young children should have the "toxin-antitoxin" treatment for diphtheria unless the "Shick Test" has shown conclusively that they do not need it.

UNIT IV

A WORKING TOGETHER FOR HEALTH

COMMUNITY HYGIENE

A feeling of security is a great aid to comfort and happiness. It is strongest in places where the people are properly safeguarded. In such communities, police departments are organized to protect against those who seek to rob and destroy. Fire departments are equipped to hold the great destroyer, fire, in check. Local, state, and national *public health departments* combat invisible germ enemies that are always alert to invade our bodies.

Public Health Services:

Defense against communicable diseases has long been a cause for community interest in matters of health. *Quarantine* was one of the earliest forms of public health work. The word, *quarantine,* is from the Latin and means a period of forty days. It goes back to the time of the Romans who detained incoming ships and crews for forty days in an effort to keep out the "plague".

After Pasteur's discovery of germs as a cause of disease, community interest in health greatly increased. This interest has grown until, today, huge sums of public money are spent in protecting the health of the people. Such work covers a wide variety of activities. Quarantine is enforced against communicable diseases like smallpox, scarlet fever, diphtheria, measles, whooping-cough. Sanitary engineers are engaged to construct systems for supplying pure water and for the safe disposal of sewage. Provisions are made for studying diseases and experimenting with methods for their prevention and control. Efforts are made to interest the members of the community in health problems. Large numbers of health booklets and pamphlets are prepared and distributed. Newspaper and magazine articles are published, and the radio is utilized in the work. Campaigns against dirt, flies, and mosquitoes are organized and vigorous attempts made to popularize them.

Public health work in the United States is organized on a local, state, and national basis. Many inter-connections and inter-relationships exist among these units. In a general way, however, towns and cities, townships and counties exercise a watchful care over the health of their people through Local Boards of Health. The State Board of Health seeks to unify the work of the local authorities, and promote the well-being of all the members of the Commonwealth. The National, or Federal Government, is particularly interested in preventing the entrance of disease from abroad, and in interstate problems of health.

The National Government and Health:

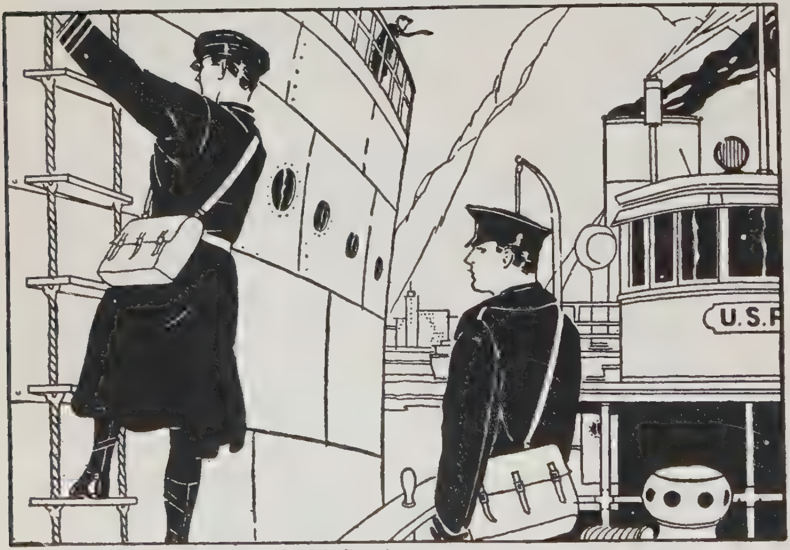
The health activities of the national government cover a wide range of interests and are scattered through a number of departments.

The most extensive health work is performed by the United States Public Health Service of the Treasury Department. The work of this branch of the government dates back to 1798 when the "Marine Hospital Service" was organized to provide medical care for sick and disabled sailors. The name was changed to the "Public Health and Marine Hospital Service" in 1902, and in 1912, it became the "United States Public Health Service", its present designation. Its powers and duties have been extended by acts of Congress from time to time, and include the following:

1. *The protection of the United States from disease from without:* Incoming ships are stopped at the "Quarantine Station" of the port and boarded by United States Public Health Service Inspectors. Passengers and crew are examined for signs of communicable diseases like smallpox, yellow fever, plague, cholera, trachoma. Precautions are taken to prevent the introduction of disease in this way. Immigrants are given rigid health examinations before being admitted. In many cases, immigrants are also examined by United States health officials before they leave foreign ports for this country. This practice has many advantages.
2. *The prevention of the spread of disease in the United States:* All interstate traffic is closely supervised. Drinking water on trains and boats

is analyzed and required to meet healthful standards of purity.

3. *The provision of medical service and hospital treatment* for merchant seamen, and all who have ever served in the armed forces of the United States. Numerous hospitals and sanitoriums are maintained for these purposes.
4. *Cooperation with local and state boards of health:* Experts in the United States Public Health Service are always ready to help local or state officials in checking epidemics or solving special health problems that may arise.



Courtesy, U. S. Public Health Service.

PROTECTION OF THE UNITED STATES FROM DISEASE FROM WITHOUT

Inspectors of the United States Public Health Service boarding an incoming ship at a "Quarantine Station"

5. *The conduct of research into the causes of disease:* This work is centred around the Hygienic Laboratory in Washington, D. C. The conquest of disease has been greatly advanced by the efforts of the research workers of this department. Valuable discoveries have been made in the control of such diseases as yellow fever, hookworm, pellagra, cholera, measles, Rocky Mountain spotted fever. Scientific studies are also carried on in connection with milk protection, pure water supplies, sanitary disposal of wastes, and stream pollution.
6. *The supervision of the manufacture of vaccines, serums, and antitoxins:* Purity is one of the first essentials for these preventives of disease. They must also be of uniform strength and quality so that a physician can determine accurately the amount that is being used in any particular case. The high standards that are set up for the manufacture of smallpox and typhoid vaccine, diphtheria antitoxin, and similar preparations should encourage us to make the fullest use of them.
7. *The education of the public in matters of health:* Information on a wide variety of topics is prepared for free distribution, or sold at a trifling cost. Weekly summaries of existing diseases throughout the United States are sent to local and state boards of health so that any dangerous developments may be discovered and checked at the start. The radio is often used to carry health messages directly to the people.

The Department of Agriculture is especially concerned in the sanitary production, handling, and distribution of foods. It aids the farmer in combating insect enemies of plants and animals. It seeks to protect the consumer by administering the "Pure Foods and Drugs Act." This law requires the producer or manufacturer to state clearly upon the label whether the product contains preservatives, artificial coloring materials, drugs, narcotics, or adulterations of any kind. It does not necessarily guarantee the purity of the product, but protects the user from fraudulent misrepresentation of the products that are sold in interstate trade. References to national and international pure food laws can be found on the labels of many foodstuffs that we purchase.

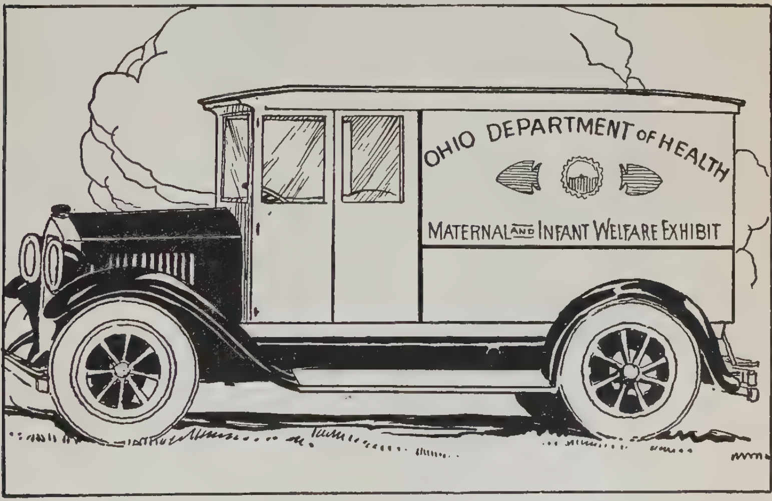
The Department of Labor carries on work in child hygiene. It conducts research into the causes of infant and childhood diseases. It publishes valuable information on child care. It seeks to interest local communities in problems connected with the welfare of their children.

The Bureau of the Census, in the Department of Commerce, collects records of births and deaths. These "vital statistics", as they are called, are organized in different ways to show trends in these important matters from year to year.

The Office of Education, in the Department of the Interior, is interested in healthful school conditions, and in the welfare of the school children of the nation. The Post Office Department exercises a watchful care over things that are sent through the mails. It prosecutes those who use the mails to advertise, or sell, harmful or fraudulent remedies.

State Interest in Public Health:

Health matters within a State are usually controlled by a State Board of Health. This unit consists of a Director, or Commissioner, and several members. It is organized into departments, with an expert at the head of each.



Health Cars Are Used in Many States

Some Health Cars carry exhibits to arouse interest in health. Some are equipped so that the doctors, dentists, and nurses that travel with them can give health examinations and health advice to persons who might not otherwise be able to obtain them.

The duties of the State Boards of Health vary somewhat among the States, but in a general way, they may be outlined as follows:

1. *Supervision of local boards of health:* State authorities usually check the enforcement of state health regulations by the local officials.
2. *Establishment of uniform rules and regulations* throughout the State regarding matters like milk, water, and other food supplies, sanitary disposal of sewage and wastes, and housing conditions.
3. *The Control of Epidemics:* State health officials should keep a close watch upon communicable diseases and send reports regularly to local boards of health. Whenever there is danger of a spread of disease from one community to another, the State should take control of the situation and check the disease as soon as possible. The conditions surrounding epidemics of disease should be studied by the State, and precautions taken to prevent similar outbreaks in other communities.
4. *Registration of Births and Deaths:* The handling of the "Vital Statistics," or registration of births and deaths within a State, is usually centered in the State Board of Health. This insures uniformity in the information that is obtained and results in a complete record of these significant events within the State.
5. *Interest in Child and Maternal Hygiene:* The State should take the lead in matters concerning the health of infants, children, and mothers within the Commonwealth. This work can often be successfully carried on by the local health

Safeguarding Public Health

In many states signs are posted to indicate to strangers that the water is safe to drink

workers, but the State Department must often create interest in it and point out its needs and its advantages. Where local authorities are not equipped to do it, the State ought to assume its direct control.

6. *Maintenance of Public Health Laboratories:* The State should provide facilities in which tests can be made in order to detect the presence of disease germs in milk, water, and other foods. It should assist physicians in making analyses that are often necessary in order to detect the presence of certain diseases. It should conduct research of its own into problems connected with the health of the citizens of the State.

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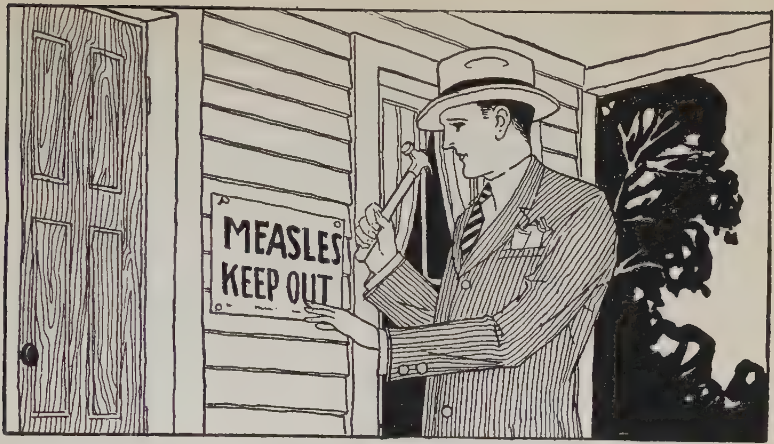
7. *Conduct of Publicity Campaigns:* The State should take an important part in educating the public in health matters. It should receive reports from all parts of the State, and should study the facts and figures contained in them, and send out warnings whenever necessary. Advice appropriate to the season of the year should also be published, including such things as precautions to prevent spread of colds and grippe in winter, avoidance of sunstroke in summer, and seasonal advice regarding diet and clothing.

Local Public Health Control:

Local Boards of Health are usually organized in towns and cities, and in the local political units like townships, districts, or counties. Local Boards of Health differ in the extent of their work according to the size of the community, the amount of money the public is willing to appropriate for the work, and the interest of the people in matters of health. Some of the duties of the local health department are prescribed by the State. If the State law imposes a quarantine for certain communicable diseases, the local officials are obliged to establish it and see that its requirements are obeyed. If the State requires milk to be pasteurized, the local community provides for its enforcement. Health practices that are not directly specified by the State are often done voluntarily by the local authorities in the interests of community welfare.



Local Board of Health Official
Establishing a Quarantine for a Contagious Disease

The health work of local Boards of Health in progressive communities will be found to include many of the following activities:

1. *Recording of Births and Deaths:* The local health officials should attempt to get as complete a registration of births and deaths as possible. Copies of these records are usually forwarded to the State Health Department, where helpful summaries and reports are compiled and published.
2. *Control of Communicable Diseases:* Communicable diseases should be watched for signs of spreading, or becoming "epidemic". Isolation and quarantine measures should be established and enforced. Sources of infection should be traced and controlled.

3. *Sanitation:* The water supply should be frequently tested to prevent the spread of disease in this way. The disposal of sewage, garbage, and other wastes should be supervised. The actual construction of water supply and sewage disposal systems is usually handled by the Public Works or other departments of the local government. The Health Department, however, should give expert advice regarding the safety of the systems that are constructed. It should keep a constant check upon the quality of the service that they render the people of the community.
4. *Milk and Food Inspection:* Milk is usually required to meet certain standards of cleanliness, purity, and quality, before being delivered to the consumers. Food producing establishments should be kept in a sanitary condition and all who handle food should be free from communicable diseases. Local health officers must see that all regulations concerning these matters are properly enforced.
5. *Housing:* The housing conditions of a community have a direct relationship to the health of the people. Germs thrive in dirt, filth, dampness, and lack of sunshine. Crowded, unsanitary living conditions favor the spread of epidemics. On the other hand, clean, well-built homes, greater amounts of fresh air and sunshine are unfavorable to germ life. They likewise help to increase body resistance to disease. The local health authorities should assist other city departments that have a part in the control of housing conditions. Permits should be refused for the erection

of buildings that do not measure up to highly satisfactory sanitary standards.

6. *Infant Welfare and Child Hygiene* have an important place in local community health work. It is the purpose of this work to advise and assist parents in the proper care of their children. "Baby Clinics" or "Baby Welfare Stations" such as that illustrated on page 164 are doing fine work in helping young children to pass successfully through this very dangerous stage of their existence.
7. *Establishment of Clinics:* Many local health departments maintain clinics where persons may receive advice and treatment for diseases like cancer, tuberculosis, heart disease, and others.
8. *Publicity and Education of the Public:* The public should be kept advised of the work and accomplishments of the local health department. If a feeling of pride in the local department can be developed, greater support will usually be given by the citizens. Newspapers, magazines, booklets are all useful for this purpose. Lectures by members of the health department are helpful in instructing the public in health matters. The radio is a very valuable aid in many communities.

THE WATER SUPPLY AND HEALTH

Water is one of the great necessities of life. All living things need it in order to exist. In an earlier chapter on "Foods", we learned that the body is approximately two-thirds water. The blood is largely water. Many tissues and organs contain considerable water, and even bones are more than one-third water. Water is constantly being lost to the body. Two to three pints a day are lost as perspiration. Some water leaves the body as vapor in expired air. More is eliminated with the urine and other body excretions. These losses must be made up by drinking several glasses a day in addition to that which is obtained in our foods. As water is ordinarily taken into the body in a raw state, it is especially important that germs of disease are not transmitted in this way.

Water is essential to cleanliness. Water is an excellent solvent of many substances and has innumerable uses in industrial operations. It is one of the most widely used substances in the world.

Sources of Water:

The moisture that falls as rain or snow is the original source of our water supply. Some of this moisture evaporates and returns directly into the air as vapor. The remainder sinks into the ground, or runs off into pools or streams.

Water from Wells and Cisterns:

In isolated houses and in many towns and villages, each home has a cistern or well. Rain water is often collected in cisterns or barrels and stored for later use. The water that disappears into the ground is often obtained by sinking a well until the water level is reached. Precautions that help to insure the purity of the water supply from such sources are discussed more thoroughly in the next chapter. Public health officials often include among their duties, the inspection and testing of the water supply in private homes. The laboratories of the Board of Health will analyze samples of water for any person who wishes to learn of the purity of a particular water supply.

Town and City Water Supply Systems:

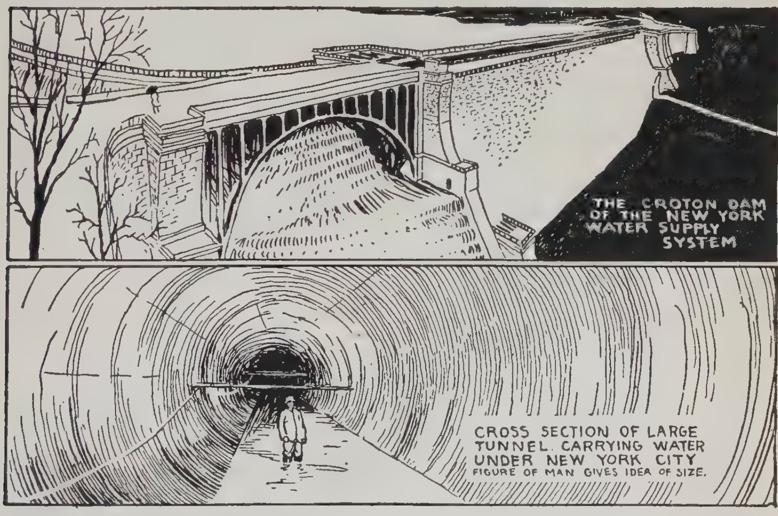
A large part of the water that falls from the clouds runs off the surface of the ground into streams or into natural or artificially constructed lakes or reservoirs. This run-off, or surface water, forms the chief source of many town and city water supplies. It is pumped from these sources through pipes or water mains into the homes of the people.

Surface water is liable to pollution from impurities of many kinds. Sewage and industrial wastes are often poured into rivers and streams. Human excreta may get into streams from houses located along their banks. The fact that water is usually taken into the body in a raw state makes its purity an important health consideration. The responsibility for the purity of a public water supply rests upon the governing officials. There is little that the private user of the water can do to test its purity. He must depend upon the ability and watchfulness of the public health department in this important matter.

The problem of a satisfactory city water supply is a long standing one. The ancient Romans once obtained their water from the polluted Tiber River. They sensed the need for purer water and built great aqueducts of stone to bring water from purer sources back in the hills above the City.

Modern cities often spend huge sums to secure a safe water supply. Many years ago, New York City planned to bring water from the Croton River, about forty miles from the city. A dam was built and an artificial lake, or reservoir was formed. The water was brought into the city through an aqueduct. As the city increased in population, this supply became inadequate for all its needs. Another source was obtained, far back in the unpolluted streams of the Catskill Mountains, some one hundred and twenty miles from the city. The great aqueduct that carries this water into the City of New York is laid underground, passing far below the bed of the Hudson River at Storm King Mountain. At one stage of this long underground journey from the mountains to the city, the water is aerated by forcing it out of little fountains into the air. This helps to remove any unpleasant odors it may have obtained within the aqueduct. Reservoirs are built at places along the aqueduct, so that a reserve supply will be available if anything should interfere with the main source.

Many cities take their water supply from rivers and streams that are open to pollution from sewage and industrial wastes. In such cases, the water is usually filtered and purified before it is used. Philadelphia, for example, takes a large part of its supply from the Delaware River. Before it is pumped into the water mains, it is filtered by passing through layers of sand. It is further purified by the addition of a substance like chlorine which kills any germs that may not have been removed by the filtering process. Frequent tests are made to make sure that the filtered water is safe to drink.

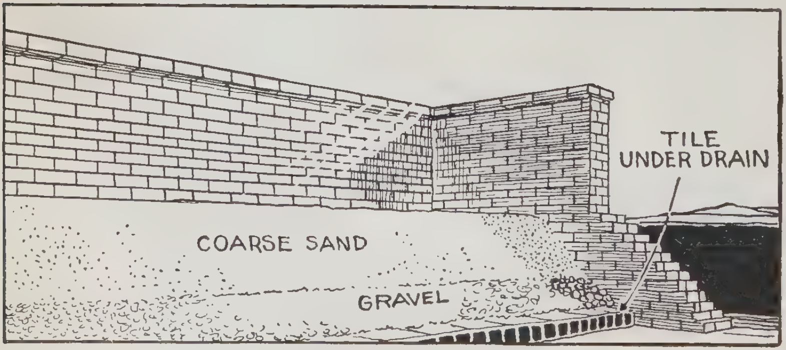


Cities Spend Vast Sums of Money to Provide a Safe and Plentiful Water Supply

Where water is scarce, cities often spend large sums to secure an ample supply. The City of Los Angeles in California, for example, obtains water from mountain sources, some three hundred or more miles distant from the city. Huge aqueducts are constructed to bring the water from these places into the city. Care must be taken to prevent contamination at any stage of this long journey.

How Water Is Purified:

A sand filter usually consists of a bottom layer of hollow tiles to carry off the filtered water. Over the tile is placed a layer of coarse gravel and upon this a deeper layer of coarse sand. About four feet of water is run in on top of the filter. A growth of tiny, harmless plant and animal life that forms about the grains of sand helps to enmesh, and destroy disease germs and other impurities as the water slowly passes through the filter. When the surface layer of



Cross Section of Sand Filter

sand gets so thick from this growth and collected impurities that the flow of water through it is hindered, the water is run off and the top layer of sand removed and cleaned. The cleaning is repeated as often as necessary, until the top layer of sand is reduced to a thickness of about twelve to eighteen inches. When this occurs, the sand which has been removed and cleaned is returned and the filter built up again.

Before the filtered water is distributed throughout the city, it is often purified by adding a disinfectant to it. Chlorine is the usual germ-killing substance that is used. So little chlorine is needed that there is practically no taste imparted to the water by this treatment.

SANITARY DISPOSAL OF WASTES

The germs of diseases like typhoid fever, cholera, diarrhœa, and dysentery leave the body of the patient in the excretions. They are often spread from person to person in the water supply. The sanitary disposal of body wastes, therefore, becomes an important public health problem.

Sewage Systems in Towns and Cities:

Towns and cities build sewage systems for the disposal of wastes. These systems begin with an outlet pipe from each house. The sewage is then gradually collected into larger and larger underground drains and sewers until it reaches the final outlets.

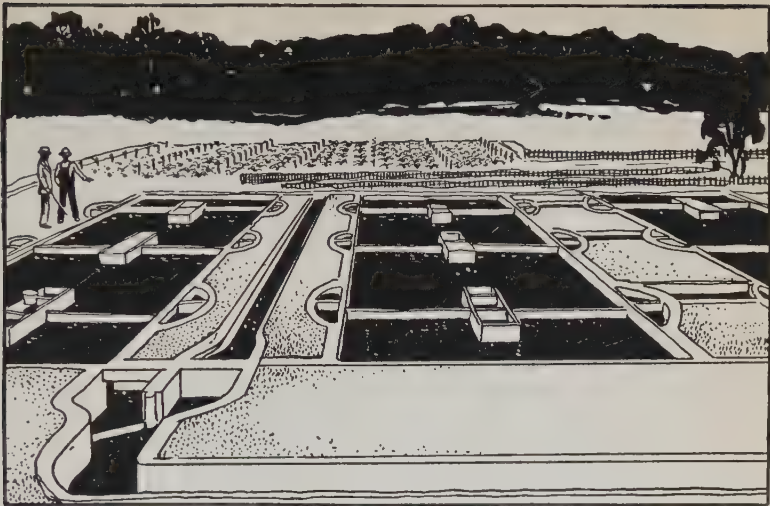
Methods of sewage disposal vary. In some cases, sewage is emptied into a nearby lake, river, or other stream of water. If the body of water that receives it is large enough and the amount of the sewage is not too great, the wastes are so diluted that they do not become a menace to health. The oxygen and bacteria in the water act upon the organic matters in the sewage, decompose them, and render them harmless. Sunlight also helps to kill the disease germs. If the volume of sewage is too large, it may not be rendered harmless. It becomes a nuisance from the odors that are formed and a menace to health from the disease germs that may be present in it.

The most sanitary methods of sewage disposal in isolated homes are discussed in the next chapter, pages 147-150.

Sewage Disposal Plants Are Needed:

There are several ways of treating sewage to make it harmless before emptying it into a stream of water or disposing of it in other ways. Trained sanitary engineers should study local conditions carefully before deciding upon the best methods for use in any particular community.

Most sanitary sewage disposal systems utilize the action of oxygen and bacteria to decompose the organic matter in the sewage. The sewage may be emptied into tanks or reservoirs, where the solid parts settle to the bottom and slowly decompose.



MAKING SEWAGE SAFE

The liquid part is sprayed over the surface of the filter bed. As it slowly trickles through the filter, the organic wastes are decomposed and rendered harmless.

This solid part, or "sludge", as it is called, is removed from time to time, dried and burned, buried, or disposed of in other ways. The liquid part can be rendered harmless by further purification by disinfectants. One of the most successful methods of rendering sewage harmless consists of filtering it through coarse gravel, cinders, or crushed rocks. The liquid is sprayed over the surface of the filter bed. As it slowly trickles through the filter, the organic wastes are decomposed and rendered harmless. The spraying insures a plentiful supply of oxygen in the liquid and the open, porous nature of the filter allows ample surface for the growth of the harmless bacteria that decompose the sewage. As a final precaution, chlorine is often added to the liquid that flows out of the filter before it is emptied into the stream that carries it away. This will kill any disease germs that may not have been destroyed by the action of the filter.

MAKING MILK SAFE

Milk is an excellent food. It contains varying amounts of all the food elements the body needs. It is also a good food for germs. Care must be taken at all stages of its production in order to prevent the spread of diseases like typhoid fever, diphtheria, scarlet fever, and tuberculosis.

Producing Safe Milk:

Public health officers should insist upon high standards of purity and cleanliness in the production of milk. All cattle should be tested for tuberculosis because the germs of this disease can be transmitted in milk. Diseased cattle should be eliminated from the herd in order to safeguard the consumers of the milk.

The cowyard should be properly drained so that the cows will not become covered with mud and dirt on their way into the barn. The inside of the barn should be clean, light, and airy.

MAKING MILK SAFE
Care must be taken at all stages of milk production, transportation, and handling

Before the milking is commenced, any dirt that might fall into the pail should be brushed off the cows, and their udders wiped with a clean, damp cloth. The milkers should be clean and free from disease. A small-top milking pail should be used in order to lessen the amount of dirt that might get into the milk. All utensils used in the dairy should be sterilized and kept scrupulously clean.

Safe Storage and Transportation of Milk:

The correct storage of milk is important. The warm milk from the cow should be rapidly cooled to about 50° F. or lower to prevent the growth of bacteria in the milk.

One of the best means of keeping milk safe is the process of *Pasteurization.* This consists in heating it to a temperature of from 142° to 145° F. and holding it at that temperature for about thirty minutes. It should then be bottled immediately and cooled to 50° F. or lower and kept cool until used. This protective treatment destroys disease germs that may be in the milk, but does not injure its food values.

Another important duty of public health officers is the supervision of all persons connected with the production of milk. Persons who develop typhoid fever, diphtheria, or scarlet fever often harbor the germs of these diseases for long periods after their recovery. Such persons should not be allowed to handle milk at any stage of its production. In sanitary dairies, the employees are regularly subjected to health examinations.

State health officials often use score cards to rate dairies, creameries, and city milk plants. They take into account the cleanliness of production, the number of bacteria in the milk, the amount of butter fat, dirt, and other substances in it. Tests of this kind require the services of a laboratory and trained employees. In some cases, the milk producers themselves set up high standards of production to which they all agree. Trained field workers visit the farmers and show them how to conduct their dairies in a sanitary way. In order to enforce the rules, no milk is purchased from producers that do not comply with the standards that are adopted by the group.

It is only by constant watchfulness over the production of milk that epidemics of typhoid-fever and other milk-borne diseases can be prevented. Many such epidemics have been directly traced to isolated farms where typhoid germs were found.

PRACTICAL APPLICATIONS

For Effective Study:

1. What were some of the public health developments that followed Pasteur's discovery of germs as a cause of disease?
2. Name some of the health activities of our national government?
3. Tell briefly some of the work done by each of the various departments of the national government that deal with health activities.
4. Name some of the types of health work that are done or should be done by state governments.
5. What is meant by a "local" board of health?
6. What work should be done by a local board of health?
7. What measures are taken by cities to protect their water supply?
8. By what means do cities dispose of their
   (a) Garbage?
   (b) Sewage and other wastes?

For Observation or Investigation:

1. What is meant by "public health"?
2. Find out what the government of your own state is doing for the health of its communities. Is there anything that should be done which is not being done? If so, find out "why."
3. Who are the officers and members of your local board of health? What regulations are made by your local board of health for the benefit of the community?
4. Where does your drinking water supply have its origin? Is there any danger of its being contaminated? What measures are taken to insure its purity?
5. What is the best method of disposing of sewage or waste?
   (a) for cities?
   (b) for rural (country) districts?
6. Why is the purity of the milk supply so very important?
7. What measures are taken to insure the purity of milk?
8. Name some of the ways in which you can aid the local board of health in promoting the welfare of your community.

For Health Habit Formation:

1. Co-operate with your national, state, and local governments in raising the standards of public health.
2. Help to create sentiment for public health measures by being conscientious in observing them, and by speaking in their favor to those who do not understand.
3. Assist your local board, even at the cost of personal inconvenience, in carrying out its regulations and recommendations.
4. Read articles on public health in newspapers, periodicals, and books. Many people subscribe to a good health magazine. (Your doctor can recommend one).
5. As a good citizen, be public-spirited rather than selfish-minded, in your support of measures for raising the standards of health. Be willing to make sacrifices.

HEALTH IN HOME AND SCHOOL

The home is an important influence in our lives in many ways. Fortunate are those who receive in the home an enduring interest in mental development, an example of high moral character, and an intelligent training in proper habits of living.

A Suitable Location for the House:

The ground upon which the house is built should be elevated enough to insure a freedom from dampness and mosquitoes. The house should be placed so that the surface water will run away from it rather than toward it.

Sunlight is essential to health. The house should be situated so that it will receive a maximum amount of sunlight during all seasons of the year. In the northern hemisphere, a house that faces the southwest will receive more sunshine on the shorter days of the year than one placed directly north and south.

A freedom from nuisances is desirable. Noises interfere with rest and sleep. Fumes and odors contaminate the air and such localities should be avoided.

Building Regulations: Communities often protect the health and safety of householders by setting up certain restrictions and regulations that relate to building construction. Many of the regulations refer to the lighting, ventilation, and sanitation of apartment houses, hotels, and tenements in which numbers of different families are housed. Restrictions are placed upon individual home builders so that their health and that of their neighbors is protected. Many communities have adopted "zoning regulations". These result from planning in advance, and set aside certain areas for business purposes and other sections for strictly residence uses. They often restrict the height of buildings so that too much sunlight will not be shut out of neighboring structures. Such regulations are enforced by requiring permits to be obtained for all new constructions and for repairs and alterations that cost over a certain amount.

HEAT REGULATOR ON WALL — CONTROLLING FURNACE

Heating and Ventilating the Home:

It has been found that the temperature, moisture content, and movement of air have important effects upon our health and comfort. The control of air temperature includes problems of heating and ventilating. When air falls below a healthful living-room temperature of 68° to 70° F. more heat can be added. If the air becomes too warm, windows can be opened and the excess heat displaced by cooler air which flows in from the outside.

Heat may be supplied from stoves or furnaces in the form of hot air, steam, or hot water heat. Each form of heating has its advantages. Hot air heating systems are usually cheapest to install, but great care must be taken to prevent dust from being circulated about the house with the heated air. Steam will heat a house more rapidly than hot water, but its heat is reduced rather quickly when the furnace fire is dampened off. Hot water heat is not as hot as steam, but it is more even and steady in its effects.

It is very difficult to control the amount of moisture which the air within our homes contains. This is especially true when the weather is cold. Writers have referred to the indoor conditions of American homes in cold winter climates as our great "Indoor Deserts". Excessively dry air is harmful to health. It dries up the moist, mucous linings of the respiratory passages and thus paves the way for colds, and other respiratory infections. The control of moisture in the home is a difficult problem. Pans of water are often placed on heaters and radiators so that the air can get some additional moisture as the water evaporates. Many gallons of water must be evaporated daily when the outside temperatures are very low. It is helpful to keep a window open somewhere in the house so that the cool, moist outside air can modify the indoor dryness. Magazine articles from time to time describe plans that persons have devised to moisten or "humidify" indoor air. It is possible that some device will be found that will interest and satisfy the needs of persons in every locality.

Air movement may be secured by opening windows at the top and bottom. A window open at the top and bottom creates a better circulation of air than if open only at the top or the bottom, but does not insure the comfort of the occupants of all parts of the room. The circulation of air is much better if an outlet is provided on the opposite side of the room.

Lighting for the Home:

Natural light is sunlight. Plan to admit as much sunlight as possible at all seasons of the year.

Artificial lighting has made great advances in the last few generations. Electricity is available even in quite remote places. Kerosene and gas are also extensively used. Electricity, however, is the most adaptable form of lighting and does not consume oxygen from the air like kerosene and gas.

Good Home Lighting for Reading and Other Close Work

Indirect Lighting in an Auditorium. Lights Are Hidden

Floor and table lamps should be freely used for reading, sewing, and other forms of close work, because it is easier to place them in positions where there is no glare or shadow.

Indirect lighting methods are often used to protect the eyes from the glare that comes from looking directly at the electric bulb. A place is lighted indirectly when the bulbs are not visible and the light is reflected from walls or ceiling. See drawings above.

Pure Water for the Home:

Several different methods are used in obtaining the water supply for individual and community uses. In some places, roofs of buildings are constructed so that the rain that falls upon them will drain off into barrels or cisterns. A few precautions should be taken to preserve the purity of this rain water. The surface of the roof should consist of a material that will not dissolve in the water that falls upon it. Between storms, dust and dirt will settle upon the roof. The drain pipes should be equipped with a two-way valve, so that the first flow of water that washes off this dust and dirt cannot find its way into the storage tank. If the cistern is placed underground, especial care should be taken to keep all sewage and waste water from draining into it. The water containers should be properly screened and covered to keep out dirt, insects, and small animal life. The containers should be scrubbed and disinfected occasionally to keep them clean and pure.

Ground water is obtained in many homes by sinking a *well* until the water level is reached. If pure water is found close to the surface, a shallow well will be all that is necessary. The underground water will collect in it and then can be pumped out as needed. The location of a well in relation to other buildings is of great importance to health. The well should be situated where both surface and underground drainage from house and barn will be *away* from the well and *not into* it. Shallow wells should be lined with stone, brick, or other suitable material. The stone lining should extend a little above the ground in order to prevent surface water from flowing into the well. The well should be tightly covered to keep out dirt and other contaminating things. See diagrams on page 146.

If the water is located far below the surface of the ground or a shallow well proves unsatisfactory, the deeper "ground water" may be obtained by means of an *artesian well.* In sinking an artesian well, a hole a few inches in diameter is drilled into the ground and a pipe driven down. When the proper depth is reached, the water either forces itself out of the pipe or is pumped out. Such wells often extend hundreds of feet below the surface of the ground. The water from artesian wells is likely to be pure because the deep layers of sand through which it passes filter out disease germs or other impurities which might have found their way into it at the surface of the ground. The mineral content of such water depends upon the nature of the soil through which it has passed, rather than its distance below the surface. Towns and cities as well as individual homes in isolated places often obtain their entire water supply from deep wells to insure its greater purity.

Surface water that runs off into streams, or collects in natural or artificially constructed lakes and reservoirs, often forms the water supply of towns and cities. This water is pumped through underground pipes directly into the homes and other buildings in the community. Surface water like this is exposed to contamination from sewage and factory wastes and may be unfit to be used in a raw state. Communities that take their water supply from such sources usually filter and disinfect it before pumping it into the water mains and pipes that distribute it. Protective filtration and disinfection methods have been discussed in Unit IV, pages 130-131.

Courtesy, Metropolitan Life Insurance Co.

Properly and Improperly Located Wells

Disposal of Wastes:

The disposal of wastes has a close relationship to personal and public health and comfort. There are many forms of wastes that must be cared for, including garbage, rubbish, ashes, and sewage or body wastes.

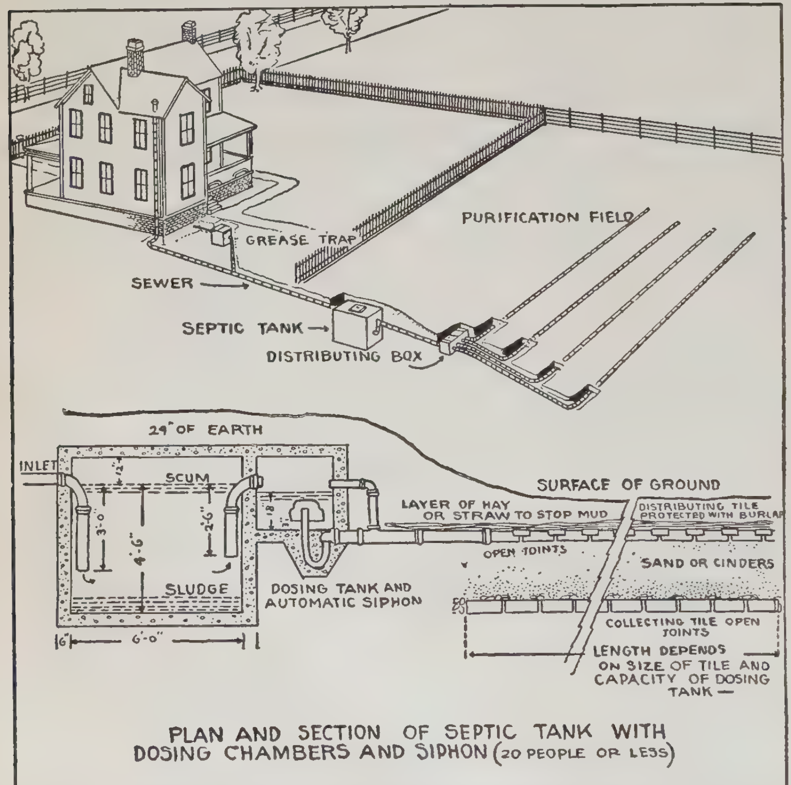
These problems in city homes, where garbage, ashes, and rubbish are regularly collected, are much simpler than in places where each household is responsible for their disposal. Sewage systems in towns and cities likewise relieve the householder of many problems connected with the safe disposal of body wastes.

Rubbish for city collection should be tied up or placed in receptacles which will keep it from blowing around the streets. Ashes are best handled in metal containers. This reduces the danger of fire from hot ashes. Garbage should be placed in covered metal cans to keep flies and animals away from it. The cans should be cleaned and disinfected frequently.

When the householder must provide for the disposal of rubbish, it is easiest to burn it in the heater or in a safe place out-of-doors. Garbage is often fed to the pigs, burned, or buried.

Sewage Disposal: In city homes, sewage is carried off through underground pipes or sewers. Problems connected with sewage systems were discussed in the previous chapter, pages 131-134.

In rural homes and in communities without sewage systems, the disposal of body wastes is a very important health consideration. The germs of typhoid fever, cholera, and other intestinal disorders are often spread in body excretions.



From *Sewage Disposal for Suburban and Country Homes*, Supplement No. 58 to the Public Health Reports, U. S. Public Health Service.

SEPTIC TANK

Sewage in individual homes can be disposed of in a sanitary way in a properly constructed septic tank

The method selected for disposal of body wastes is dependent largely upon the availability of a water supply to carry them off. When water is plentiful, a "septic tank" is a satisfactory and safe method to use. After the liquid sewage is received into the tank, the solid particles settle to the bottom and decompose. The liquid "effluent" runs off through loose jointed tubes laid below the surface of the ground. The solid matter in the tank has to be removed at intervals, and dried out, burned, or buried. Care must be taken to prevent drainage of the liquid into the water supply of the house. "Cess pools" are sometimes used to receive the sewage instead of septic tanks. These are not recommended, however, because of the dangers of pollution of a water supply from the untreated sewage that collects there.

When there is a lack of water, body wastes can be disposed of by chemical means, or by sanitary "outdoor closets". In a "chemical closet", the wastes are emptied into a tank containing a caustic soda solution which liquefies and disinfects the material. When filled, the contents must be removed by draining off the liquid or caring for it in other odorless and sanitary ways.

"Outdoor closets" are of several types. The most sanitary ones are lined with cement, brick, or other materials to make them water tight, so that the drainage from them cannot find its way into a water supply. All such "closets" should be fly-proof, and have earth banked up around them to keep out surface water. Pits for outdoor closets should never be dug deep enough to reach the water level beneath the ground and pollute the water supply. Booklets containing drawings and directions for constructing outdoor toilets can be obtained from the Supt. of Documents, Govt. Printing Office, Washington, D. C.

Care of the Bathroom:

The bathroom is regularly used by all members of the family and everyone should help in keeping it clean and sanitary. Soap and hot water should be regularly used to clean the lavatory, or washstand, the tub, and the closet, or toilet. Each member of the family should have an individual wash cloth and towel. Extra precautions should be taken by members of the household who may be suffering from colds or other communicable diseases. The germs of such infections can be transmitted by contacts with spigots or other articles in common use unless care is taken to prevent it.

CARE AND TREATMENT OF FOODS IN THE HOME

Clean and *wholesome* are two words frequently used in discussions concerning foods. Governmental inspection and care of foods ends at our doorsteps. Beyond this point, the responsibility for clean and wholesome foods is wholly ours.

A Clean Kitchen Is One of the Essentials of Healthful Living

Cleanliness in the Kitchen:

The kitchen is the room in the house especially planned for the preparation of foods. It should be constructed and equipped with a thought toward the comfort and efficiency of those who work in it.

One of the first essentials is cleanliness. Plenty of sunlight and fresh air should find their way into it. The articles of furniture should be of such a nature that they can easily be cleaned. There are certain relative positions of the stove, tables, cabinets, sink, and other articles that help to reduce movements, lessen fatigue, and make the work of those that prepare the meals more of a pleasure than a disagreeable task. Linoleum makes a good floor covering for the kitchen. It is sanitary, does not absorb spilled foods, and is easy to clean. The proper methods of washing dishes receive considerable attention in "domestic science" courses. The washing should remove particles of food and also clean the parts of the cups, glasses, and cutlery that the lips have touched. Wash the dishes in hot, soapy water and rinse in hot, clear water. If the rinsing water is hot, the dishes will dry quickly in a few minutes and will not need to be wiped with a cloth.

There must be adequate means to protect foods from spoiling and from contamination by flies and other insect and animal pests.

Control the Growth of Bacteria, Yeasts, and Molds in Foods: Bacteria, yeasts, and molds exist almost everywhere. They find their way into foods from dust in the air, and from contacts with insects, animals, dirty hands, or any object that harbors them. *Cleanliness* in all connections with foods should, therefore, be the first watchword in their care and treatment.

Bacteria, yeasts, and molds are tiny, microscopic plant forms. Like all plants, they grow best under certain conditions of temperature, moisture, and light. The secret of their control, therefore, is to keep foods under conditions that are unfavorable to their growth, and which, at the same time, do not harm the foods. *Cool temperatures* check the growth of these tiny organisms. A temperature of 40° to 50°

F. in a refrigerator, spring house, or cool, dry cellar, will keep most foods from spoiling from these causes. *Drying* preserves some kinds of foods from spoiling. The moisture that is essential for bacteria to grow is removed in the drying process. It must be remembered that whenever water is added to these dried foods at any later time, they will spoil just as quickly as fresh ones, unless precautions are taken against it. *Heat* is sometimes used to kill bacteria and germs in food. Partially cooked meats do not spoil as quickly as raw ones. In pasteurizing milk, the temperature is raised and held at about 142° F. for half an hour. This destroys disease germs but does not impair the taste or food values of the milk.

Keep the Refrigerator or Ice Box Clean:

Foods are often kept in a refrigerator or ice box for days at a time. Take care to keep the refrigerator or ice box from becoming damp, musty, and full of odors from the foods that are stored in it. Keep covers on foods that are likely to give off odors, or absorb odors from other foods. Wipe up spilled foods at once. Remove all foods occasionally and give the interior a thorough scrubbing.

The removable parts of the drain pipe from the ice compartment should be taken out at regular times and cleaned with a brush and hot soda solution. Pour boiling soda solution through any part of the drain that cannot be removed. By doing this, the dirt and slime that has collected there will be thoroughly washed out.

Do not put paper on the shelves of a refrigerator. This interferes with the free and easy circulation of air that is needed to obtain the best results from the ice. The cooling effects of ice are the result of its melting. The heat which causes ice to melt is drawn from the foods and containers that are placed inside the refrigerator. Cold air is heavier than warm air and descends. This causes a constant current of air downward from the ice, and then up through the food compartment to the ice again, and so on as long as any ice remains. The coldest part of the refrigerator, therefore, is directly under the ice. Wrapping ice in paper or cloth may keep it from melting so rapidly, but it prevents the refrigerator from becoming as cold as if the air could come in direct touch with the ice. It is a good plan to allow hot foods to cool off a little outside the refrigerator before placing them inside.

Protect Foods against Insects and Animals:

Insects and animals often destroy foods and infect them with disease germs. The common house fly is one of the chief offenders against foods. It not only dirties and pollutes everything it touches, but also may infect foods with the germs of typhoid fever, dysentery, and tuberculosis. Rats and mice actually destroy large quantities of food and render a great deal more unfit for use. Rats are also carriers of the germs of the deadly bubonic plague.

Guard against the destruction and spoiling of foods by screening doors and windows against flies. Destroy all insect and animal pests wherever they are discovered. Keep foods properly covered and in containers which prevent insects and animals from getting at them. Many foods can properly be left in their original packages. Where there is any doubt regarding the safety of foods in paper or cardboard containers, they should be emptied into glass or other insect or animal-proof receptacles.

Milk Needs Especial Care:

Milk is one of our most valuable foods. It is also a good food for germs. In order to protect users of milk from disease germs, there is a long chain of inspections and tests that begins on the farms and ends only at our doorsteps. It is our duty, therefore, to see that this chain of watchfulness and care is unbroken between the time our milk is delivered and its use as food.

Our responsibility begins at once. Milk should not be left on the doorstep to become warm in the sun. Warm milk allows the rapid growth of bacteria and sours quickly. In very cold weather, milk freezes, and some of it pushes up out of the bottle to become exposed to dust, dirt, and animals.

The colder milk is, the longer it keeps. This suggests that we place it against the ice, or directly under the ice, where the air is coldest. If no ice is available, wrap the bottle in wet cloths and put it in as cool a place as possible. Boil the milk if no other way can be found to keep it from turning sour before it is used. The boiling of milk, however, destroys some of its vitamin content and thus lessens its food value in this respect. When boiled milk must be fed to infants, it is important to make up for the deficiency of vitamins in other ways. It is well to seek the advice of a physician before growth disorders make their appearance.

The safest way to transport milk from the dairy to the customer is in clean, sterilized bottles. However, if milk is not delivered in bottles, it should be placed immediately in a covered jar or other sanitary container. It should never be exposed to dust, dirt, or flies. Uncovered milk in an ice box is very likely to absorb flavors from other foods and acquire an unpleasant taste.

Remove caps from milk bottles with a sharp-pointed instrument. Do not push the cap down into the bottle with the thumb or fingers.

Wash the milk bottles as soon as they are emptied and do not use them for anything else. The milk man washes all bottles thoroughly, yet there are some things that leave odors that are very hard to remove. It is unfair to subject others to unpleasantness due to the careless use of milk bottles in the home.

A Vacuum Cleaner Removes Dust and Dirt without Scattering Them About the Room

Sanitary Cleaning Methods in the Home:

Dust blows around easily in the air. It is usually composed of smoke and soot from chimneys, dirt from the street, and particles of lint from articles of clothing and upholstered furniture. Cleaning methods, therefore, should aim to remove the dust and dirt with the least possible spreading or scattering about the rooms. For this reason, the use of a vacuum cleaner is a much more sanitary cleaning method than the older, dry sweeping and dusting methods. Where electricity is not available, mechanically operated sweepers are better than dry sweeping methods.

Cheesecloth, soft silk, or other cloths that do not spread lint will serve best for dusting. For highly polished surfaces, use oiled cloths. On other surfaces, slightly dampened cloths will keep down dust as the work is done. During the cleaning and afterward, rooms should be thoroughly aired.

Washing and Laundry Work in the Home:

Clean clothes are sanitary and pleasing to everyone, and strengthen one's feeling of self-respect. Sanitary housekeeping directs that laundry work be done in another place than the kitchen, on account of the steam, dampness, and odors that go with laundry work. If advantage is taken of modern aids to laundry work, such as electric washers and ironers, much of the drudgery of this work will be eliminated.

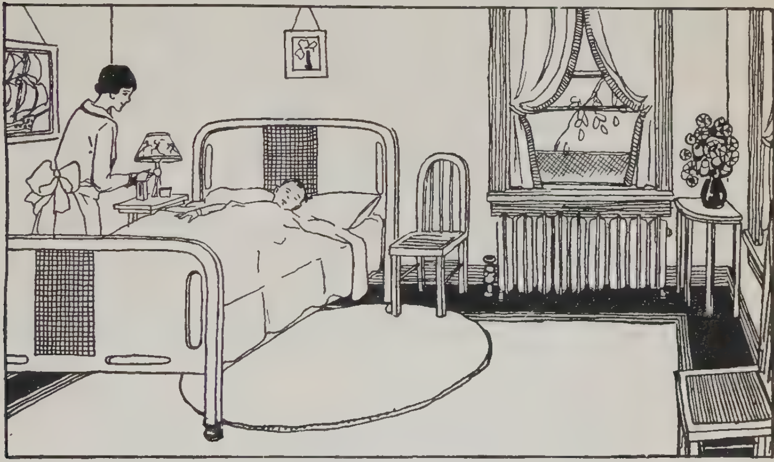
THE SICK ROOM IN THE HOUSE

When sickness comes, the sick room becomes the most important place in the house. The thoughts of all are centered upon it. Everyone should help the patient and the doctor in every possible way.

Choosing the Room:

Choose a quiet room with plenty of sunshine and fresh air. Little noises which are scarcely noticed in health often annoy and irritate the sick.

Remove all unnecessary things which might collect dust and germs and interfere with the entrance of fresh air and sunlight. Curtains may be needed to protect the patient's eyes from glare. These should be simple and frequently washed. Do not permit articles of clothing to hang about the sick room.



A SICK ROOM
Choose a Room with Plenty of Sunshine and Fresh Air

Keep the Sickroom Clean and Sanitary:

Germs of disease are spread from the sick to the well. Keep the sick room clean. Soap and hot water are valuable for this purpose. Use great care in disposing of the body wastes from the sick room. They should be promptly removed and destroyed, or treated with powerful disinfectants to kill disease germs in them.

Remove soiled clothing and have it laundered separately. Provide a separate set of dishes for the patient and wash them apart from those used by other members of the family.

Be Cheerful in the Sickroom:

Cheerfulness in the sick room is a tonic for the patient. Do not allow the patient to hear recitals of the ills of others or disturbing tales of any kind. The conversation within the room should be in a natural tone of voice. Avoid the whispers that arouse the suspicion of the patient. Remember that a word of praise for the fight already made and cheery and hopeful encouragement for the future are quite as necessary for the mind as the medicine is for the body.

A Quarantine Should be Strictly Enforced:

Many diseases like smallpox, scarlet fever, diphtheria, measles, whooping-cough, chicken pox, and mumps are easily passed from person to person. In order to prevent the spread of such communicable, or contagious diseases, the patient is subjected to an enforced isolation, or *quarantine,* until this danger is passed. A sign is usually posted upon the house announcing the quarantine. The length of the quarantine differs with certain diseases. It would be interesting to look up the rules of your community in this respect.

During a quarantine, all persons except those actually caring for the patient should be kept out of the sick room. Those who look after the patient should take care that they do not spread the disease when they leave the sick room. In most cases, a disinfecting bath and a change of clothes are recommended for this purpose.

The Convalescence:

The period of recovery from a disease is called the *convalescence.* The return to normal strength may be rapid or slow, depending upon the nature of the disease and the body resistance of the patient.

The physician's orders during convalescence should be strictly obeyed. During many diseases, the strain upon the heart, kidneys, and other organs of the body is very severe. In such cases, permanent injury to these organs may result if the patient attempts to resume an active life too soon. With young children, the period of convalescence is often a trying one for the patient and the parents. The patient may feel so well that it is difficult to understand why it is still necessary to remain in bed. At such times, stories, quiet occupations and games are indispensable.

CARE OF A BABY IN THE HOME

When there is a baby in the home, great care should be taken to bring it successfully through the very perilous first years of life. The baby should early develop proper health habits connected with sleeping, feeding, and elimination of body wastes. Those who care for the baby should arrange a healthful program of daily activities and follow it faithfully.

Washing the Baby

The baby should be bathed every day. The bath should be given in a small tub, or large basin, kept extremely clean and used for no other purpose. The room should be warm, not below 70° Fahrenheit. The water should be about 90° Fahrenheit for the first six months. After this age, a temperature of 80° to 85° Fahrenheit is suitable for the next few years of life. Use a clean, soft wash cloth and a pure, mild soap. Especial attention should be given to cleansing the ears, eyes, nose, and mouth. A piece of soft gauze or linen wrapped around the end of a finger or a toothpick will help to clean these delicate parts. The bath should be given at the same time each day and not too soon after feeding.

The baby's clothes should be clean, simple, loose, and light. They should be selected so that the baby will be warm in cold weather and not overheated in hot weather. Do not use heavy, tight-fitting clothes.

Develop regular habits of feeding from the start. Between feedings, give the baby plain water from a bottle if there is need for it. This drinking water should first be boiled to kill all possible germ life in it, and then cooled to the proper temperature for drinking purposes. Do not overfeed. Give also orange juice and water, or tomato juice, either fresh or from a freshly-opened can, for their regulating and protective values. Bottles should be thoroughly sterilized.

The elimination of body wastes should be regular. Whenever irregularities develop, proper treatments should be given.

During the first few months of his life, the baby should sleep most of the time. He should have his own separate crib or bed from the first. He should be placed in it at the regular sleeping time and permitted to go to sleep in a natural way, without resorting to rocking, or patting.

A Baby Clinic

Mothers are encouraged to bring babies regularly to these clinics for help and advice concerning their proper growth and development.

Out-of-door sleeping is a healthful habit to develop early. Children who sleep out-of-doors usually grow normally and are not so liable to colds because they gradually accustom their bodies to changes in temperature. If the baby sleeps inside, be sure the windows are open, and the hands and feet are warm enough. The baby should never sleep in a draft. The day clothes should be changed for clean, comfortable night clothes whenever the baby is put to sleep.

Sunlight is essential to proper growth. Gradually accustom the baby's skin to the outdoor sunlight.

Follow regularly the physician's directions concerning the length of the exposures.

After six months of age, fortify the baby against diphtheria by the toxin-antitoxin treatment. This can be given by the family physician or obtained through Health Centers, Baby Clinics, or Baby Welfare Stations. Records show that many more cases of diphtheria occur during the first few years of life than in the later years. The baby should be vaccinated against smallpox soon after the first birthday.

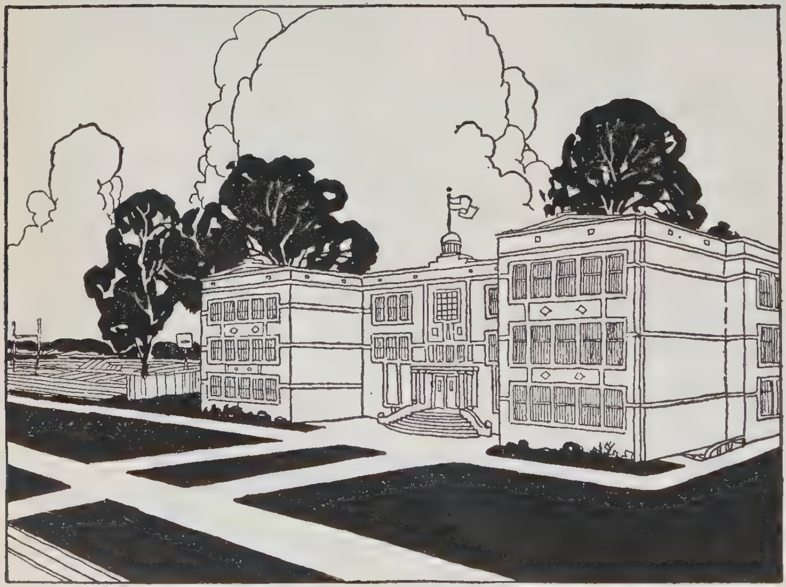
SAFE AND HEALTHFUL SCHOOLS

Schools should be constructed and used with regard for the safety and health of their occupants. New buildings should be up-to-date in every respect. Remodeled buildings should conform to the health and safety standards used in all new buildings.

The Construction and Equipment Influence the Safety and Health of the Occupants:

Safety is increased by the use of fireproof materials in the construction of the building. Wide, well-lighted corridors and stairways aid in pupil movements. Sufficient exits are needed to insure a speedy emptying of the building in an emergency.

Health can be safeguarded in many ways. Well-lighted class rooms are essential. Desks should be regulated to suit the size of the occupant and placed so that the light will come from the left. Windows should be washed often enough to keep them clean. Window shades are needed and should be used so that the greatest amount of light will be admitted without allowing direct sunlight to fall upon the desks. Electricity is the most serviceable and adaptable form of artificial lighting. The fixtures should be placed to prevent any direct glare from the bulbs. Indirect lighting systems in which the light is reflected from ceiling and walls are often used for best results. See drawing on page 143.



A MODERN SCHOOL BUILDING
Help to Keep It Safe, Sanitary, Healthful

Heating and ventilating systems should be installed to provide an abundance of fresh air for the occupants of the rooms. Mechanical systems of heating and ventilating are often used successfully in schools. They can be automatically regulated so that the temperature can be kept at about 68° to 70° Fahrenheit.

Walls of corridors and classrooms should be finished with materials that do not easily collect and show dust and dirt. A light cream color is serviceable for the interior finish of the walls. This does not absorb much of the light and reduces the glare that is reflected from wall surfaces.

Ample playground space should be provided. In congested city districts and other places where the cost of land is high, the play space is sometimes very restricted. Communities are usually generous, however, in providing large and safely equipped play space in connection with their schools. When properly used, playgrounds return large dividends in the form of good health and proper social habits.

Sanitary Care of Schools Is Essential to Health:

The cleaning of schools is important to health. The floors may be oiled to keep down the dust. In sweeping, damp sawdust may be used on the floor to prevent the spread of dust. Vacuum cleaners for school use are obtainable and give excellent results.

Blackboards can be successfully cleaned with erasers or dry chamois. Regular washing with water will help to keep their surface fresh and clean. The erasers can be thoroughly cleaned in a sanitary, dustless way by vacuum cleaners especially constructed for this purpose.

Toilet rooms need constant care and watchfulness. They should receive a daily scrubbing to keep them clean and sanitary.

Sanitary drinking fountains or bubblers should be provided. They should be constructed so that infections cannot be spread by the mouth secretions of those who use them.

Washing facilities should be provided in toilet rooms and other places where they are easily accessible. Only paper towels or towels for individual use should be permitted.

Shower baths are often installed for the cleansing bath that should follow vigorous exercise.

The school lunch room should be a model of cleanliness. The same standards for a kitchen and dining room in the home should be set up for the lunch room in the school.

The Care of the School Is a Cooperative Enterprise:

All must help in keeping the school clean and sanitary. The classrooms, corridors, stairs, lunch rooms, toilets, playgrounds, playrooms, all present their separate problems. Plans must be made for their care. These should be clearly understood and obeyed by all. Form the habit of wiping the feet before entering. Put waste paper and rubbish in the receptacles provided for this purpose.

Protect others from disease germs by placing the hand or handkerchief over the nose and mouth when coughing or sneezing. Don't spit, it spreads disease. Keep pencils and other articles out of the mouth. School materials, such as pencils, pens, books, and modeling clay, should be kept for individual use only. Do not remain in school or insist on attending when there is any chance of spreading a disease to others.

PRACTICAL APPLICATIONS

For Effective Study:

1. Name some of the essential factors in a healthful location for a home.
2. Name some of the important factors in good ventilation. How can each be regulated and controlled?
3. Name some of the advantages of electricity over gas for lighting purposes; of gas over kerosene.
4. Mention a few of the precautions that should be observed in order to protect the purity of the water supply.
5. How may food be kept clean and wholesome in the home?
6. Why is it important to guard food carefully against animals and insects?
7. What special measures should be taken for the care of milk?
8. Name some sanitary methods to be used in cleaning the home.
9. What is meant by "quarantine"? "Convalescence"?
10. Name some of the more important measures to be observed in taking proper care of the baby.

For Observation or Investigation:

1. What are "zoning" regulations? What regulations exist in your community?
2. Mention any of your local building regulations that have to do with health.
3. Why are lamps (floor or table) better for reading than wall or ceiling fixtures?
4. Discuss a few of the features of a modern, sanitary bathroom.
5. What causes food to "spoil"? How may this be prevented?
6. How do you receive and care for milk in your own home? Are these ways sanitary in all respects?
7. Discuss some of the measures to be taken for the care of the sickroom.
8. Name some of the dangers of "convalescence" and tell how they may be avoided.
9. What can you do to help keep your school (room) healthful?
10. Who are responsible for the cleanliness and health of the school?
11. What can you do to help keep your home clean and healthful? Your school?

For Health Habit Formation:

At Home:

1. Swat the fly.
2. Keep the screen door closed.
3. Be sure to shut the refrigerator door tightly.
4. Take good care of the milk bottle.
5. If there is a communicable disease in the house, help to keep it from spreading.
6. Help to protect the baby. He cannot protect himself.
7. Try to keep the bath tub and the other bathroom fixtures clean and sanitary.
8. Avoid "raising dust" when cleaning.

At School:

1. Put waste of all kinds in the proper receptacles.
2. Keep the toilets clean. Wash your hands.
3. Use your handkerchief when coughing or sneezing.
4. Be sure to observe regulations regarding contagious diseases.
5. Avoid rough play, dangerous to yourself or others.

UNIT V

STIMULANTS AND NARCOTICS

The human body is a living, "going" machine. Vital processes must continue to function as long as life exists. The need for energy to keep them going is constant. The supply of energy must be continuous.

Sources of Energy:

Energy is stored up in fuels of different kinds. Gasoline is fuel for an automobile. Wood, coal, or oil are fuels for a locomotive, and foods supply the fuel requirements for our bodies. The energy of gasoline is released when a mixture of gasoline vapor and air is ignited, or exploded, by a spark of electricity within the cylinders of the car. The energy of wood, coal, or oil is released by the process of combustion, or burning of the fuel in the fire box of the locomotive. In the human "engine" the fuel elements are oxidized or burned up in the cells, the necessary oxygen being taken from the air we breathe. Heat is produced and energy is released to run the human machine and keep the vital processes "going" as long as life exists.

The principal fuel elements of the body are obtained from the digestion and absorption of the starches, sugars, fats, and oils. They are distributed throughout the body by the circulation of the blood.

Normal energy needs are usually met by supplying the body with proper foods and the regular practice of good habits connected with exercise, fresh air, elimination of waste materials, rest, and sleep. Additional body heat and energy can be obtained in a number of ways. Some can be obtained from the natural reserve supply that is normally stored up in the body. Athletes often increase this energy reserve by a training period in which great care is given to proper foods, exercise, rest, and sleep. Extra fuel to meet seasonal or occupational demands is usually supplied by increasing the amount of fuel foods taken into the body. In cold weather, for example, the body can make good use of more carbohydrates, fats, and oils than when the weather is warm or hot. A woodsman, blacksmith, or ditch digger needs a greater amount of fuel food to supply the daily energy needs of the body than an office worker. It is possible to cause the body to use up some of its store of energy by the use of *stimulants*. This use will be discussed in succeeding paragraphs.

Nature of Stimulants and Narcotics:

A *stimulant* is a substance which calls forth energy for a short time without furnishing material for supplying real energy. For this reason, it may leave the body weaker than it was before it was used. A *narcotic* is a substance that deadens the cells and tissues of the body.

All narcotics and some of the stimulants have poisonous effects upon the body, varying according to the amount taken and the frequency of their use. Strychnine, for example, is a valuable heart stimulant when administered by a physician in the proper dosage, but becomes a sure, swift, fatal poison in excessive amounts. Alcohol, when first taken or when taken in small quantities, seems to act as a stimulant. The drinker becomes more lively and active. The heart beats faster and there is a feeling of greater warmth. Later, if sufficient alcohol has been taken into the body, the drinker becomes drowsy, because of the narcotic action, or the deadening of normal activity. The body heat, likewise, will be found to have been materially decreased. The body is actually colder than it was before the alcohol was taken. Tea and coffee act as stimulants because of the heat and the sugar they usually contain. They have in them a narcotic drug called caffeine. Tobacco contains a narcotic called nicotine. Patent medicines sometimes contain narcotics, more especially the "pain killers" and "soothing syrups."

Narcotics are generally habit-forming in their nature. After the body cells have become accustomed to the presence of narcotics in the body, the cells need more and more of the narcotic substance to secure the desired effects. Thus the person who uses a narcotic feels a need for increasingly large quantities of it. When he cannot do without the narcotic, he is no longer his own master and is an "addict" of the particular form of narcotic he craves.

Good athletes do not turn to drugs for increased power or energy. They rely upon natural energy reserves built up during training periods from proper foods, fresh air, sunshine, and regular exercise. These insure the good digestion and circulation that characterize a first-class physical condition.

ALCOHOL AND ALCOHOLIC BEVERAGES

Alcohol is formed from the sugar in the juices of fruits, or from a pulp (mash) of certain starch grains, by a process called fermentation. Fermentation is a kind of decomposition process, furthered by the help of the yeast plant.

Alcohol has a proper use in industry. It is an excellent solvent for some things that will not dissolve in water. Large quantities are used in the manufacture of artificial silk, leather, photographic films, and for hundreds of other useful industrial purposes. Unfortunately for health, alcohol is used as a beverage and is responsible for many body disturbances. Some of the properties which make it useful in industry make it injurious in the body.

Alcoholic Beverages:

Alcoholic beverages are drinks, or liquors, containing alcohol. For thousands of years before men knew the true nature of alcohol, they made and drank alcoholic beverages to their own disadvantage. Science is now making plain to us the nature and extent of this damage. Before examining this evidence, however, let us note another name that is sometimes used for alcoholic drinks, namely, *intoxicating liquors*. The word intoxicating comes from two Latin words, *in* (meaning "in") and *toxicum* (meaning "poison"). We shall see that such drinks are really poisonous.

A strong solution of alcohol (60% to 80%) applied to the skin will produce redness, itching, and some heat. Applied to an open wound, it will cause a burning sensation. It has somewhat the same effect upon the mucous membrane which lines the alimentary canal. Any alcoholic solution stronger than 10% may be used as a disinfectant, the function of which is to destroy germs. As germ cells belong to the same general order of life as living cells, the harmful effects of alcohol upon body cells is indicated, although it never reaches the body cells in germ-killing strength.

Alcohol in highly concentrated form has the power to penetrate the walls of the body cells, enter the protoplasm, and actually destroy the cells. Large doses of alcoholic liquor can cause death after the alcohol has been absorbed. This condition is known as acute alcoholism, or acute alcoholic poisoning. Alcohol in more diluted form, or small doses of alcoholic liquor, long continued, may cause chronic poisoning of body cells and paralyze their ability to function. Alcohol has a particular affinity for the cells of the nervous system. Through the nervous system, it affects many other parts of the body.

Alcohol and the Nervous System:

The brain is the center of the nervous system. Alcohol deadens first the highest nerve centers, those which control thought. If enough is taken, it will next affect the nerve centers that control muscles and movement, and finally it will affect the ability of the senses to perceive things. A drinker first loses his judgment, then the power to move properly and finally, his senses.

It should be noted that the thing which separates man from animals, his higher thought, goes first. He loses his fine consideration for others. His senses of relative values and of proper discrimination diminish and disappear. At first the drinker appears only happy and gay, but this is the first sign that the "brakes" (nerve controls) are off. Then he may become rough and inconsiderate, laugh loudly, talk boisterously, say silly things, become unreasonable, and, in some cases, quarrelsome. Such are the effects of the deadening of the higher nerve centers.

It is because a man's judgment and feeling for others has been deadened that he will do things while under the influence of alcohol that he would not otherwise do. Fine careers have been ruined and the happiness of homes destroyed by addiction to alcohol.

Alcohol has started many on a career of crime. Its continued use dulls the moral sense and weakens the will power.

In the lower nerve centers, alcohol not only causes a loss of muscular power and coördination, but also causes the drinker to lose control of his special senses. His vision is interfered with while under the influence of liquor. The habitual use of large amounts of alcohol often leads to a loss of appetite and blunts the sense of taste. Heavy drinkers want highly seasoned food and even this food sometimes does not satisfy them. Heavy drinking causes an actual lowering of the body temperature, even though the drinker may feel warmer.

In the final stages of heavy drinking, the drinker goes into a heavy sleep or stupor from which it is hard to awaken him. He may even become unconscious for hours.

Alcohol sometimes causes, or aids in causing, an irritation or inflammation of the nerves known as alcoholic neuritis.

Effects Upon the Heart and the Circulation:

The effects of alcohol upon the heart and the circulation of the blood are produced principally through loss of control in the nerve centers. The rate of heart beat is controlled by the nervous system. When the nerve centers which control the heart beat are deadened by alcohol, the heart beats faster, the "brake" (control by nerve centers) being off. The blood vessels of the skin become dilated, resulting in an oversupply of blood to that region. This is what causes the flushed face of the heavy drinker. The oversupply of blood to the skin also results in a decreased supply of blood to the internal organs.

The increased blood supply in the skin causes an undue loss of body heat through increased radiation. Thus while the heavy drinker may feel warmer because of his warm skin, he actually suffers a decrease in body temperature. A drunken man, if inactive and exposed to severe winter weather, will freeze to death more quickly than one who is sober.

Effects of Alcohol Upon the Muscles:

If sufficient alcohol is drunk, the nerves controlling the muscles begin to lose their power. Heavy drinkers "see double" because the muscles which move their eyes are out of control; the tongue (composed of muscles) is also affected, and the speech becomes "thick" and hard to understand. The nerve centers controlling the larger muscles begin to lose their power and the man will stagger, and, if drunk enough, will fall and be unable to arise without help.

Any loss of strength and ability to direct one's muscles skillfully (good coördination) is important to the workingman. In general, the drinker will lack the strength of the abstainer, will be inclined to be clumsy, and will make more mistakes. Not only will work be unsatisfactory, but accidents will frequently result. For this reason it has long been the practice of some employers to employ abstainers, rather than drinkers. This has been particularly true in the case of positions involving danger or great responsibility, as in the operation of railroad trains. In this age of high speed machines there are many such positions.

Athletes who drink heavily do not last long. Alcohol has ruined champions in many lines of sport. Such effects are particularly noticeable in baseball and boxing. Connie Mack, manager of many "Big League" championship baseball teams, is particularly opposed to the use of alcoholic liquor by ball players.

Alcohol and the Accident Rate:

Alcohol may indirectly cause accidents in a number of ways. It affects the judgment of those under its influence; it gives persons a false sense of confidence, thus leading to recklessness and a disregard for consequences. It causes a state of mind in which one pays little attention to the rights of others. It interferes with the work and efficiency of our faithful sentinels, the special senses, and it causes a loss of muscular skill and proper coördination, which results in clumsiness and mishaps.

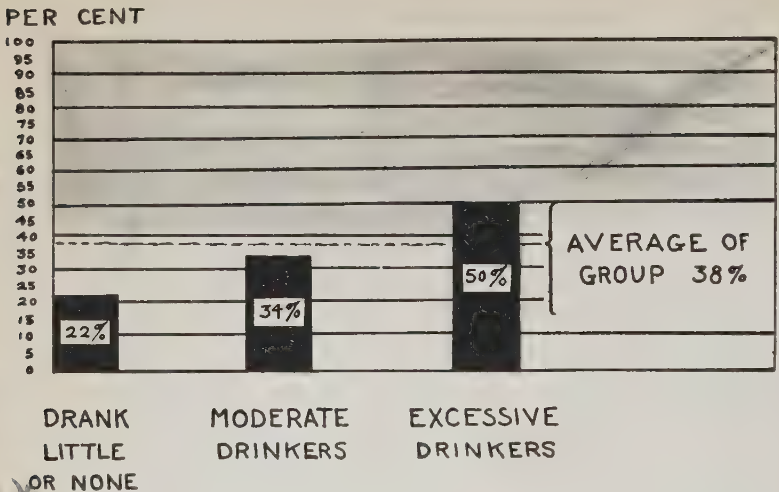
Figures show that many accidents in our daily life are caused by the influence of alcohol. The Brotherhood of Locomotive Engineers does not permit any of its members to drink, either on or off duty. When you are traveling, it is a great comfort to feel that the engineer of the train, the captain of the ship, or the pilot of the airplane is not under the influence of intoxicating liquor. Many automobile accidents can be traced to alcohol. Many accidents with firearms and numbers of accidental drownings are due indirectly to alcohol.

Industrial concerns have reported that there were more accidents among drinkers than among abstainers. Insurance companies have claimed that there were more accidents after a holiday than after a regular working day, due to the influence of intoxicating drink in the form of a "hang-over" from the day before.

Effects of Alcohol Upon the Stomach and Other Organs:

Large quantities of alcohol tend to irritate the mucous lining of the stomach and intestines and interfere with the digestion of food. Vomiting often follows the irritation of the stomach from heavy drinking. Continued heavy drinking may result in a condition known as irritative or chronic gastritis, an inflammation of the membrane lining the stomach.

Those who "drink" have a tendency to overeat. The overload of food in the digestive system plus the presence of alcohol creates a double strain on the



Graph showing relationships between use of alcoholic drinks and deaths from pneumonia. *(See also page 183.)*

digestive organs. Such overeating and drinking may contribute to the onset of many serious diseases.

Diseases of the kidneys and the liver are frequently caused, or greatly aggravated, by heavy or habitual drinking of alcoholic liquors. The strain of the poison imposed on the body by alcohol will be greatest on a weakened tissue or organ, if one exists. Sometimes, these conditions develop slowly over a long period of years. Why run that chance?

Alcohol Reduces Resistance to Disease:

Life insurance companies do not like to write a policy for steady or heavy drinkers because they know they are not good risks, that is, the insurance company is more likely to lose money on drinkers because of earlier death. Certain figures will be shown later in proof of this point, although it is probable that very few people would dispute it.

One reason for anticipating earlier deaths for drinkers is that they seem to develop certain diseases more easily, and when they are infected, they are more likely to die than abstainers.

Dr. Capps and Dr. Coleman of Cook County Hospital, Chicago, studied all the cases of pneumonia occurring over a period of eight years, with the following results:

Deaths from Pneumonia*

		% of Deaths (Approx.)
	Average (all)	38% died
I.	Drank little or none	22% died
II.	Moderate drinkers	34% died
III.	Excessive drinkers	50% died

According to these figures, the abstainer, or the one who drinks very little, has a better chance to recover than a moderate drinker, while an excessive drinker has less chance than the average man. See also Graph on page 182.

Drunkards are also less likely to recover from the shock of an operation than the normal person. One probable reason for this is that the abstainer is more

*Capps & Coleman, Cook County Hospital, Chicago, Ill.

likely to live a well-ordered life and is in better condition physically to meet an emergency than one who has injured his body with alcohol. Alcohol weakens self-control. Investigations have also shown that alcohol affects the red and white corpuscles of the blood and interferes with the efficiency of the red corpuscles in carrying oxygen to the tissues and of the white corpuscles in fighting disease germs. Alcohol also seems to decrease the ability of the body to form antibodies with which to fight the infections of a disease. Therefore, drinkers are probably more vulnerable to disease than non-drinkers.

Alcohol Is Not a Food:

It has been claimed that alcohol has certain food values, but any such food value would be more than offset by the harmful effects which the presence of alcohol creates. So far as is known, alcohol cannot be converted into substances which the body can retain. It cannot be used to build up or replace worn-out tissue. When food elements which have been assimilated into the blood stream combine with oxygen, they are said to burn. When alcohol combines with oxygen in the tissues, it is burned, but it fails to measure up to the chief purposes served by a true food. In addition, it is far more expensive than food. Some physicians now prescribe sugar and water in certain cases of fever instead of brandy or whiskey as was formerly the custom.

Alcohol Is Like a Narcotic Drug, Not a Stimulant:

For a long time it was believed that alcohol was a stimulant. Men grew noisy, talkative, and "acted big" after drinking. They felt that they had been inspired or stimulated. Now we know that such actions are the result of the deadening of certain nervous centers which act as "brakes" on our thoughts and actions. When the brakes are off, men, like machines, begin to run wild. Alcohol deadens and eventually may destroy these nerve centers or "brakes." It is therefore like a true narcotic and affects us in much the same manner as other dangerous drugs.

Alcohol is like a narcotic in that it tends to be habit-forming. Its own after-effects create a thirst for more in ever increasing quantities. The occasional or moderate drinker tends to become an habitual drinker; the habitual drinker tends to drink even more heavily; and a possible end is always that of an habitual drunkard. Jack London's story, *John Barleycorn*, is an excellent example of this. Probably no drunkard ever thought that such would be his fate when he took his first drink. Safety-First—Don't Begin.

SCIENCE TESTIFIES AGAINST BEVERAGE ALCOHOL

The Case Against Alcohol:

The case against alcohol centers in its relation to the accuracy of the nervous system. Whatever harms the brain and nerves impairs the integrity of life. The sole purpose of its use as a beverage is to force the nervous system to lie, thus vitiating its power of recording and acting upon the truth. Men drink to feel warm when they are really cold, to "feel good" when conditions are not good, to feel emancipated from those reserves and restraints which are the essence of character building. Alcohol is a depressant, appearing as a stimulant mainly because it checks the highest nerve operations first. Its influence impinges on the chief mental functions; sensation, reason, motion. It leaves its subject uncertain as to what he sees or feels, hazy as to cause and effect, and unsteady as to resultant action. No man of high purpose can afford to endanger in any degree the validity of those mental processes which register his contact with reality. Alcohol is always a habit-forming drug; the greater the injury to the nervous system, the more insistent the demand for it, and the weaker the will power in resistance. The chief argument used in favor of moderate use of alcohol is its value in conviviality. But, as President Eliot has observed, "Abstinence from alcohol kills no joys of any account while it impairs the chances of continuous working power."—*David Starr Jordan, noted scientist, president National Education Association, 1914-15.*

Influences of Alcohol Upon Offspring:

Experiments with small animals indicate that if even only one parent is steadily exposed to the fumes of alcohol, some of the offspring will be weak, defective, or deformed. These experiments also show that this weakness often extended for several generations. It is not known whether this discovery is equally true of human offspring, but there is reason to believe that it may be. Social workers have noticed more cases of physical weakness among children of drunkards than among other children.

Alcohol and Insanity:

Large and repeated amounts of alcohol will so affect the brain cells and structure that one of several forms of insanity may result. Delirium tremens, in which the patient imagines he sees horrible shapes and forms ("snakes" and other apparitions), is probably the best known of these. Investigation has shown that between 1917 and 1922, 4.6% of all the new cases of insanity admitted to hospitals for the insane were forms of alcoholic insanity.

Alcohol and Human Efficiency:

Since experiments have shown that alcohol deadens the higher nerve centers, we are not surprised to learn that the use of alcohol interferes with the quality and the quantity of work that one is capable of doing.

Various investigators have shown that alcohol causes drinkers among typists, typesetters, and sharpshooters to turn out work inferior to non-drinkers.

Furthermore, soldiers who had been given alcohol in moderate quantities did not march so well *(Endurance!)* as those to whom alcohol had not been given. Other experiments showed that drinkers made more mistakes than non-drinkers in adding figures (simple additions) and in detecting errors. Because of his drinking, the drinker with his false sense of self-confidence is generally the last one to realize or to admit that his work is inferior. He thinks he "is good!"

Possible Effects of Alcoholic Indulgence Upon Employment and Advancement:

Many employers prefer men who are non-drinkers or total abstainers. As a rule, such men have superior self-control and are to be trusted more. They are not so likely to be injured by accidents or to cause accidents to others. Indulgence in alcoholic liquors is sometimes taken as a sign of weak will power and of a lack of ability to resist temptation. Drinkers often associate with undesirable companions. Such men are not wanted in responsible positions and may not be considered fit for promotion. It may mean much for your future success to be able to say that you do not drink alcoholic liquors.

Enforcement of Liquor Laws:

All manufacturers of alcoholic beverages are required by law to pay a tax to the United States Gov-

L-I-Q-U-O-R *Spells* "Ruin"

"Any man who studies the social condition of the poor knows that liquor works more ruin than any other one cause."

—THEODORE ROOSEVELT

ernment on the liquor they make. In most states both manufacturers and sellers of alcoholic beverages must pay a state or city tax also. As these taxes are high, they increase considerably the cost of liquor sold.

To avoid paying this high cost many people attempt to make "home-brew" (alcoholic liquor) in their own homes. Home-brew is often more injurious to health than the alcoholic drinks that are made and sold by those who are authorized by law to do it. This is because it is usually made by inexperienced people. A lack of proper "aging" is one of the factors that make home-brew harmful and dangerous. "Stills" for making alcohol are sometimes hidden in out-of-the-way places to avoid paying taxes. People who run them are called "moonshiners."

Because of the greater cost of legal liquor due to high taxes, there has been much transportation and sale of illegal liquor, particularly in the large cities. The people who transport it and who sell it are called "bootleggers," and the liquor they sell is called "bootleg" liquor. Such liquor is often improperly made. Frequently the alcohol in it is a cheaper grade known as "denatured" alcohol or "wood" alcohol. Wood alcohol is very poisonous and may cause blindness or death. Denatured alcohol is alcohol that is intended for industrial purposes only. The government has required that some unpleasant substance be placed in it to prevent it from being used in alcoholic drinks. Attempts are sometimes made to get this poison out of denatured alcohol. If this is not done properly, the effects will be dangerous to one who drinks it. Many deaths have been caused by drinking denatured alcohol or wood alcohol, but not so many as have been caused by the drinks that contain common ethyl alcohol.

So-called "imported" liquor is very often not imported at all. Bootleggers are men of criminal type, and they cannot be trusted as to the quality of what they sell. Dangerous bootleg liquors are usually put up in containers and with labels that are intended to lead the purchaser to believe that he is getting government-approved liquor or genuine imported liquor at less than the usual price.

Personal Liberty:

Personal liberty cannot be permitted to interfere where the good of an entire community is concerned. Group welfare is more important than individual liberty. One does not have the right to decide what he may eat or drink *if* it affects the welfare or happiness of others. No one disputes the right of Congress to regulate traffic in dangerous drugs, and we are now beginning to realize that alcohol is a poisonous and habit-forming narcotic drug. As such, it should be subject to government regulation and control. The individual should surrender his personal preferences in favor of the general welfare.

> **IT SPILLS OVER**
>
> "The effect of drinking alcoholic liquor cannot be confined to the drinker. It spills over into the community. Personal liberty ends where public injury begins."

Summary:

Intoxicating liquor should be avoided for the following reasons:

1. It has little value as a food.
2. It is not a stimulant, but a narcotic drug.
3. There is real danger of habit-formation in its use.
4. The medical profession is using it less and less.
5. It has ill-effects on the brain and the nervous system, the heart and the circulation, digestion, the liver, and the kidneys.
6. Its use lowers resistance to disease.
7. Possible ill-effects may be caused in the children of drinkers.
8. It gives a false sense of self-confidence.

9. It is responsible for many accidents.
10. It interferes with good judgment and self-control.
11. Its use is frequently associated with the evils of crime.
12. It may cost one a good job, or the chance for promotion.
13. Money can be spent in other ways that will contribute to a more lasting enjoyment of life.
14. All good citizens should support the existing laws.

ALKALOIDS

Some plants produce substances that have a peculiar and sometimes very powerful effect upon the body. These substances are known as alkaloids. When used for medical purposes, in proper manner and dosage, under the careful supervision of a physician, they serve useful purposes. Without such supervision, the taking of these substances may be harmful and very dangerous. If misused, they become powerful poisons, centering their attack largely on the nervous system. Most of these alkaloids come from the bark, roots, leaves, or seeds of plants. These are known as the vegetable alkaloids. Animal alkaloids are formed by the decomposition of flesh or animal matter and are known as ptomaines. (Thus, ptomaine poisoning is a result of eating spoiled or tainted flesh or fish food.)

Quinine is a vegetable alkaloid that comes from Peruvian bark. It is useful in treating malaria. Other alkaloids from Peruvian bark are used in preparations for making textiles moth-proof. Cocaine is an alkaloid that comes from the leaves of the coca plant. It is used as a local anesthetic for deadening pain in minor surgical operations, as for instance, in the extraction of a tooth. It is characteristic of most alkaloids that they affect the nerves in some manner. Many tend to produce insensibility to pain and even unconsciousness. Most anesthetics and many antiseptics are alkaloids in nature. Caffeine is the principal alkaloid of coffee and tea. Atropine is an alkaloid that is used by oculists in enlarging the pupil of the eye for the purpose of examination ("drops" in the eye). Small quantities of strychnine are used in prescriptions for "strengthening" the heart, or as a heart stimulant, but large quantities act as violent poison and may cause death. Opium, a drug from the seeds of the poppy plant, contains at least 25 alkaloids. Of these, morphine is probably the most important. Morphine is used in the medical profession for inducing sleep and for deadening pain. In all about 800 alkaloids are known to science, but only about 24 are in common use—mostly medical in nature.

CAFFEINE

Tea and coffee both contain the vegetable alkaloid, caffeine, and it is through this that the nervous system is affected. It is possible that small quantities of tea and coffee are not harmful, except as they may displace food or beverages which have distinctly greater values to health. This is especially important

People who drink a number of cups of tea or coffee "for their nerves" make them worse.

in the case of growing children, where milk should be liberally used for beverage purposes. There is no nourishment in tea and coffee, themselves, although there is some food value in the sugar and cream that may be taken with them. The heat from hot tea or coffee may be stimulating or valuable for adults on occasion. Childhood or youth has no need for such stimulation.

One of the great objections to the use of either tea or coffee is that it tends to become habit-forming in its use, and therefore many people drink more than they should. Such people are generally of a nervous type and drink great quantities of it. Taken in such quantities, it has the effect of making them

Some carbonated drinks contain caffeine or other harmful substances. Avoid their habitual or extreme use.

even more nervous and irritable than before, after the first effects of the stimulation have worn off. Taken in too great quantities, tea and coffee may affect the kidneys, and interfere with digestion and proper bowel elimination. They may cause overstimulation of the nervous system, rapid heart action, and irritability of disposition. Overstimulation of the brain may cause wakefulness at night, although part of this may be due to the fact that the heavy tea or coffee drinker is probably a nervous person by disposition anyway. People who drink tea or coffee as a stimulant when working hard, in order to overcome fatigue, may work harder or longer than they should, thus causing ultimate harm.

It is like whipping a tired horse pulling a heavy burden uphill. Our ideal should be to keep in such good physical condition that there will be no need for the stimulation of tea and coffee.

It should be noted that certain of the soda-fountain or carbonated soft drinks contain caffeine or other habit-forming drugs. The same precautions used for tea and coffee should also be observed in connection with such drinks. They are habit-forming and, in excess, are harmful.

TOBACCO

Tobacco is a plant which was introduced into Europe from America about the middle of the 16th Century. Its use throughout the world has spread so that its production and sale is a business involving hundreds of millions of dollars yearly.

Tobacco leaf contains a vegetable alkaloid called nicotine. Nicotine is one of the most deadly poisons known to man. A small quantity in highly concentrated form will cause death almost instantly after it has been assimilated. Fortunately the quantity of nicotine found in tobacco is not large. Much of it goes off into the heat and the smoke as the tobacco is consumed. But some of the nicotine is absorbed into the system through contact of tobacco with the mucous membrane of the lips and the mouth, and some of it is absorbed from the smoke that goes into the mouth, throat, and air passages.

Effects of Tobacco Upon the Body:

Tobacco makes the heart beat faster. Long continued and immoderate use results in a fluttering heart beat and at times pain in the region of the heart. It disturbs the nervous system, sometimes causing nervousness.

Tobacco smoke irritates the delicate lining of the throat. Its immoderate use often causes the characteristic smoker's cough and a hoarseness of the voice.

During the growing period of one's life, the use of tobacco is especially harmful. Its use interferes with the regular growth and development of the body that should go on without interruption throughout these years.

Smoking reduces physical strength and endurance. The shortness of breath and reduction in alertness and accuracy that follows the use of tobacco is a severe handicap in athletics. Many coaches, or trainers refuse to have on their teams players who smoke during the playing season.

Tobacco Interferes with Mental Work:

It has been shown by experiments with smokers and non-smokers that the use of tobacco has a measurable effect upon many forms of mental work. Persons using tobacco were found to be less accurate, to tire more easily, and to learn new things less readily than those who refrained from its use.

Both everyday experience and the examination of

Smoking reduces physical strength and endurance. Athletic coaches and trainers forbid its use during the playing season.

school records draw attention to the fact that smoking and successful scholarship do not go well together. Many cases have been discovered where the achievement records of students started to fall when they began to use tobacco.

Counting the Costs of Smoking:

Tobacco is a habit-forming drug. After its use is begun, more and more must be consumed to satisfy

Colonel Charles A. Lindbergh uses neither alcohol nor tobacco. His great flight required steady nerves and great skill.

the craving for it that gradually develops. It thus becomes a very expensive habit.

The youth who smokes is often handicapped in obtaining employment. Loafing often goes with smoking, especially when the habit is so strong that time must be taken from the business hours to satisfy the craving for it.

Smoking is offensive to many people. The smoker generally carries the unpleasant tobacco smell about with him on his skin and in his clothes.

Smoking is a cause of many fires. The careless handling of matches, cigarettes, cigar stumps, and tobacco ashes results in the loss of lives and property.

When one takes into consideration the harmful effects of tobacco upon the body, its interference with scholarship, its influence upon the character of the user, and the other effects that have been stated above, the total costs are too serious to warrant a beginning or a continuance of its use in any form.

> "There is no agency in the world that is so seriously affecting the health, efficiency, education, and character of boys and girls as the cigarette habit."
>
> HERBERT HOOVER.

NARCOTICS

By narcotics we mean substances that have a deadening influence upon the normal healthy body. This paralysis is caused by the influence of narcotics upon the nervous system. Some narcotics are known as anodynes and are taken to relieve pain. Others are known as hypnotics because they produce insensibility or unconsciousness. This stupor or lethargy may sometimes result in death. Some narcotics, if taken in small doses, are anodynes (relieve pain), but in larger quantities become hypnotics (cause unconsciousness). General anesthetics like ether and chloroform are not ordinarily regarded as narcotics or hypnotics because their effects soon wear off. Narcotics are sometimes given to patients in hospitals, or are prescribed by physicians in order to secure relief from pain. Many physicians are loath to give such prescriptions, however, because of their habit-forming character. People become addicted to the use of these drugs and feel that they cannot live without them. Great wars generally produce large numbers of drug addicts. Why?

Many of the narcotic drugs come from opium and cocaine (see "alkaloids," page 192). Morphine and heroin, derived from opium, are the most common and dangerous. Opium is smoked by some Orientals and to a small extent it has been introduced by them, or their imitators, into this country. Morphine may be taken as a pill, as a liquid in the form of laudanum, or as a solution injected under the skin by a hypodermic needle. Heroin, another narcotic drug derived from opium, is generally taken in the form of snuff. It is regarded as so dangerous that its importation, even for medical use, is forbidden in this country.

Cocaine comes from the leaves of the coca plant. It is used in surgery for deading the nerve-endings in minor operations. Novocaine is preferred by most surgeons because it is as effective as cocaine for deadening the nerve cells to pain, and it is not habit-forming so far as is known. Cocaine is frequently used as a stimulant by cowardly criminals in order to make them bold and fearless when committing a crime. It very likely weakens their sense of moral judgment, for under its influence they shoot to kill. As a result many criminals receive the death penalty for a shooting which would never have taken place if they had not been under the influence of the narcotic. While the first effects of cocaine are highly stimulating, its later effects are narcotic and come in the form of physical and mental collapse. Its continued use causes disorders of the nervous system, indigestion, and loss of appetite and weight. Beware of such substances.

There are other forms of narcotic drugs that are offered to users. One of them, a Mexican drug, is used in the form of cigarettes. The safe thing is to avoid all strange substances. Don't eat, chew, sniff, smoke strange substances, permit anyone to make experiments upon you, or get you to experiment. Let strange substances strictly alone. It may mean a life of misery. Turn your back on the person who would tempt you. Guard your health first.

Effects of Narcotics Upon the Nervous System:

The principal effects of narcotics upon the human body are due to the action of vegetable alkaloids upon the cells of the central nervous system. These substances seem to have a peculiar affinity, or liking, for the nerve cells, and are absorbed into them more readily than into the cells of other kinds of tissue. Once in the cell, the alkaloids act as poisons, and interfere with the normal processes that are necessary to the healthy life of the cell. Among other things, it is probable that they prevent the nerve cells from taking a normal amount of nourishment from the blood and from returning waste products from the cells to the blood. The cells are first made numb to feeling, and later, if the dose is large enough, the entire nervous system may be paralyzed, thus causing a heavy stupor, or unconsciousness. Other organs controlled by the nervous system are unfavorably affected to some extent by this depressing influence upon the nerve centers and brain.

One of the most dangerous features of the effects of these narcotics upon the nerve cells is that after the nerve cells have accustomed themselves to the presence of the alkaloid, they seem to be uncomfortable without it. As soon as the effect begins to wear off, the cell hungers and craves for its replacement. This pain is very real. It has been described by those who seek to get rid of the habit as resembling the stabbing from swords. These are known as "withdrawal" pains. They occur as the effect of the poison is withdrawn from the cell.

To obtain relief, the sufferer takes more of the narcotic, and for awhile he feels comfortable and happy. Then as the effects wear off, the terrible withdrawal pains begin again, and again the sufferer seeks relief by taking still more. Thus the habit of drug addiction is formed. As the habit deepens, the cells require larger doses to get the same effects that smaller doses once gave. Soon the satisfying of this craving for the drug becomes the first and main object in the life of the person who is addicted to its use. He becomes a slave to this appetite. In this way he gets into the power of the people who sell or peddle the "dope," as the narcotic drugs are often called. Often these people are criminals of the lowest type. Addicts generally have no regular employment because of their failing. Consequently they often resort to stealing in order to obtain money for the expensive drug.

Effects of Narcotics Upon Character:

Dope addicts are generally undesirable types of people and many of them are criminals. Certain investigations have shown that about 50% of those examined were not in normal mental health. "The traits of lying, irritability, unscrupulousness, cowardice, disregard for others, and a lowering of the whole moral tone, which characterize the behavior of the addict, have long been recognized."* The fact that the drug addict is constantly in fear of not getting his supply and worrying about the possibility

*George B. Wallace, "The Rehabilitation of the Drug Addict," *Journal of Educational Sociology*, Volume IV, No. 6, p. 348 (February, 1931).

The dope addict feels himself an outcast from family and friends.

of not being able to get any more when he wants it may be in part responsible for this.

The fact that people shun and do not trust a "dope" addict makes him feel peculiar. His manner of life becomes secretive and false as he tries to gratify his unnatural appetite and at the same time to prevent the knowledge of his addiction from reaching his friends and relatives. A few bright people have been addicts, notably De Quincy who wrote *Confessions of an Opium Eater.* Such instances only give rise to the false belief that brilliant people are often neurotic. They might have achieved even greater accomplishments had they not been handicapped by narcotic addiction.

It is practically impossible for a dope addict to cure himself. Studies of these unfortunates show that nearly all of them have tried to cure themselves, not once but a number of times, some as many as ten times. In most cases the "cure" did not last longer than a year. The crushing defeat of the spirit when one goes back to this form of slavery to appetite can easily be imagined. Then the poor unfortunate must again try to free himself. The results will be about the same as before. Sometimes other addicts who know them tempt them back. Dope peddlers have been known to blow heroin into the faces of people who have tried to cure themselves, in order to break their resolution and to get them back into the habit.

A Road to Crime:

Richmond P. Hobson, a great hero of the Spanish-American War, devoted the most of his life to fighting the narcotic evil. He was President of the International Narcotic Education Association and told a true story of the evil effects of narcotics.

A young man was to be hanged for murder. He had killed a shopkeeper in a holdup. Although he was of good family, his relatives and friends were unable to save him. Just before he was hanged, he told the newspaper reporters that he was not entirely to blame for what had happened. His trouble started one afternoon when, as a student, he was returning home from high school. A stranger offered him a pill to take. He declined it. The stranger then dared him to eat the pill. Rather than be "dared," he ate it. The next day he took another. Before he realized it, he was an addict and could not do without it. The man who sold the dope then had him in his power. He was forced to pay, and to pay highly for his pills. To get money he had to steal. Ultimately this led to murder and the gallows.

A summary from a social service report shows that of all the people sent to the workhouse and the penitentiary in 1928, 12% were dope addicts. If trivial offenses were excluded, this percentage would rise to 40%.

The "Dope" Traffic:

Because of the great suffering and economic loss caused by the use of narcotic drugs or "dope," most of the civilized nations of the world have passed laws designed to control and prevent the spreading of this evil. Rigid governmental restrictions on their importation, manufacture, and distribution are enforced in order that their use may be limited to medicinal purposes and dispensed only on the prescription of a physician. Contrary to these strict laws a vast illegal trade has sprung up. Narcotics are more easily smuggled into the country because they can be concealed in small packages, and the scarcity of supply makes this smuggling and later sale quite profitable. The people who sell this stuff are lawbreakers of the meanest sort, because they are making money through spreading human misery. In order to increase their sales, they are constantly trying to lure innocent people, especially young folks, into starting the habit. In this way they secure new customers who cannot do without the drug.

Patent Medicines:

Before 1906 many patent medicines contained large quantities of narcotic drugs, to kill pain and make the sick feel better. It can be realized that while the patient felt better temporarily, he was really worse off than before. He still had his original illness and in addition he had the narcotic habit. The Federal Pure Food and Drug Act of 1906 required that if a patent medicine contained a poison (including narcotics) it must be so stated on the label. It is further provided by law that only small quantities of narcotics may be used. These poisons, while small in quantity, amount up if the patent medicine is taken in large amounts. Thus people waste their money on medicines which make them feel better for awhile, but do not cure their troubles. They later find they must keep on taking such medicines. It is estimated that the people of the United States spend over $195,000,000 yearly on patent medicines. One of the saddest instances is that of young children and babies who are given doses of these medicines that are habit-forming. Children may cry for it because they get used to it and feel they must have it. It does them no lasting good.

Avoiding the Drug Habit:

Some unfortunates have contracted the desire for drugs through medical or hospital experiences where it may have been prescribed for them for the relief of pain. There seem to be waves of new cases following wars. Doctors try to be sparing in the use of these drugs, realizing the dangers of habit-formation for their patients. It is possible that others acquire the desire after using certain patent medicines that contain such drugs. Sometimes drug addiction follows the habitual use of alcohol. Many of these cases are people who are highly neurotic (bad nervous disposition) who resort to alcohol to excess or drugs (or both) to get relief from the ill effects of their disordered nerves.

Others acquire the habit through associating with people who use narcotics. Here the value of associating only with people of good character may easily be seen. Some are tempted to try the drugs out of curiosity; it has been said that it would be safer to gratify one's curiosity by playing with a rattlesnake. People who live under great mental strain—a few doctors, nurses, actors, and individuals from all walks of life, high and low, may become victims to the narcotic habit. Still others take the first step innocently, not knowing what it is. Beware of strangers, or people whom you do not know well, who urge you to take unknown substances, particularly at social gatherings. Remember that the "dope ring" is always seeking new victims from whom they can make money. Avoid taking pills or "sniffing" substances on a dare, just for fun, or to make you feel better. Avoid it, for your life may hang in the balance. The dope habit is often spoken of as a "living death." For the addict all other interests have ceased but the desire to get more dope.

There are no halfway measures with the use of narcotics. One is either absolutely free of their influence, or else one is a slave to the habit. They cannot be taken in moderation. To take them once is to risk creating a desire to take them again. To take them a few times starts the habit. After a short period of time, the afflicted one is thereafter subject to an overmastering appetite for the narcotic.

Legislation for the Control of Narcotics:

The countries of the world realize the great evil that threatens them if the narcotic habit spreads. They also know the harm done to individuals; poverty through the loss of jobs and the wasting of money on drugs; ill health and disease caused by drugs, exposure, and poor hygiene; inefficiency due to the absorption of the individual in his habit and its satisfaction; and finally the loss in character and the resort to crime.

In the United States, the Federal Pure Food and Drugs Act of 1906 eliminated a great deal of indulgence in narcotics through the use of patent medicines. In 1909, legislation was passed forbidding the importation and use of opium for other than medicinal purposes. In 1914, the Harrison Narcotic Act required the registration of users, and attempted to control the distribution and consumption of narcotic drugs. The Jones-Miller Act of 1924 attempted further improvements. There is need for laws among the individual states that will help to prevent the illegal and secret sale and distribution of narcotics. The seaboard and border states are in particular need of such laws, as they have the most dangerous conditions with which to contend.

International Coöperation:

International coöperation in combating the narcotic drug evil goes back to the Shanghai Conference called by President Taft in 1909. Later international conferences were held at The Hague, Holland, in 1912 and 1913, and at Geneva, Switzerland in 1924 and 1925. The question of the growth, manufacture, and distribution of narcotics is one of the difficult problems that the League of Nations is attempting to solve.

It is not so easy as it looks. The source of evil is the production of the plants from which the narcotic drugs are extracted. The growing of these plants is

International Coöperation Is Needed!

almost the only source of revenue to poor natives of certain nations—India, China, Persia, Peru, Bolivia, and certain islands of the Far East. Before such crops can be taken from these people, some substitute must be found for them to grow, so that they may still earn a living by cultivation of the soil.

What is needed is a production of the plants limited approximately to the amount required for the medicinal needs of the world. This cultivation should be under close official supervision. There is also needed a system of accounting for every pound of the raw product, through the process of manufacture, with further accounting for every ounce of the finished product. When this is done, the illicit dope traffic will largely disappear.

At present narcotics are being raised far in excess of the world's medical needs. Factories in European countries and in the United States are engaged in turning out narcotic products in quantity many times the amount required for medical purposes. It is this surplus that makes possible the illegitimate dope traffic. Citizens of the various countries must arouse sentiment for the passage of laws adequately restricting production, manufacture, and trade in narcotic drugs.

PRACTICAL APPLICATIONS

For Effective Study:

1. What are stimulants?
2. What are narcotics?
3. What effect does alcohol have on the body cells?
4. State briefly the undesirable effects of alcohol on various tissues and organs of the body.
5. Explain how alcohol may lower resistance to disease.
6. Why is alcohol regarded as not having true food value?
7. Why is "bootleg" liquor dangerous? "Home-brew"?
8. What are alkaloids? What effect do they have on the body? Name some alkaloids.
9. What harmful substance is contained in tea and coffee?
10. What poison is contained in tobacco? Tell some of its possible harmful effects on the body.
11. What are "withdrawal pains" in connection with drug addiction?
12. Describe some of the harmful results of the use of narcotics:
    (a) on the body.
    (b) on character

For Observation or Investigation:

1. Is alcohol a stimulant or a narcotic? Explain.
2. Name some occupations in which total abstinence from alcoholic liquors is desirable.
3. Ask your insurance agent to explain the difference between a "good risk" and a "bad risk," and to name some instances.
4. How may the use of alcoholic liquors interfere with one's occupation and opportunities for advancement?
5. Make a list of ten good reasons why it is well to avoid the use of intoxicating liquors.
6. Name some instances of cases where individual liberty is justly restricted for the welfare of many.
7. Tell how the use of tea and coffee may be very undesirable.
8. Make a list of reasons that will show why smoking is not a good habit.
9. Why are narcotic drugs of any kind dangerous? How may they be avoided?
10. Why should one read the labels of all patent medicine bottles "before using?"
11. What has the United States government done (and what is it still doing) to restrict the use of narcotic drugs?
12. In what respect can international coöperation be helpful in stamping out the illegal drug or "dope" traffic?

For Health Habit Formation:

1. Touch not! Taste not! Consider not!
2. Remember—you can never develop an appetite for anything harmful if you never taste it.
3. For alcohol, tea, coffee, tobacco, and narcotic drugs safety and good health lies in *not beginning.*
4. Narcotics are of no value for "bad nerves." They make them worse.

5. The superior person is the one who doesn't need a stimulant or a narcotic, and has brains enough not to be tempted into using either.
6. Don't do things because you are "dared." Simpletons often offer foolish risks. People of character, good judgment, and will power are above them. They *dare be different.*
7. The best is none too good to select as the model for your life.
8. Do not take unknown substances from strangers or slight acquaintances.
9. Use your influence, now and later in life, to secure legislation that will improve social conditions of all kinds.
10. Remember that "character is the sum of one's habits."

UNIT VI

INDUSTRIAL HYGIENE

The change from student to wage-earner is an outstanding event in one's career. It usually requires many alterations and adjustments in habits of living. It has important effects upon one's health.

Choosing an Occupation:

In the upper grades, a great deal of attention is given to things concerned with the choice of a career. Facts about trades and occupations are assembled and discussed. In some schools, shops, studios, and other special rooms are equipped to give actual experiences in many different kinds of work. These aid pupils in discovering their own interests and abilities and help in making more intelligent choices.

Limitations upon the Choice of an Occupation: One's health sometimes imposes a handicap upon the choice of an occupation. Underweight is often accompanied by under-development of strength and energy. Defective eyesight makes employment around moving machinery especially dangerous. Heart disease is a serious drawback in many types of work. A condition of deafness makes it difficult to find suitable employment.

Occupations sometimes have harmful effects upon health. These are often due to the nature of the materials that are handled or the conditions under which the work is performed.

School Shops Provide Actual Contacts with Many Trades

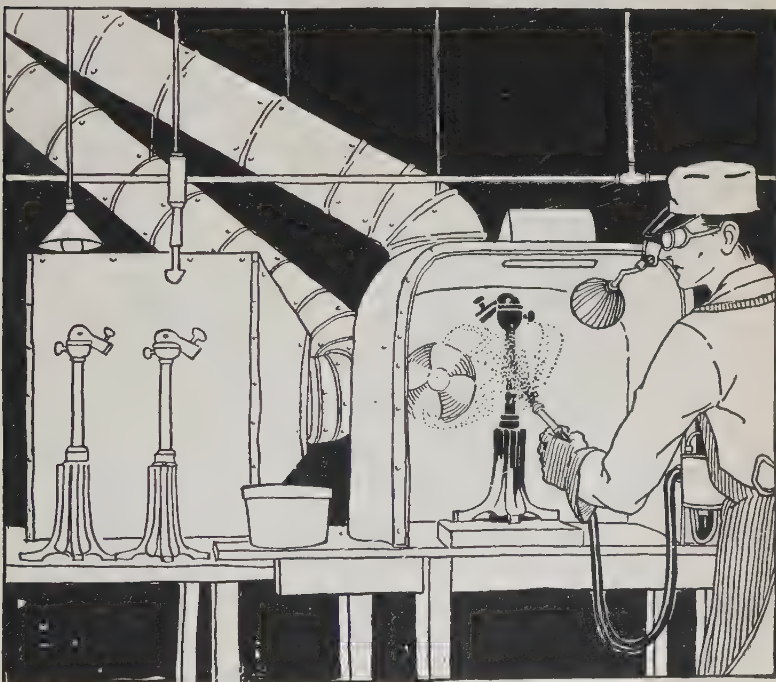
Occupational Dangers:

In some trades and occupations, poisoning may result from the materials that must be handled. Lead poisoning is one of the commonest of these effects. It can gain an entrance to the body in the air that is breathed, or through the digestive tract, or by absorption through the skin. Great danger to health exists where small quantities are taken into the body regularly over long periods of time. In such cases, the lead is slowly absorbed and chronic poisoning results. This leads to illness, and often, death.

Occupations in which lead poisoning is a menace include painting and plumbing, and glazing on pottery and tiles. The danger is especially great in the manufacture of electric storage batteries. In all occupations where there is danger of lead poisoning, good ventilation is extremely important. Dangerous lead-containing fumes should be carried away before the workers have an opportunity to breathe them. The workers should be especially careful in matters of personal cleanliness. Clothes should be changed, hands washed, and finger nails cleaned before eating, so that lead will not be introduced into the body.

Mercury, arsenic, and phosphorus are substances that may cause poisonous effects in persons who handle them. Phosphorus is used in making the matches that can be struck anywhere. Safety matches that can be struck only on the box do not contain phosphorus, and are harmless. There are two kinds of phosphorus that are used in matches, a harmful and a harmless kind. It is important for the workers to know which kind is being used in the factory. Proper ventilation to carry off the poisonous fumes, and habits of personal cleanliness are safeguards for those who work with such poisonous materials.

Dust is a dangerous hazard in many occupations. Harmful changes in lung tissue and high rates for pneumonia and tuberculosis are often found among workers in certain dusty occupations. The dusts from metal grinding and polishing, and marble and granite cutting and polishing are especially harmful to lung tissue. Mining is usually a very dusty occupation. In the textile industries, there is danger from the organic dusts that consist of particles of the cotton and woolen fibers that are handled. Proper ventilation to carry off the dust is essential to health in such occupations. In many places, the law helps to protect the workers by requiring that masks or dust protectors be worn.



Ventilating Systems Draw Off Poisonous Fumes

Carbon monoxide gas is an occupational danger in some forms of work. It is especially dangerous around blast furnaces, coke ovens, and in garages. The danger of this gas is increased by the fact that it has no odor and, therefore, no danger signal. It is easily absorbed by the hemoglobin of the red corpuscles in the blood and prevents the body from getting a normal supply of oxygen. Symptoms of carbon monoxide poisoning are dizziness, headache, throbbing of the temples, and ringing in the ears. The lower limbs become paralyzed and thus the victim is prevented from getting to the fresh outside air. The victim also loses consciousness in a very short time and death is frequently the result of this poisoning.

Conditions of Work Affect the Health:

The conditions under which work is performed have effects upon the health. Good lighting helps to protect the eyesight of the workers and reduce the number of accidents. Large window areas are often built into the walls of modern factories. The placing of artificial lights is important. They should light the work to be done but not shine directly into the eyes of the workers, or create a dangerous glare.

Proper heating and ventilating are important. Ventilation is a protective means for reducing the dangers from poisonous fumes, gases, and dusts. It also has beneficial effects upon the efficiency of the workers. Cool, moving air is a stimulant to normal body activities.

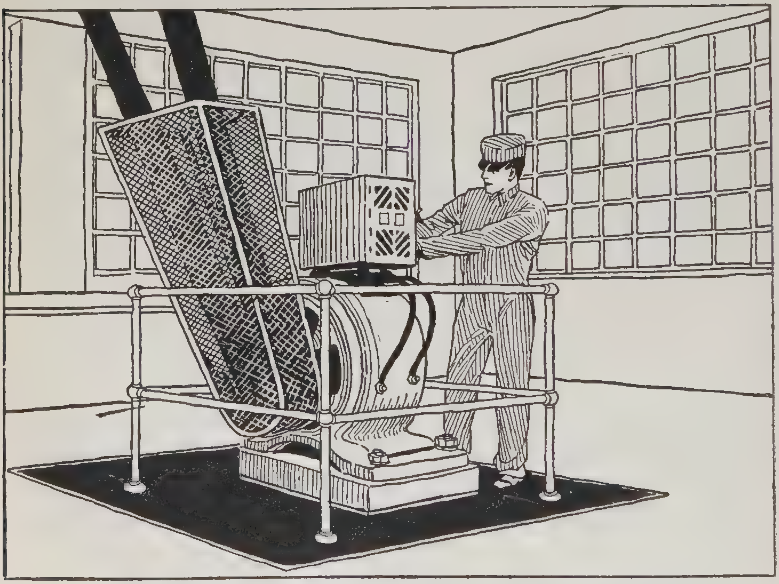
Safe drinking water and sanitary washing and toilet facilities should be provided. Individual drinking cups, bubbler fountains, and paper towels reduce the dangers of contact transmission of communicable diseases.

Many states exercise control over many of the conditions under which women and children are permitted to work. They are not allowed to work in especially dangerous occupations. Limits are placed upon the hours of their work. They cannot exceed a certain number a day, nor be in excess of specified weekly totals. Age limits are placed upon the entrance of young people into industry and additional or "continuation" schooling is often provided for them. It would be interesting to obtain your local or state regulations in these matters and compare them with other places.

Accident Prevention in Industry:

Safety devices are required by law in many dangerous industrial operations. Grinding wheels have guards to protect the eyes of the workers. Goggles are supplied to workmen in dangerous occupations like riveting and caulking. These safeguard the eyes from chips of steel that often fly about in such work. A careful workman, however, is the best safety device. Neither the law nor the employer can prevent accidents when workers will not use the safety appliances that are provided, or take reasonable care to protect themselves and others from injury.

The clothing should be suited to the work. It should not be so tight that it restricts movements, or so loose that it might catch in moving machinery.



Safety Guards around Moving Machinery Help to Prevent Accidents

Harmful Effects of Fatigue: Muscular fatigue is a state of muscle exhaustion which follows long continued activity. When persons are fatigued, the output of work is lessened and the number of accidents is increased.

Fatigue, as a rule, occurs often under poor conditions of work. Improper lighting and ventilation hasten its onset. High speed production in which the worker must steadily turn out a large amount of work is very fatiguing. The monotony of doing the same thing over and over again leads to fatigue and carelessness in performance.

As a result of learning by experience that fatigue means a reduction in the output of material, employers are realizing that healthful working conditions pay for themselves in many ways. Such conditions include shorter working days and a shorter working week. The Saturday half holiday or the five-day working week is used in many places with good results. Throughout the day, provision is often made for short rest periods for the workers. Seating facilities for some types of work, and properly shaded lights help to lessen fatigue and improve the quantity and quality of the work.

Health Service for Workers:

Progressive employers are giving more and more attention to the health of their workers. They spend large sums of money in providing medical and nurse service, lunch rooms, and rest and recreational facilities. These tend to improve the health of the workers. Many firms provide for a medical examination of all new employees. This helps to place them in positions for which they are physically adapted.

In many places, employees are required to report to the company doctor or nurse for treatment of all cuts or abrasions of the skin, no matter how slight. By this means, infections are prevented and loss of time from work is greatly reduced. Contagious diseases among employees are watched as carefully in many industrial plants as they are in schools, and exclusions made to prevent their spread.

Such health procedures lessen the absence of workers. They reduce the labor "turnover", or the number of new workers that must constantly be hired to take the places of those who leave. The employees are better suited to their work and are more satisfied with it. Accidents are prevented. The spirit of co-operation and loyalty is promoted. It is recognized in industry that the physical and mental welfare of the workers determine the operating efficiency of a manufacturing plant.

PRACTICAL APPLICATIONS

For Effective Study:

1. What are some of the physical limitations upon one's choice of an occupation?
2. How is dust dangerous? In what industries?
3. What is "lead poisoning"? How may it be contracted? In what industries does the danger exist? What precautions should be taken against it?
4. Why is carbon monoxide gas particularly dangerous?
5. Name some of the proper health conditions that one should expect from an employer.

6. What are some of the harmful effects of over-work or of working "over-time" too much?
7. Why should small injuries receive prompt medical treatment?

For Observation or Investigation:

1. In many places a boy or girl must satisfactorily pass a physical examination before obtaining a working certificate. Why is this a good thing?
2. Name some occupations that are dangerous from the standpoint of materials handled.
3. In what industries is special ventilation needed?
4. What dangerous gas comes from the exhaust of an automobile? How may it be avoided?
5. For what industries does your state have health regulations?
6. Name some of the protective devices that are used to protect the health of workers.
7. Why do employers of large numbers of people find that it is advisable to furnish a good lunch service, recreational facilities, and free medical service?

For Health Habit Formation:

1. Consider carefully your physical condition and health needs in selecting your future work.
2. Avoid employment that may be unsuitable for your particular physical condition.
3. Do not work for an employer who will not properly safeguard your health.
4. Be sure to use all safety measures or devices that are provided for your protection.
5. Remember that, "*A careful workman is the best safety device.*"
6. Give immediate attention to small cuts and injuries.
7. Be sure to eat a lunch that is adapted to the type of work that you may be doing.

UNIT VII

PHYSICAL EDUCATION

Exercise is necessary to life. It strengthens the muscles and promotes the development of good muscular tone. It facilitates the exchange of oxygen and carbon dioxide in the deeper air cells of the lungs, thus helping to keep these cells in a healthy condition. It strengthens the heart and aids regularity in the elimination of body wastes. Exercise is one of the most important aids in developing the harmonious action of all the parts of the body.

Exercise in the form of play, games, athletics, dancing, swimming, skating, hiking, etc., are all conducive to the production of energy and the enjoyment of life. Most of these types of exercise bring large numbers of muscles into action and train groups of muscles to work together.

Competitive games and sports also have other valuable lessons to teach in the preparation for the "game" of life. Leadership on the playground and on the athletic field is a prized asset of the boy or girl who has won the right to lead through the practice of fair play and good sportsmanship. The first lessons in the value of team work, and the added strength that comes from coöperative effort are often received on the playground.

"A game for every boy and girl and every girl and boy in a game" is a slogan that well expresses the aim of physical education today. Large sums of money are being spent in providing the play space and equipment that is needed for such a program.

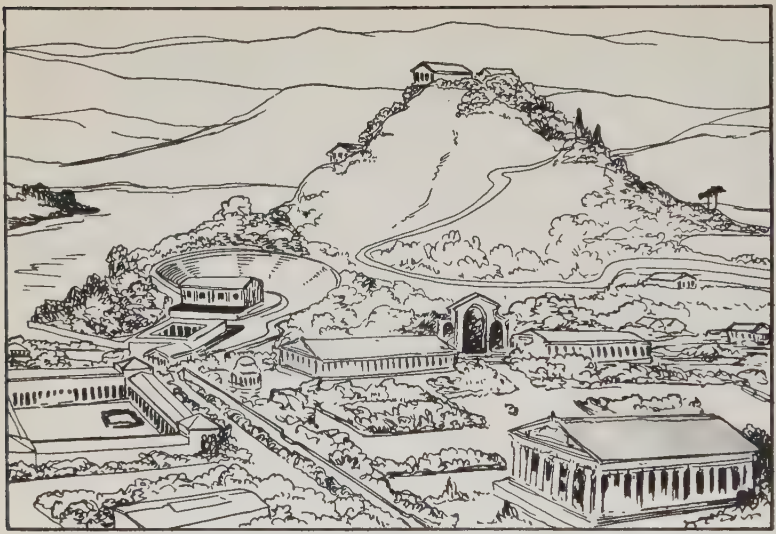
In the pages which follow, you will find a number of interesting and helpful aids in getting the most out of the physical education opportunities that are provided by your school and local community. The brief, historical account of the development of physical education serves to show how the present day ideals have been a slow outgrowth from the past. The ideals of a good sportsman, and the platforms of the national associations for the promotion of competitive games will serve admirably as standards for an individual or a school. The last section gives explicit directions for playing a number of competitive games for the upper grades.

FROM THE PAST TO THE PRESENT

The Ancients:

Physical education, consisting of games, athletics, dancing, swimming, wrestling, boxing, horseback riding, and exercises leading to physical efficiency as warriors or soldiers, has played an important part in the education of youth since the very early days of mankind.

The Greeks, both Spartans and Athenians, accorded physical education a place of distinction in the training of their young men. In fact, it is said that Greece reached the height of her superiority in



VIEW OF OLYMPIA (Restoration)
The original Olympic Games were held at Olympia in Greece.

art, sculpture, literature, science, and dramatic expression during that period in which the education and training of the body was considered of paramount importance.

The Olympic games of today were revived in 1896 in Athens. The original games were held every four years, beginning about 776 B.C. The events were general in character and included cultural as well as physical activities. The awards were Laurel Wreaths (sacred to Apollo, the god of health and strength). Individual winners were honored in their home cities; they were feted and acclaimed as worthy of their high honors. As time went on, the Olympic games, started as tributes and ovations to the Greek gods, degenerated. Professionalism, gambling, and a falling off of general participation led to a lack of interest among the people.

The Romans did not care for the games as they understood little of their religious significance. It was through their opposition, and the apathy of the Greek people to them, that they were given up during the second century B.C.

The Romans gave but little time or attention to physical education, except as it was used to develop efficient soldiers. The conquest of Rome, the great number of slaves, and the idleness of the masses led to luxury, vice, dissipation, and the downfall of this once proud and truly great nation.

The Middle Ages:

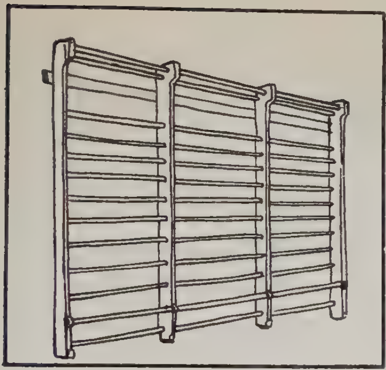
Physical education was neglected during the Middle Ages when the emphasis in all phases of life was placed upon the spiritual things and the preparation for the life hereafter.

During the age of chivalry there was a revival of physical activities. The body was no longer thought of as an instrument of Satan. The pages, squires, and knights practiced all types of exercises, athletics, and games that would fit them for tournaments, the practice of arms, and the Crusades.

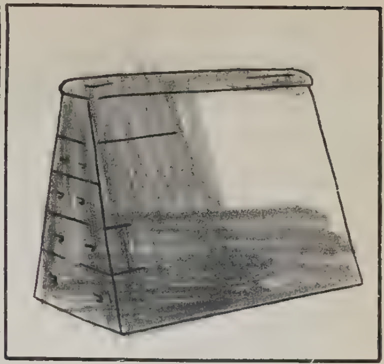
The Germans:

The Germans under Friedrich Ludwig Jahn, during the latter part of the 19th century, used gymnastics, athletics, and games to energize the youth of Germany. Father Jahn, as he was affectionately called, was a great patriot. He wanted to arouse the people of Germany, particularly the young people, to a spirit of national unity, to throw off the yoke of Napoleon, and to cause the independent states of Germany to consolidate and form a Federation of States. Jahn used strenuous exercises. He emphasized discipline, love of the out of doors, use of apparatus including parallel and horizontal bars, horses, ropes, ladders, etc., along with games and athletics.

The influence of Jahn and German Gymnastics has long been felt in this country. Germans who came here during the middle of the 19th century organized their gymnastic and singing societies. In time their system of physical education was introduced into many public schools including the large cities of St. Louis, Milwaukee, Cincinnati, Indianapolis, and Philadelphia. The German system of physical education emphasized marching, calisthenics, exercises on various pieces of apparatus, games, athletics, and dancing. Much of the work was formal in character and was ill adapted to the classroom. Gymnasiums and athletic fields were few in number and so the contribution of the Germans



Corrective Apparatus



Vaulting Apparatus

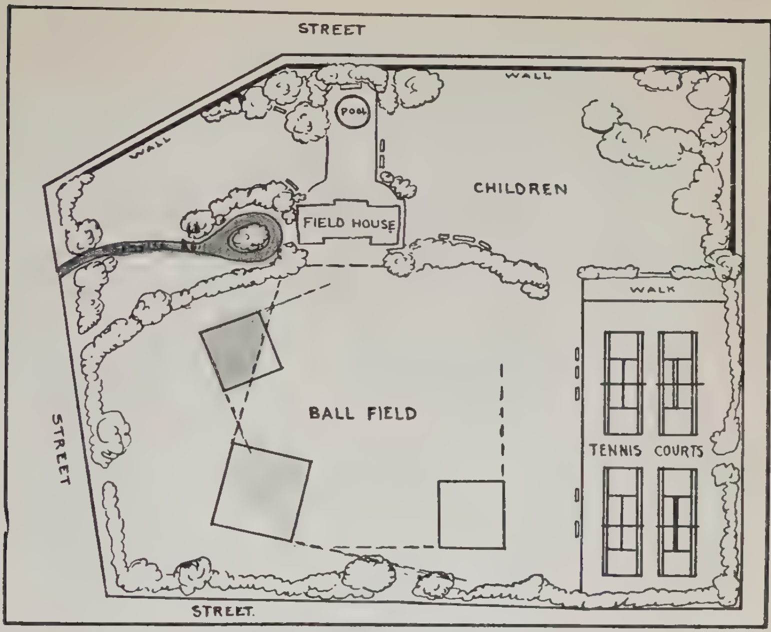
in classroom, gymnasium, and playroom was distinctly worthwhile, not only for the members of their group but also in stimulating interest in and enthusiasm for physical education. The German-Americans started one of the first normal or training schools for teachers of physical education in this country.

The Swedish System:

Swedish physical education was introduced into the United States by the followers of Pere Henrik Ling, the father of Swedish gymnastics. The Swedes began their work in and near Boston, Massachusetts. The system is distinctly formal. It has its main appeal in *corrective* exercises. The use of the Stall-Bars and Vaulting Box are typical of the Swedish System.

In the United States:

A group of leading educators met during the year 1889 in Boston, Massachusetts, to discuss ways and means for introducing physical education into the public school courses of study. Colleges, private schools, and organizations such as the Y.M.C.A. and Y.W.C.A. had long since introduced physical education including games, athletics, competitive sports, and similar activities into their programs. The school men who met in Boston wanted a system of exercises that could be practiced in the classroom, for at that time few schools were equipped with either gymnasiums or athletic fields. They also wanted exercises that could be taught by the classroom teachers and that would necessitate but little equipment. Only ten to twenty minutes per school day were to be given to the exercises. Their purpose was primarily to be disciplinary and to "let off steam." To meet this situation, the physical education leaders who attended the conference recommended a series of free-hand exercises, or calisthenics, with a limited number of classroom games and dances adapted to classroom use. It was the best that could be done under the circumstances but it has not proved satisfactory as a system. Free-hand exercises are difficult at best. They demand a teacher who is fired with enthusiasm, one who can catch and hold the interest of boys and girls. The classroom teachers were not trained and as a group they were not in-



A MODERN PLAYGROUND
"A game for every child and every child in a game."

terested, and so physical education as a classroom procedure was neither popular nor was it very successful. The big muscle activities brought into play by running, jumping, throwing, and climbing, interpreted in games, athletics, stunts, dancing, swimming, boxing, wrestling, and a host of others, call for large gymnasiums, play spaces, athletic fields, swimming pools, and trained teachers.

The National Recreation Association was founded in 1906. Joseph Lee of Boston, Massachusetts, was one of the original members. It was he who said, "The boy without a playground is father to the man without a job." The slogan of the Association, *"A game for every boy and girl and every boy and girl in a game"* was enthusiastically received. Playgrounds and recreation buildings sprang up all over the country. Money to carry on the work was easily raised, leaders were trained and in a very short space of time this movement had spread from coast to coast. The play appeal "caught on." Parents, educators, and most important of all, boys and girls were enthusiastic about it. It is natural for children to play, to sing, dance, have fun and here was an association made up of men and women who were willing to give of their time, their energy, and their money to see that children and adults were given play spaces and play buildings. It is no wonder that this movement was popular and is still spreading.

The World War and the examination of the young men who entered the service in the Army, Navy, and Marine Corps showed a condition of physical unfitness that was a surprise and a shock to the thinking people of the country. The Provost Marshal General's report of December 20, 1917, showed that almost one-third of the men examined were judged to be unfit for service as soldiers.

Millions of dollars were spent for the recreation and physical contests of the soldiers and sailors during the war. The military and naval authorities recognized the importance of regular exercise and elaborate programs of plays, games, athletics, boxing, and wrestling were set up. The conditions disclosed by the physical examinations during the World War did much to foster sentiment favorable to State Legislation for either permissive or mandatory laws pertaining to the teaching of health and physical education. By permissive legislation is meant that cities or school districts might set aside necessary time in the school program for physical education and apportion money from the school budget to put the program into effect. Mandatory legislation means that school districts *must* provide for the financial support, the teaching, and the supervision of physical education.

At present some thirty-six states in this country have permissive or mandatory laws governing the teaching of physical education. This number represents about 90% of all the public school children in the United States.

Practically all private school and colleges have extensive programs. Athletics, games, swimming, the arts of self-defense, e.g., boxing, wrestling, and fencing, are considered as essential in the education of the students in these institutions.

AIMS AND IDEALS OF PHYSICAL EDUCATION

Mind and Body Are One:

The old belief that one could educate either the mind or the body without considering the other part has long been discredited. Man is a unity. His thoughts and emotions affect his body. His body condition affects his ability to think and to act. The emotions of joy and happiness favor digestion and good will, while those of fear or anger cause a cessation of the digestion processes and put the body on a fighting basis either to get away from the thing it fears or toward the thing it wants to fight.

Exercise Necessary to Life: [illegible]

The beating of the heart, the breathing in and out of air, the digestion of food, and the functions of the nervous system are all examples of energy or work. Life is action. It depends upon good food, sunshine, clean air, exercise, and the following of good health rules. Energy is at its lowest level when we awake. We then wash and eat breakfast or "stoke our furnace" and the energy scale rises until it reaches a high point at about eleven o'clock in the morning. It then gradually runs down only to rise again after our noonday meal. It runs down in the late afternoon, rises after dinner, and goes down again as bed time approaches. Energy comes as a force from within. Exercise in the form of play, games, athletics, dancing, swimming, skating, hiking, etc., all are conducive to the production of energy and the enjoyment of life.

Aim of Physical Education:

Dr. J. F. Williams of Teachers College, Columbia University, has stated, "Physical education should aim to provide an opportunity for the individual to act in situations that are physically wholesome, mentally stimulating and satisfying, and socially sound."

In other words, boys and girls should be provided with clean, modern, well-ventilated gymnasiums and well kept playgrounds. The equipment should be of the best. The costumes of the pupils taking part should be neat and allow for easy movement. The exercise should be fitted to the individual needs of the pupils. It is futile to give a prescription of general exercise to young and old, tall and short, fat and thin, anemic and full blooded, lazy and energetic, and expect that all will profit from such a procedure. The exercises should be given in the out-of-doors whenever weather conditions will permit. There should be joy, happiness, and satisfaction in the exercises.

Competitive Athletics and Games:

These activities appeal to young and old alike. They are as old as man. It is natural to compete against some one else. Young children run to see who can win the race. Girls and boys play baseball, soccer, field hockey, basketball, football, and take part in track and field athletics for the fun of it and also to win victories. Some young adults and many men and women play tennis and golf to get out of doors, for social contacts, but also to win. For as one ex-college president has said, "It is not in victory alone that we get our thrill, but also in honorably contending for it."

Prayer of a Sportsman:

"Dear Lord, in the battle that goes on through life,
I ask but a field that is fair;
A chance that is equal with all in the strife,
A courage to strive and to dare.
If I should win, let it be by the code
With my faith and my honor held high;
If I should lose, let me stand by the road
And cheer as the winners go by."

—Brayley.

Fourteen Points in Good Sportsmanship:

A GOOD SPORT

Does:	*Does Not:*
1. Play fair at all times;	Cheat;
2. Play hard to the end;	Quit; is not yellow;
3. Keep his head;	Lose his temper though wronged;
4. Play for joy of playing and success of team;	Play for money or other reward;
5. Good team work;	
6. Keep training rules;	

7. Obey orders of coach or captain.	Play to grandstand;
8. Do his best in all school work;	Abuse his body;
	Shirk;
9. Back his team in every honest way but—	Neglect his studies;
	Bet—betting is not necessary to show loyalty;
10. Always give his opponent a square deal;	Take any technical advantage, but treats visiting players as guests;
11. Show respect to officials, accept adverse decisions gracefully, and expect officials to enforce rules.	Blame officials for defeat, crab, kick, nor complain.

When He Loses:

12. Congratulates the winner; gives his opponent full credit under most trying circumstances; learns to correct his faults through failures.	Does not show his disappointment; is not a sorehead; does not alibi; does not make excuses.

When He Wins:

13. Is generous, modest, considerate.	Does not boast; does not crow; does not rub it in.

At All Times:

14. Is true to his highest ideals.	Does nothing unworthy of a gentleman and a 100 per cent American.

—Daniel Chase, formerly New York State Director of Physical Education.

THE AGE OF CHIVALRY
The Preliminaries and the End of a Combat.

What Constitutes a Sportsman?

Professor Kennedy of Princeton University who at one time acted as President of the National Collegiate Athletic Association says, "A Sportsman is one who loves the game for its own sake; who has a scrupulous regard for the rules of fair play and strives under these rules to pit his best against the best of an opponent whom he respects; who admires excellence in the game for its own sake and who pays an instinctive tribute of respect to excellence whether it be his own or that of an opponent; who in the stress of competition strives to the uttermost without descent to breach of rule or vindictive spirit; who hates a quitter, an alibi, or a boast; who in the course of the game preserves courage in the face of odds, and dignity, self-respect, and good will in the presence of defeat; who wishes an amateur game to be played by amateurs and not by masquerading professionals; who delights to meet all comers upon the democratic fields of sport with a recognition that it is well for youth to have this early training in the knowledge that in the life of a great democracy he is the better man who proves it. These, though by no means all, are some of the important elements in that fine and subtle attitude of mind called sportsmanship." 256 - 864

National Collegiate Athletic Association:

Associations to guide, direct, and supervise high school athletics have come into being as the athletic movement has spread and therefore it may help to present the platform of the National Collegiate Athletic Association. The provisions are important and wholesome.

The purposes of the Association are:

1. The upholding of the principle of institutional control of, and responsibility for, all collegiate sports.
2. The stimulation and improvement of intramural and intercollegiate athletic sports.

3. The promotion of physical exercise among the students of the educational institutions of the United States.
4. The establishment of a uniform law of amateurism and of the principles of amateur sports.
5. The encouragement of the adoption by its constituent members of strict eligibility rules to comply with high standards of scholarship, amateur standing, and good sportsmanship.
6. The formulation, copyrighting, and publication of rules of play for the government of collegiate sports.
7. The supervision of the regulation and conduct, by its constituent members, of intercollegiate sports in regional and national collegiate athletic contests, and the preservation of collegiate athletic records.
8. In general, the study of the various phases of competitive athletics, physical training, and allied problems, the establishment of standards for amateur sports, and the promotion of the adoption of recommended measures, to the end that the colleges and universities of the United States may maintain their athletic activities on a high plane and may make efficient use of sports for character building.

Athletic Competition for Girls:

For many years it was not considered proper for a girl to take part in competitive athletics and games. This very narrow viewpoint has gradually given way to a condition wherein girls and young women compete in practically all of the major games. Unfortunately, abuses have arisen and mistakes have been made. But many of these are being or have been corrected. The credit for this correction belongs to those farsighted, intelligent, and sympathetic women who have coöperated with Mrs. Herbert Hoover in formulating the platform of the Women's Division of the National Amateur Athletic Federation.

Platform of the Women's Division:

National Amateur Athletic Federation of America
Adopted at the First Annual Meeting, Chicago, Ill., April 22, 1924

1. The Women's Division of the National Amateur Athletic Federation of America believes in the spirit of play for its own sake, and works for the promotion of physical activity for the largest possible proportion of persons in any given group, in forms suitable to individual needs and capacities, under leadership and environmental conditions that foster health, physical efficiency, and the development of good citizenship.

2. To accomplish this ideal for women and girls, it aims:

(a) To promote programs of physical activities for all members of given social groups rather than for a limited number chosen for their physical prowess;

(b) to protect athletics from exploitation for the enjoyment of the spectator or for the athletic reputation or commercial advantage of any institution or organization;

(c) to stress enjoyment of the sport and the development of sportsmanship, and to minimize the emphasis placed on individual accomplishment and the winning of championships;

(d) to eliminate types and systems of competition which put the emphasis upon individual accomplishment and winning rather than upon stressing the enjoyment of the sport and the development of sportsmanship among the many;

(e) to restrict recognition for athletic accomplishment to awards which are symbolical and which have the least possible intrinsic value;

(f) to discourage sensational publicity, to guide publicity along educational lines, and to stress through it the sport rather than the individual or group competitor;

(g) to put well-trained and properly qualified women in immediate charge of athletic and other physical education activities;

(h) to work toward placing the administration as well as the immediate leadership of all physical education activities for girls and women in the hands of well-trained and properly qualified women;

(i) to secure adequate medical examination and medical follow-up advice as a basis for participation in physical activities;

(j) to provide sanitary and adequate environment and facilities for all physical activities;

(k) to work for such adequate time allotment for a physical education program as shall meet the needs of the various age groups for growth, development, and maintenance of physical fitness;

(l) to promote a reasonable and sane attitude toward certain physiological conditions which may occasion temporary unfitness for vigorous athletics, in order that effective safeguards shall be maintained.

(m) to avoid countenancing the sacrifice of an individual's health for the sake of her participation in athletic competition;

(n) to promote the adoption of appropriate costumes for the various athletic activities;

(o) to eliminate gate receipts;

(p) to discourage athletic competition which involves travel.

Fundamentals in Athletic and Game Competition for Junior and Senior High School Boys and Girls:

1. There should be a thorough medical examination given by a competent physician to every boy or

girl who takes part in competitive games or sports. Such an examination would determine the organic and functional condition of the heart, the lungs, and other vital organs of the body. The physician could suggest safeguards that would help girls and boys from overdoing. He could advise with the parents relative to the pupils' physical and medical condition. He could recommend against and if necessary forbid competition when conditions such as a weakened or damaged heart, kidney disturbance, malnutrition, or lack of stamina would indicate that the pupil should not take part in strenuous athletic or game competition.

2. Parental permission should be secured before any pupil is permitted to engage in athletics or games that are practiced and played after school hours and on school holidays. The parents have a right to know where their children are at all times and to decide whether or not they should take part in a program that often means long hours of practice. It should be said that no exercise schedule should interfere with a pupil's regular school work. The boys and girls should play the games for the joy and fun derived from taking part. Exercise should not be dull, monotonous, or uninteresting work and so the parents should know of what is going on during extra school hours. They should be inter-

ested in the games and when possible they should attend them. Athletics and games offer interesting and desirable social contacts for pupils and parents.

3. Parents should be advised of the school's responsibility for accidents or injuries incidental to practice and games. In general school authorities do not accept any financial responsibility for accidents or injuries that take place in practice or games. In some cases, however, the school athletic association may pay for X-Ray pictures if it is necessary to have them taken to help determine the extent of an athletic injury. The school should provide adequate playing equipment and take every precaution against accidents and injuries. The boys taking part in interscholastic competition should be well taught, carefully trained, and kept from overdoing in athletics. A physician should be in attendance at football games to render first-aid and to advise the coach or athletic director to take out of the game any boy who shows evidences of extreme fatigue or of an injury that interferes with his best performance.

4. Amateur standards should be rigidly enforced. School boy athletics must not be confused with professional athletics. The boy plays for the fun of it, for the honor of the school and for the school letter or other award that symbolizes

athletic achievements on the field of competition. The professional plays for money. To him, it is just another day's work. It is true that he too may love the game and play with all the zest and enthusiasm of an amateur. But it is his means of earning a living or of helping him to do so. No school boy should play for money, neither should he play with or against players who receive money for their playing. Athletic scholarships in colleges are no more harmful in themselves than other kinds of scholarships, but when they are used to attract tramp athletes, athletes who travel from one college to another seeking money offers, they are indefensible. The athletic scholarship player who cares little for his studies and less for the traditions and prestige of his college has no place in college. So in high school, we should hold fast to the definition of an amateur, "one who practices an art for the love of it."

5. Scholarship standards should be enforced. No boy or girl who is deficient in school work should be permitted to represent the school in athletic or any other form of competition or exhibition. This rule should apply to the school band, orchestra, glee, debating, and dramatic clubs. The pupils should be permitted to take part in the regular physical education classes because this is a part of their regular school program,

but if they are failing in their studies they should be given extra help, coaching, sympathetic understanding of their difficulties, and such time as is necessary to catch up with their class work. The parents, taxpayers, and the teachers have a right to expect honest effort and hard work from the boys and girls who have the great privilege of attending a junior or senior high school, and so if athletics with its long hours of practice and games keeps the pupil from doing satisfactory work in his studies, then he should give up athletics until he shows that he can do both.

6. Training rules and regulations are necessary for good performance and the safeguarding of health. Pupils, parents, teachers, and coaches should all work together toward the common goal of team work, a high plane of conduct, and the development of loyalty to self, the school, and the community. These latter are traits that are not only valuable and worth while in school. They are essential for good citizenship and ethical conduct. There is a tendency to minimize the so-called old time virtues in these days of business efficiency. But it is nevertheless true that honesty, loyalty, integrity, and faithfulness to a good cause are just as worth while, just as essential, and vital as they were in the days of our ancestors. Athletics and team games will never make a gentleman out of a cheat or a ne'er-

do-well, neither will they make a scholar out of a boy who is either too lazy to do his best or one who does not care to learn, but they do provide situations that will bring out the qualities of truth, sportsmanship, and leadership which may be latent in the youth. They will make him strong, vigorous, alert, skillful, enthusiastic, and coöperative insofar as he is interested and willing to try and is determined to succeed.

7. No athletic program is sound or educationally justifiable that overworks or "burns out" a boy in competition. There have been many fine school-boy athletes who have been made to compete beyond their powers of recuperation. A coach who uses a boy's speed or strength to build up his (the coach's) reputation is a traitor to his profession and a thief of the boy's strength and vitality.

GAMES FOR THE UPPER GRADES

1. Shuttle Relay:

Number of Players—20-100.

Place—Out of doors or in gymnasium.

Formation—The players are divided into two or more groups of equal numbers. Each group in turn is divided into two divisions, which stand facing each other in single file, with the leader of each division toeing a starting line. There should be from fifty to one hundred and fifty feet between the starting lines.

Object—Each team tries to have its last runner dash across the finishing line before the other team finishes running.

The Game—At a signal, the leaders on one side of the ground run forward, but instead of touching a goal or terminal line at the opposite end of the ground, the runner "touches off" the leader of the line facing him, and passes at once away from the playing space. He should not line up again with his team. The player thus touched dashes forward in his turn and touches the first player in the file facing him, from which No. 1 came, and passes off game limits. Each player thus runs only in one direction, instead of in two, as in a single relay race. The team wins whose last player first dashes across the starting line opposite him.

Note:—As in single relay race, this may be played by handing a flag from one runner to the next, instead of touching off. If flag be used, it should not be on a stick, because of danger to the eyes. This game may also be played with strict observance of athletic rules. The first runners should be started with signals "On your mark!" "Get set!" "Go!" There should be a judge to watch fouls for each division of each team and two judges at the finish. Fouls consist in starting over the line, even with part of the foot, before being touched off, or in a failure actually to touch.

2. Arch Goal Ball:

Number of Players—8-12 on a team.

Place—Playground or gymnasium.

Equipment—Basketball and basketball goal.

Players—The players are divided into seven groups and line up in single file, in two or more lines facing a basketball goal. Each line has a basketball and stands behind a starting line.

Object—Each team tries to finish first by having the last man in the team cross the starting line before the others have finished.

The Game—At a signal, each leader passes the ball backward overhead. The next player takes it and passes it in the same way, and so on, to the end of the line. When the last player receives the ball, he runs forward and tries to throw it into the basket, standing on a line marked from five to ten feet from the goal. He is allowed but one throw, then quickly takes his place at the front of his line and at once passes the ball backward overhead. The last player, in turn, runs forward to cross the starting line.

3. Jump the Shot:

Number of Players—10-60.

Equipment—A bean bag or other soft article is tied to the end of a ten-foot rope.

Formation—The players stand in a circle, with one in the center holding the rope.

The Game—The center player swings the rope around to describe a large circle on the floor, with a sufficient length of rope to place the bag in line with the feet of those in the circle. The circle players jump to avoid being caught around the ankles by the rope. Anyone caught in this way retires from the circle. The player wins who longest retains his place.

Note:—This game may be varied by alternate players in the circle representing a team. A point is scored against the team whose player is caught by the rope. The team with the lowest score after a given time limit wins the game. In this variation no player when hit retires from the circle.

4. Bat Ball:

Number of Players—12-15 on a team.

Place—Out of doors, or in gymnasium.

Equipment—Volley or Basketball.

Bases—(a) Batsman's base or home base, a convenient flat object. (b) 15 foot line (15 feet from base a) drawn in dust or indicated by handkerchiefs. (c) Runner's base (at least 50 feet from base a). Runner's base may be a jumping standard, mat, large stone, small tree, or any other convenient object.

Formation—Players are divided into two teams of equal numbers. One side is at bat while the other side is scattered promiscuously over the field.

Object—Each team tries to score the most runs.

Game—Batsman tosses up ball and bats it with open palm (one chance only). The ball must at least pass the 15 foot line. Upon hitting the ball, batsman runs around runner's base, going to right and back to home base. Runner is safe after crossing 15 foot line on return.

2. Runner is out: (a) When ball is not batted beyond 15 foot line; (b) When batted ball is caught by a fielder; (c) When hit by ball thrown by fielder.

3. Fielder cannot advance, run or walk, with ball, but must throw from spot where the ball was picked up or caught. The ball should be passed from fielder to fielder in order to make shorter, more accurate throws at runner.

4. Fielder cannot hold ball more than 3 seconds (count 1, 2, 3).

5. Batting side changes as soon as all on one side have had a turn at bat.

6. Each run scores one point.

7. Penalty for fouls indicated in 3 and 4.

8. Time—Game can be played a definite length of time or a certain number of innings.

5. Human Hurdle Relay:

Number of Players—20-100.

Place—Out of doors, or in gymnasium.

Formation—The players are divided into four or more circles, equal in number. The circles are in single formation facing outward. Players are seated on floor, with legs extended, feet pointing away from the center of circle. A space of at least one foot should be between each pupil.

Object—Each team endeavors to have all its players finish the hurdling of the feet and return to their original places before the other team finishes.

The Game—Count off from right to left. At command, No. 1 stands, immediately facing to the right, runs and jumps over the extended legs of all pupils until he reaches his former position, then sits down and touches off. No. 2 stands, facing to the right and follows a like procedure. He returns to original position and touches off No. 3. Each pupil in a like manner, executes the above. The last individual upon reaching his original position becomes seated and raises his hand to designate that he has finished. The team wins whose last player is first to reach his original sitting position, providing fouls have not been committed.

Fouls—1. Failure to jump over extended legs.
2. Touching off before becoming seated.
3. Jumping over more than one player at a time.

Note:—This game may be varied as follows—As soon as No. 1 has jumped over the feet of No. 2, the latter immediately stands and follows No. 1. In turn, No. 3, 4, etc., follow, continuing the running and jumping as described above. When the original place in the circle of each player is reached, he must sit down immediately in order that the players following him may jump over his feet. The last pupil remains standing after passing over all the extended legs and reaching his place. The team wins whose last player reaches original position first and is standing, provided no fouls have been committed.

6. Kick Base Ball:

Number of Players—18-25.

Place—Out of doors, baseball diamond.

Equipment—Soccer football.

Formation—The ground is marked off and the players arranged similar to the regular game of playground baseball.

Object—Each team tries to score the most runs.

The Game—The pitcher delivers the ball by rolling it on the ground to the kicker, who stands on a home plate three feet square. The kicker, of course, endeavors to kick the ball fair. A ball that crosses the home plate, higher than the knees of the kicker, is called a ball, unless the player kicks at it. A player may also be put out if he is hit with ball when off any base. In all other respects the game is played like baseball.

7. Leap Frog Relay:

Number of Players—10-60.

Place—Out of doors, or in gymnasium.

Formation—Two teams of equal number are arranged in file formation according to size. A starting line is drawn across one end of the playing space. A finishing line or wall is designated as a goal at the other end.

Object—Each team endeavors to have its last player execute the required leaping, touch the wall, and dash over the starting line before the other team finishes.

Game—On a given signal, No. 1 of each column of files advances 2 ft., faces to the right (or left), and makes a back. The next player immediately runs and jumps over No. 1 and makes a back, one pace in front of the first player. The third player proceeds and so on until all are down. Then the first player stands, runs, and jumps over all the backs in succession, tags the wall, and proceeds to the starting line. The second player as soon as No. 1 has cleared his back immediately stands, faces forward, jumps over all backs, and runs to starting position passing by way of left side to rear of No. 1. All players follow in a like manner. The team wins whose last player having touched the wall, is first to dash over the starting line.

Fouls—(1) Failure to jump over all backs and tag wall.

(2) After touching wall must turn left about and run along line of backs to original starting position.

8. Tug of War:

Number of Players—10-80.

Place—Out of doors, or in gymnasium.

Equipment—A long, strong rope.

Formation—The players are divided into two teams. The teams line up in single file on either side of and facing a line. Each player grasps the rope with both hands. A mark is made at the exact middle of the rope to coincide with the starting line.

Object—Each team tries to pull the other team over the line.

Game—At a starting signal, each team pulls on the rope. After a designated time limit, the referee announces which team has pulled the greater amount of the opposing side's rope over the line.

Comments—The game may be varied as follows:—(a) The team wins which first pulls 5, 10, or all of the players of the opposing team over the line. (b) Starting from a kneeling position. (c) Starting from a sitting position. (d) Starting from a lying position.

9. Progressive Dodge Ball:

Number of Players—20-60.

Place—Out of doors, or in gymnasium.

Equipment—Basketball.

Formation—The ground is divided into three equal courts, each thirty by thirty feet. The end courts may be shorter if equal space be not available. The players are divided into three equal teams, which may be designated by colors, red, white, and blue. There is one referee for the game who also acts as scorekeeper. At the opening of the game, the two teams line up, each on its inner boundary line, each player standing with one foot at the line. The center team is grouped near the middle of the center court. The teams change courts at the end of each inning, and the line up just described is resumed at the opening of each inning.

Object—To hit opposing players with a flying ball (not a bounce). A player is "out" if he steps out of his court to avoid being hit. The two end teams play against the center team (but not against each other), and the center team also plays the ball in an aggressive game, trying to hit players on either of the end teams.

The Game—The game is played in three innings, each of five or more minutes duration. The different teams will be in different courts for each inning lined up as described above. After the ball has been put regularly in play, teams may only secure the ball when it has been played into their own court. After the ball has been put into play, the player catching it runs either to the left or right boundary line of his field and throws the ball at one of the opposing players (red or blue). These players, meanwhile, immediately upon hearing the whistle, should have run toward the rear of their courts to lessen the chances of being hit. The ball is then thrown back and forth until some one is hit. The player hit leaves the field and play is resumed. The player who gets the ball either runs up to the boundary line and throws it at his opponent or passes the ball to some other player in his own team who does this. The opponents try to avoid being hit. A ball thrown by either end team across the center court, may be caught by a player on the opposite end. A player is not out if the thrower of the ball overstepped the boundary line while throwing. The only kind of hit that puts a player out is one from a ball "on the fly" thrown from behind a boundary line. Players may dodge in any way they choose, but a hit from a flying ball on any part of the person or clothing puts a player out. At the close of each inning the teams change in regular order from right to left. That is the Blue team moves to the center, the White team to the left court and the Red team to the right court. For the third inning another change is made. Then a new inning is started and the teams change courts, all players who have been hit and are out, return to their respective teams. Each inning begins, therefore, with full teams.

Duties of Referee—(1) Puts the ball in play by tossing it to the center team, and at the same time blows his whistle as a signal for the game to start. (2) Blows his whistle whenever a player is hit. The player who has been hit leaves the court. (3) Blows his whistle for play to resume. (4) Calls time for the close of innings.

Score—A score is kept for each team for each of the three innings and consists of a count of the players who have been hit (put out), during the inning. The team wins which at the close of three innings has the smallest score; that is, has had the smallest number of players hit.

10. Volley Ball:

Number of Players—10-30.
Place—Playground, or in gymnasium.
Equipment—-Volley ball, tennis or volley ball net.
Ground—For large teams, this game should be

played on a ground measuring fifty feet long and twenty-five feet wide. A tennis net or a net two feet wide, is stretched across the center of the ground, from side to side, extending one or two feet beyond the boundary on either side. The upper edge should be from six feet six inches to seven feet above the ground.

Players—The players are evenly divided into two teams; the players scatter over their respective courts without special arrangement. There is a captain for each side. An umpire is desirable.

Object—Each team tries to keep the ball in lively play toward its opponents' court, as each team scores only on its opponents' failure to return the ball or keep it in the air.

The Game—The ball is put in play by being served by a selected member of either team, who should stand at the rear of his court with one foot on the rear boundary line and the other behind the line. From this position the ball is tossed upward lightly from one hand and batted with the open palm of the other hand, over the net into the opponents' court. The server has two trials. A served ball may be assisted on its course by any other players on the server's side, using one or both hands (open palm), no player so assisting the ball on the serve may strike it more than twice in succession, and the server under such circumstances may not strike it more than once; but should the ball then fail to land in the opponents' court, the server loses his second serve. In serving, the ball must be batted at least ten feet by the server before being touched off by any other player on his side. If return ball hits a player on the server's side and bounces into the opponents' court, it is considered in play. The players on a side take turns in serving. A ball which bounds back into the court after striking any other object except the floor or ceiling is still in play. In sending ball across net, player should aim for an unprotected part of opponents' court, or try in other ways to place them at disadvantage. The service changes to opposite side when the serving side: (a) allows the ball to touch the floor; (b) knocks it out of bounds; (c) fails to return it to the opponents; (d) when ball hits net during service; (e) when served ball falls outside opponents' court; (f) when player on serving side touches net at any time.

Score—The game consists of twenty-one points. Only the serving side scores. One point is scored when: (a) a good serve is unreturned; (b) any time when the opponents fail to return a ball which is in play; (c) when the receiving side touches the net. (Failure of serving side to return ball to opponents' court, merely puts them out. The serve passes to opponents and no score is made.)

Scoring on fouls—(a) touching net by a player on receiving side, allows serving side one point; (b) a ball sent under net counts one for opposing side;

(c) if ball strikes any object outside court and bounds back, although it is still in play, it counts one for opposing side. A ball sent out of bounds in returning a service scores one point for opposing team. One point is scored for opponents whenever a player catches ball or holds it for even an instant.

11. Fox and Geese:

Number of Players—10-30.

Place—Out of doors, or in gymnasium.

Formation—One player is chosen to be the Fox, another to be the Gander. The remaining players are the Geese, who line up in single file back of the Gander, each with his hands on the shoulders of the one next in front.

Object—The Fox tries to tag the last Goose in the line.

The Game—The Gander swings his flock, keeping in front of the Fox in order to prevent him from tagging the last Goose. He may spread out his arms and dodge around in any way he sees fit to circumvent the efforts of the Fox. Should the Fox succeed in getting past the Gander and tagging the last Goose, the last Goose becomes Fox and the Fox becomes the Gander.

12. Fox and Geese Dodge Ball:

Number of Players—20-60.

Place—Out of doors, or in gymnasium.

Equipment—Basketball.

Formation—About twelve or fifteen of the players form in single file and stand in the center of a circle formed by the remaining players. The first player of the file is called the "Gander," the others are the "Geese." They place their hands on the hips of the players next in front.

Object—The players of the circle try to hit the last Goose in the file with the basketball.

The Game—At a signal from a leader, the ball is passed swiftly around and across the circle. The Gander tries to keep the end Goose from being hit by swinging his file from side to side and at the same time batting the ball away. If the end Goose is hit, he joins the players in the circle and tries to help eliminate the other Geese. To keep up the interest of the game, it is advisable to change the players often, permitting the circle players to become Geese, and vice versa.

13. Blue and White:

Number of Players—10-50.

Place—Out of doors, or in gymnasium.

Equipment—A 12-inch disk of cardboard painted Blue on one side.

Formation—Class is divided into two equal teams. They stand in two ranks, facing each other and separated by a strip of neutral ground about five feet wide. One rank is named White and the other Blue.

At each end of the field behind the players a goal or safety territory is designated.

Object—Each team tries to capture the greatest number of opponents.

The Game—A leader tosses the disk in the air, allowing the pupils to see the side exposed, and then calls Blue or White, according to whichever side turns uppermost. The team whose name has been called, immediately runs to its goal of safety pursued by the opponents who endeavor to tag as many as possible before they reach safety. Every one caught before reaching the goal is taken prisoner and must join the opposing team. The remaining players return to their original positions and the game continues. The side which has caught the greatest number of opponents in a stated length of time is declared the winner

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~~14.~~ All Up Relay:

Number of Players—10-60.

Place—Out of doors, in gymnasium, or classroom.

Equipment—Three Indian clubs for each team.

Formation—The players are divided into two or more teams of equal numbers which compete against each other. The different groups line up in single file behind a starting line drawn on the ground. Directly in front of each team, at the opposite end of the running space which should be from 20 to 50 ft. long, are drawn two circles, each 3 ft. in diameter and placed side by side, with rims touching. In one of the circles of each pair three Indian clubs are placed.

Game—On a signal, number one of each file runs forward and with one hand only, changes the clubs from one circle to the other. Each club must be made to stand and none must touch the outline of the circle. As soon as each player finishes this, he runs back to his file, touches the next player on the hand and passes off, back of the line. The second player should be waiting for this touch off with toe on the starting line and hand outstretched. This second player, on receiving the touch off runs forward to the circle and changes the clubs from the second ring back to the first, observing the same rules of procedure. Each player in turn does this, the file winning whose last player is first to dash over the starting line on his return.

Note:—This is a very popular game for athletic contest, especially for younger girls. When used in this way, an especially careful observation for fouls should be kept by official judges. One foul is scored against a team for (a) each time a runner starts over the line without the touch off. (b) Each time both hands are in play at once in changing the clubs. (c) Each club that is not replaced after falling. (d) Each club that is left standing anywhere but within the circle for which it was intended. When played thus, according to strict athletic rules, the teams win in the order finishing plus the smallest score on fouls. If team A finishes first with six fouls, team B second with four fouls and team C third with no fouls, team C wins, being given first place, B second and A third.

15. Poison Snake:

Number of Players—10-50.

Place—Out of doors, or in gymnasium.

Equipment—Fifteen Indian clubs.

Formation—The players join hands to form a circle. The Indian clubs are placed in the center of the circle, with spaces between them in which a player might step.

Object—The players try, by pushing or pulling their comrades by means of the clasped hands, to make them knock over the clubs.

The Game—Any player who overturns a club or who unclasps hands must at once leave the circle, the club being replaced. The first players so leaving start a "scrub" circle; players disqualified in the scrub circle start another in their turn, etc. The player wins who is left in the original circle. Where several circles have been formed, the several winners may form a circle at the close and play to determine the final winner.

Note:—This game has possibilities for much sport and skill. The agility with which players leap over or pass between the clubs is as important a part of the game as the pulling and pushing. The clubs should be sufficiently scattered to make it possible for a player to save himself in this way. Children may need to have this feature of the game pointed out to them.

UNIT VIII
REVIEW OF ANATOMY, PHYSIOLOGY, AND HYGIENE

I. THE BODY AS A WHOLE

We are composed of body and spirit. The human body has been the subject of interesting study for many ages. Wise men and scientists have studied the materials of which it is composed, how the parts are put together, how the parts work or function, how to take the best possible care of each part and of the body as a whole. The study of the materials of which the body is composed and how they are put together is called *anatomy.* The study of how these parts work or function is called *physiology.* A knowledge of some anatomy and physiology is necessary for a proper understanding of *hygiene,* the science in which we study the rules of health.

The Body as a Machine:

The human body has been compared with an automobile. The bony skeleton or framework of the body corresponds to the chassis of an automobile. The body generates heat and power like the motor that runs a machine. Energy in the body is produced by the *oxidation* (burning) of fuel in the tissues where it is used. It is dependent upon many other processes:

1. The proper digestion of foods containing energy.
2. A proper supply of oxygen from the lungs.
3. The circulation of the blood which distributes fuel (digested food) and oxygen to the tissues in various parts of the body.
4. The nervous system that controls or regulates all of the body processes.

Like an automobile, the body requires constant attention and frequent inspections. We must be sure that all the parts are working properly. Many states require regular periodic inspection of all automobiles. The human machine should occasionally be checked up by a competent physician. Defects should be corrected in order that accidents may be avoided.

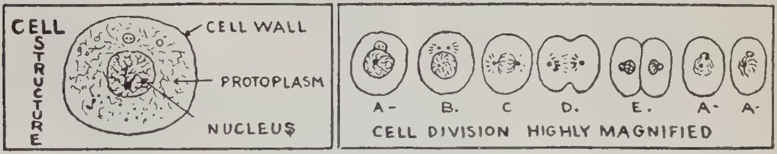
Signs of Good Health:

Health includes *mental* as well as *physical* well-being. It is often thought of as that condition of the body in which each part works in harmony with every other part. This includes good physical development earned by proper care and right methods of living. Another characteristic of good health is a *lack of awareness* of the body and its parts. When the various parts of the body carry on their work without troubling us, they are most probably in excellent condition.

Our emotions have an effect on our health. Worry, anger, grief, or great excitement, for example, will interfere with one's appetite, or even the proper digestion of food. They may interfere with one's work or rest. It is therefore necessary to cultivate good mental habits such as cheerfulness and confidence. The healthy person is generally unselfish and finds happiness and relaxation in helping others. The Boy Scout and the Girl Scout organizations afford excellent opportunities for the development of these traits.

For Effective Study:

1. Point out some of the similarities between the body and the automobile.
2. What is meant by good health?
3. Name some of the rules for the formation of good health habits.



Cells Are the Units of Body Structure

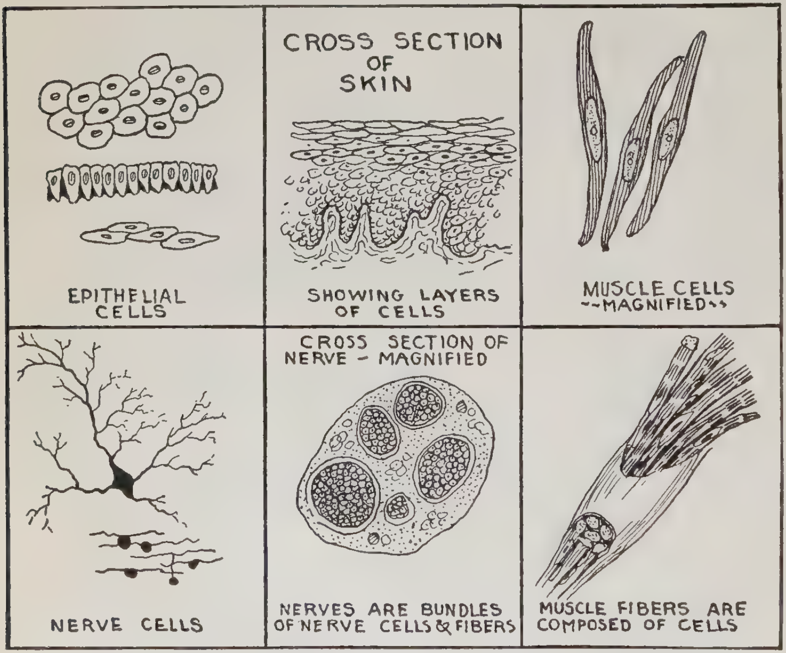
The Structure of the Body:

The body is composed chiefly of *protoplasm.* In its simplest form this is a grayish, jelly-like substance composed of carbon, oxygen, calcium, and a few other substances. Protoplasm is found in microscopic units called *cells.* Cells have three parts:

1. The *cell wall* which surrounds the body of the cell.
2. *Protoplasm* which makes up the body of the cell.

3. A tiny life center or *nucleus* inside the body of the cell.

Cells vary in form or kind according to the purpose they serve. They make up different kinds of tissue: bone tissue, muscle tissue, nerve tissue, and



All Tissues and Organs of the Body Are Composed of Cells

many others. Each cell leads its own life. It grows and develops from food materials brought by the blood. It excretes or throws off its waste products through the cell walls. It responds by movement to such things as heat, light, electricity, and chemicals. It reproduces or multiplies by dividing into two halves, after which each new part becomes a full grown cell like the original.

Cells grow and develop under conditions of healthy living. They need exercise and proper food and are benefited by sunshine, fresh air, and rest. They sometimes become diseased. Warts are an example of this. Cancers and tumors are also thought to be due to an unnatural growth of certain cells. Such conditions should never be neglected.

For Effective Study:

1. Name the parts of a cell. What else can you tell about them?
2. Name the health habits that benefit the life and growth of cells.

Firm Foundations for the Body:

The foundations of the body consist of the bony framework or skeleton and the muscles attached to them. The bones and muscles give strength and firmness to the body and enable us to move about, run, jump, play, and work.

II. BONES AND JOINTS

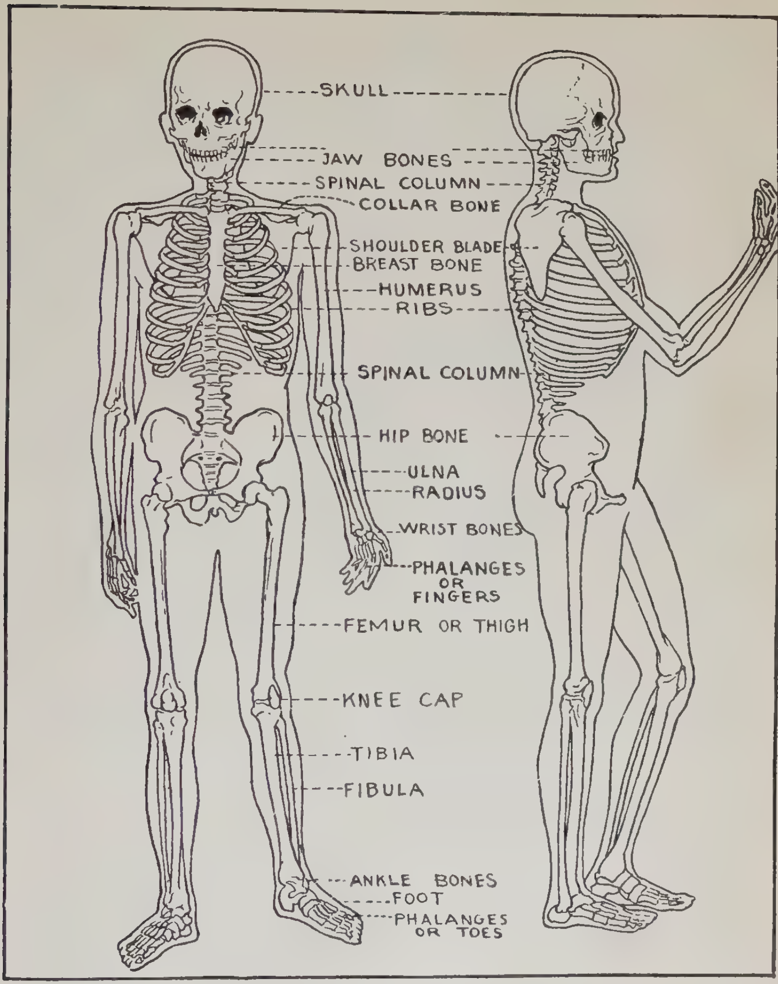
The Skeleton:

The *skeleton* has three main parts consisting of (1) the bones of the head, (2) the bones of the body, and (3) the bones of the limbs.

The *skull* or *cranium* is composed of broad, flat, or rounded bones firmly joined together. They protect the brain. The bones of the face are somewhat smaller and form places for the attachment of muscles that assist in chewing and other muscles that help to give expression to the face. The jaw is also one of the bones of the face. It contains the *teeth* which are a form of bone.

The bones of the body or *trunk* keep the body upright and form protecting cavities for most of our vital organs. The *spinal column* is composed of thirty-three bones, or *vertebrae.* The lower nine vertebrae form what is called the lower spine. Each vertebrae has an opening through which the spinal cord passes. The vertebrae are held together by ligaments and small muscles. This gives strength to the spinal column, so that it can keep the head and body upright. The great number of small bones tied together in this way gives to the spinal column the flexibility needed for bending, stooping, or twisting.

The side view of the skeleton on page 273 shows a number of natural curves in the spinal column, from front to back. These natural curves give a pleasing effect to the body. Good posture is necessary to keep these curves in their natural form. A curve of the spinal column from side to side is known as a lateral curve. It is not normal, and is caused by poor posture or some defect in the bones.



The Skeleton

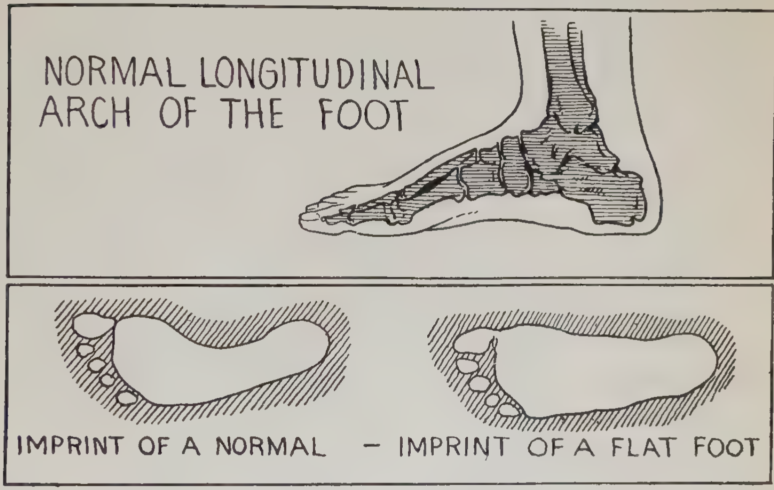
The *ribs* are twelve pairs of hoop-shaped bones that extend around the chest cavity thus protecting the heart and lungs. In back they are joined to the vertebrae. In front the upper seven are joined by cartilage to the *sternum,* or breast bone. The next three pairs are attached by their cartilage to the cartilage of the seventh rib. The lowest two pairs are called *floating ribs* because their front ends are unattached. At the top of the chest cavity is the collar bone or *clavicle,* and just in back is the shoulder blade or *scapula.* There are two of each of these bones, one on each side. Muscles cover the ribs and raise them in the movements of breathing.

The *pelvis,* or *hip bones,* form the base of the abdomen. They contain cup-like cavities into which the rounded head of each thigh bone (*femur*) fits. The pelvis or hip bones protect the organs in the region below the abdomen such as the bladder and rectum. There is a large cup-shaped cavity on the outer surfaces of the pelvic bones for articulation with the head of the femur or thigh bone.

Bones of the Arms and Legs:

The bone of the upper arm is called the *humerus.* It is attached at the top to the scapula (shoulder blade) and the clavicle (collar bone). At the lower end (elbow) it joins the two bones of the lower arm, the *radius* and the *ulna.* Then come eight small *carpal* bones in the fingers called *phalanges*, three in each finger, two in the thumb.

The bone of the upper leg is called the *femur*. It fits into a rounded socket in the hip bone, or pelvis. The two bones of the lower leg are called the



Preserve the Normal Arches of the Foot

tibia and the *fibula*. In front of the knee joint is a small flat bone called the *patella* or kneecap. This is sometimes injured or dislocated in playing strenuous games like football. There are seven small *tarsal* bones in the ankle, and five *metatarsal* bones in the foot. The fourteen bones in the toes are also called phalanges.

The bones of the foot form two natural arches, one from front to heel called the *longitudinal arch*, and the other not quite so noticeable, running across the ball (front) of the foot, and called the *transverse* arch. These arches act like springs in a wagon or an automobile and help to prevent jarring. Muscles and ligaments keep these arches up and give them flexibility. When the muscles and ligaments become weakened, the arches are lowered, and the resulting condition is known as *flat feet.* Flat feet may be caused by:

1. The wearing of shoes that do not properly fit the feet.
2. Excessive turning out of the toes in walking.
3. Occupations that require long standing on hard surfaces or other unusual strains.
4. Poor nutrition resulting in poor muscle tone.

Treatment of flat feet includes corrective exercises, proper walking, well fitting shoes, and attention to diet. It is well to seek expert medical assistance. Shoes should be fitted to the feet. Do not make your feet fit into the shoe. The shoe should be neither too large nor too small. High heels are generally harmful. They tend to cramp the toes and to spoil the balance of the body.

Structure of Bones:

In the beginning of life cartilage appears first. As we grow older, bone cells gradually replace the cartilage. This is why bones are tough and flexible in youth, but hard and brittle in old age. Bones of young people can be more easily bent out of shape. Proper posture is very important for them. The bones of older people are not easily bent, but do break more easily.

Bones are covered with a thin delicate membrane called *periosteum.* This membrane supports the blood vessels that supply the bones. Long bones have a hollow shaft filled with *marrow,* and also containing blood vessels and nerves necessary for the nourishment of the bone cells. The red corpuscles of the blood are created in the marrow and spongy portions of the long bones.

Health of Bones:

The following are important aids in the production of good bone tissue:

1. Bone-building foods which contain plenty of calcium, such as milk, dairy products, and green, leafy vegetables.
2. Practice of good health habits, play and exercise, sunshine, fresh air, rest, and sleep.
3. Proper posture.

Abnormal Conditions of Bone Tissue:

1. Tuberculosis of the bone. It is believed that this germ is spread from the meat and milk of tubercular cattle. Pasteurization makes milk safe, if it is kept cool and clean.

2. Rickets is a deficiency disease, caused by a lack of the sunshine, vitamin D, or minerals needed for good bones. It is principally a disease of young children, although adults may suffer from its effects.

3. Broken bones. A *simple fracture* is a break where the bone does not come through the skin. A *compound fracture* occurs when the broken bone comes through the skin. A *green-stick fracture* is more of a split or partial break in the bone than a complete break, as in a simple fracture.

In case of a broken bone, great care should be taken to support the broken part if it is necessary to move the injured one before a doctor arrives. Avoid movement when possible.

Joints:

Connections between bones are called *joints.* They are held together by tough bands of connective tissue known as *ligaments.* The ends of the bones are cushioned by soft, smooth *cartilage* and are oiled by a secretion known as *synovial fluid.* Joints are of the following kinds:

1. *Immovable* joints like those in the skull of an adult.
2. *Movable* joints. Some of these permit only *limited* movement, as in the spinal column. Others are of a *free motion* type, permitting many different kinds of movement. The elbows and knees

are examples of *hinge* joints; the hip and the shoulder *ball and socket* joints.

Arthritis is a disease that causes a stiffening of the joints. It comes from an infection that settles in the joints, carried there by the blood. Bad tonsils or abscessed teeth are common causes of such an infection.

A *sprain* should be treated by cold applications at once to keep down the swelling. Later, heat may be used to reduce the swelling by increasing the circulation of the blood. A sprain should not be rubbed or massaged while it remains painful. After the pain has gone, massage will help to reduce the swelling. For a *dislocation*, it is well to call a physician. *Torn ligaments*, an injury that often occurs at the knee joint in football games, also calls for a physician's treatment.

For Effective Study:

1. Name the divisions of the skeleton, and the bones of the principal parts.

2. Explain why the bones of adults are more easily broken than those of children.

3. Name and describe a bone disease.

4. Name and describe the different kinds of fractures. How should a fracture be treated?

5. Name the different kinds of joints and give an example of each.

6. Name some health habits particularly helpful for the proper growth and development of bones.

III. THE MUSCULAR SYSTEM

Muscles cover the bones and enclose cavities of the skeleton, thus giving the body form and beauty. They are also the source of energy and movement.

All muscles are composed of muscle cells. These cells are tied together by connective tissue into fibers and bundles to make muscles. Lean meat is a good example of muscle tissue. Each cell is a tiny motor that can produce movement by the burning of fuel brought to it by the blood. These tiny motors working together produce the movements of the body. Muscles are arranged in groups, so that they may pull and work together. They are generally placed in pairs, one set to pull one way when needed, and the other set to pull the other way when necessary. The biceps and triceps muscles of the upper arm illustrate this, the biceps above and the triceps below. They control the movements of the lower arm.

Muscles are of two kinds. *Voluntary* muscles are responsible for movements that are under our control, like walking or lifting. *Involuntary* muscles control activities that are generally thought of as beyond our control, like the beating of the heart and movements related to breathing, digestion, excretions, and other life processes.

Muscle Tone and Exercise:

Good "muscle tone" is the reverse of feeling tired. We have good muscle tone when we feel full of life and energy, with plenty of strength for the activities of everyday life. Regular exercise, proper food, sufficient rest and sleep, and the other health habits help to produce good muscle tone. It may be destroyed by too much or too little exercise, improper diet, and too little rest and sleep.

Exercise is possible only through the activity of the tiny muscle cells. Extra activity of muscle cells creates the need for additional fuel (food) and oxygen. More waste products must be carried away by the blood. The heart beats faster and increases the circulation so that these needs may be met. The production of this extra energy also increases the amount of heat from the extra burning or oxidation in the tissues. Thus exercise produces additional heat in the body. We get rid of this extra heat and some of the extra waste matter through perspiration.

Muscles grow and develop through exercise. Exercise makes them stronger. Too much work or too much exercise, without going through proper training, may be harmful in its resulting exhaustion. *Play* and *games* are good forms of exercise. So also is work. *Athletic sports* of many kinds are valuable. *Corrective* exercises are designed to improve bodily faults or defective posture. By using certain muscles again and again in the same way, we tend to develop skills and habits. Proper posture is an excellent muscular habit. It should be practiced continually whether walking, standing, or sitting. Catching a ball is a good example of muscular skill.

Fatigue:

Fatigue is a tired feeling in the brain or in the muscles due to waste products in the blood caused by the rapid burning of fuel. *Overfatigue* is a dangerous condition that results from using up energy faster than it is stored up. Too much work, play, or excitement with too little rest or sleep may cause this condition. During rest or sleep, the waste products that cause fatigue are carried away. A hot bath is also helpful in relieving fatigue. Massage or "rub-downs" also help to carry off these wastes. Rest and warm baths are good for stiff muscles.

Certain foods are especially valuable for building up muscles. They are called proteins. Milk, cheese, bread, lean meat, fish, eggs, peas, and beans are good muscle-building foods.

Muscle Injuries:

1. *Bruises* are usually caused by blows or bumps that tear the muscle fibers and break the tiny blood vessels. The "black and blue" appearance is caused by the blood that collects in the tissues from the broken blood vessels. Cold water should be applied at once to check the flow of blood into the injured tissues. Warm water may be used later. If the skin is broken, a bandage should be used.

2. *Strains* are muscle injuries in which the tissues are stretched, twisted, or torn. They are caused by sudden effort or effort too great for the muscles. They should be treated by rest and heat. Bandage and tape are sometimes necessary for the kind of rest needed. Heat brings extra blood to the tissues and helps to carry the excess fluid away from the injured part, and thus aids in the healing process.

Pain is nature's signal that an injured muscle should not be used. After the pain is gone, gentle massage will be helpful.

For Effective Study:

1. Distinguish between the immediate and permanent effects of exercise.
2. What is the difference between voluntary movements and involuntary movements?
3. What causes overfatigue?
4. Name some rules that seem to be put in games or sports to prevent overexercise or too great exhaustion.
5. Name some muscle-building foods. What are they called?
6. Make a list of muscular skills.
7. Make a similar list of muscular habits.

IV. FOODS

Uses of Foods:

Foods are often classified according to their contribution to the health of the body:

1. Foods that supply heat and energy.

2. Foods that build up and repair tissues.
3. Foods that help to regulate important body processes and protect our health.

Fuel Foods:

1. The principal fuel (heat and energy) foods are *starches, sugars, fats,* and *oils.* The starches and sugars are often called *carbohydrates.* After digestion, they are stored in the liver in the form of *glycogen.* As additional fuel is needed by the body, glycogen is reconverted into sugar and distributed to the tissues by the blood. Fats and oils contain about twice the heat value of starches and sugars. They are difficult to digest. For this reason fried food should be avoided as much as possible. Excess starches, sugars, fats, and oils are stored in the body in the form of fat. Proteins also have some fuel value.

The fuel value of foods is measured by a unit called a *calory.* A calory is the amount of heat needed to raise one pound (about a pint) of water four degrees on the Fahrenheit thermometer, or one kilogram (about two pints) of water one degree on the Centigrade thermometer. As a result of laboratory experiments, scientists are able to determine the amount of heat given off in the tissues by the burning of various foods as measured in calories.

People who do hard muscular work or exercise need plenty of fuel foods, especially those who work out of doors in cold weather. More fuel foods are needed by boys and girls as they grow older until they reach the end of the growing stage.

Foods for Growth and Repair:

Foods which are good for growth and repair are called *protein* and contain an element called nitrogen. Foods that are rich in protein are: lean meat, cheese, milk, fish, eggs (the white especially), nuts, dried peas and beans, and lentils. During digestion of the food, the proteins are converted into amino-acids. The body cells select from the blood the particular amino-acids that they need. More protein is needed by those who are still growing than by people who are mature or aged. Those who lead a life of muscular activity need more protein than those who do not. Too much protein is believed to be harmful. Most people do not need to eat meat more than once a day.

Water and mineral salts are also needed for proper growth and repair. The body is largely made up of water. In one form or another, it is found everywhere within the body. As a large amount of water is lost constantly through the elimination of waste and the regulation of body temperature, several glasses of water should be taken every day in addition to the water that forms a part of the food we eat.

FOOD ELEMENTS IN SOME OF THE COMMON ARTICLES OF DIET

Name of Food	Proportion or Per Cent of					Vitamins		
	Protein	Carbo-hydrate	Fat	Water	Mineral Content	Vitamin A	Vitamin B	Vitamin C
Fruits:								
Apples, raw, fresh	0.3	14.9	0.4	84.1	0.3	+	+ to + +	+ +
Bananas, raw, fresh	1.2	23.0	.2	74.8	.8	+ +	+ to + +	+ +
Lemons, fresh	.9	8.7	.6	89.3	.5	+	+ +	+ + +
Oranges	.9	11.2	.2	87.2	.5	+	+ +	+ + +
Peaches	.5	12.0	.1	86.9	.5	+ +	— to + +	+ +
Pineapples, raw, fresh	.4	13.7	.2	85.3	.4	+	+ +	+ +
Pineapples, canned	....	....	....	....	....	+	+ +	+ +
Prunes, fresh	.9	21.8	.2	76.5	.6	+ +	+	—
Strawberries	.8	8.1	.6	90.0	.5	+	+ +	+ + +
Vegetables:								
Asparagus	1.8	3.3	.2	94.0	.7	variable	+ + + ?	+ +
Beans, dried	22.5	59.6	1.8	12.6	3.5	+	+ +	•
Beans, string, fresh	2.3	7.4	.3	89.2	.8	+ +	+ +	+ +
Beets, root	1.6	9.7	.1	87.5	1.1	+	+	+
Cabbage, green, fresh	1.6	5.6	.3	91.5	1.0	+ +	+ +	+ + +
Cabbage, cooked	....	....	....	....	....	+	+ +	+
Cauliflower, fresh	1.8	4.7	.5	92.3	.7	+	+ +	+
Cauliflower, boiled	....	....	....	....	....	*	+ to + +	•
Celery stalks	1.1	3.3	.1	94.5	1.0	— to +	+ +	+ +
Lettuce, green	1.2	2.9	.3	94.7	.9	+ + +	+ +	+ +
Onions, raw	1.6	9.9	.3	87.6	.6	— to +	+ +	+ +
Onions, cooked	1.2	4.9	1.8	91.2	.9	— to +	+ +	+
Peas, fresh, home-cooked	7.0	16.9	.5	74.6	1.0	+ +	+ +	+ + +
Peas, canned	....	....	....	....	....	+ +	+ to + +	+ +
Potatoes, white, boiled 15 min.	2.5	20.9	.1	75.5	1.0	+	+ +	+ +
Potatoes, white, boiled 1 hr.	....	....	....	....	....	+	+ +	+
Spinach, fresh	2.1	3.2	.3	92.3	2.1	+ + +	+ +	+ +
Spinach, home-cooked	2.1	2.6	4.1	89.8	1.4	+ + +	+ +	+ +
Tomatoes, raw	.9	3.9	.4	94.3	.5	+ + +	+ +	+ + +
Tomatoes, canned	....	....	....	....	....	+ + +	+ +	+ + +
Eggs, Fish, Meat, Dairy Products:								
Eggs, whole, fresh	13.4	.0	10.5	73.7	1.0	+ + +	+ +	— ?
Fish, fat, like salmon	15.3	.0	8.9	74.9	.9	+	+	•
Fish, lean, like cod	16.5	.0	.4	82.6	1.2	— to +	+	•
Oysters	6.2	3.7	1.2	86.9	2.0	+ +	+ +	+
Liver	....	....	....	....	....	+ + +	+ +	+ +
Meat, lean, beef	19.3	.0	13.0	67.0	.95	+	+ +	— to +

Name of Food	Proportion or Per Cent of: Protein	Carbo-hydrate	Fat	Water	Mineral Content	Vitamins: Vitamin A	Vitamin B	Vitamin C
Eggs, Fish, Meat, Dairy Products:—	**Cont.**							
Meat, lean, poultry	19.3	.0	16.3	63.7	1.0	—to+	+	•
Milk cows whole fresh	3.3	5.0	4.0	87.0	.7	+++	++	+variable
Milk, condensed (sweetened)	8.8	54.1	8.3	26.9	1.9	+++	++	+variable
Milk, evaporated	9.6	11.2	9.3	68.2	1.7	+++	++	—?
Milk, skim, fresh	3.4	5.1	.3	90.5	.7	+	++	+variable
Buttermilk	3.0	4.8	.5	91.0	.7	+	++	+variable
Cheese (whole milk)	25.9	2.4	33.7	34.2	3.8	+++	*	*
Cereals, Flour, and Flour Products:								
Bread, white (milk)	9.6	51.1	1.4	36.5	1.4	+	+	—to+
Corn, whole (white)	....	....	....	....	....	+	++	—
Corn, whole (yellow)	....	....	....	....	....	++	++	—
Oats	....	....	....	....	....	—to+	++	—
Rice, polished	....	....	....	....	....	—	—	—
Rice, whole	....	....	....	....	....	+	++	—
Wheat, flour, white	10.8	74.8	1.1	12.8	.5	—	—to+	—
Wheat, flour, whole	13.8	71.9	1.9	11.4	1.0	+	+++	—
Sugars:								
Honey	.4	81.2	.0	18.2	.2	—	—	—
Molasses	2.4	69.3	.0	25.1	3.2	—	+	—
Sugar, granulated	.0	100.0	.0	.0	.0	—	—	—
Fats, Oils, Nuts:								
Butter	1.0	.0	85.0	11.0	3.0	+++	—	—
Cream	2.5	4.5	18.5	74.0	.5	+++	++	+variable
Cod Liver Oil	....	....	....	....	....	+++	—	—
Lard, refined	.0	.0	100.0	.0	.0	—to+	—	—
Pecans	17.0	7.0	66.8	5.3	3.9	++	++	•
Cocoanut	5.7	27.9	50.6	14.1	1.7	+	++	•
Peanuts	25.8	24.4	38.6	9.2	2.0	+	++	•
Walnuts, English	16.6	16.1	63.4	2.5	1.4	+	++	•
Miscellaneous:								
Yeast	11.7	21.0	.4	65.1	1.8	—	+++	—

In the lists of Vitamins, the signs used have the following meaning: + indicates that the food **contains** the vitamin; ++ indicates that the food is a **good source** of the vitamin; +++ indicates that the food is an **excellent source** of the vitamin; — indicates that the food contains **no appreciable** amount of the vitamin; * indicates **that evidence is lacking**, or appear **insufficient.**

Per cent of Food Elements from U. S. Dept. of Agriculture Publications as follows: Fruits from Circular No. 50, Chatfield and McLaughlin: "Proximate Composition of Fresh Fruits," 1928. Meat, lean, beef, from Department Circular No. 389, Chatfield: "Proximate Composition of Beef," 1926. All others from Bulletin No. 28, revised. Atwater and Bryant: "The Chemical Composition of American Food Materials," 1906. Vitamins from U. S. Dept. of Agriculture, Circular No. 84, Smith: Vitamins in Food Materials," 1929. Munsell and Daniel: "Foods Rich in Vitamins," published as pamphlet 434R3 (Feb. 10, 1935), by the Bureau of Home Economics of the U. S. Dept. of Agriculture, Washington, D. C.; and "Food and Health," by Henry C. Sherman, The Macmillan Co., New York City, 1934.

Among the minerals needed are calcium and phosphorus for teeth and bones, and iron for the hemoglobin of the red corpuscles. The hemoglobin is the part that carries the oxygen to the tissues. Minerals are supplied by milk, whole-grain cereals, water, vegetables, fruits, lean meat, and sea foods.

Regulating and Protecting Foods:

1. *Mineral salts.* Calcium is a mineral that is needed for many bodily processes such as the contraction of the muscles and the coagulation of the blood. Other minerals such as phosphorus, iron, and iodine are also needed by the body. Much of the mineral salts are lost in body excretions; therefore additional mineral salts should be supplied by eating such foods as milk, cereals, meat, fish, green vegetables, egg yolk, liver, and table salt.

2. *Bulky* or coarse foods. These are valuable in stimulating the muscles of the intestines, thus aiding elimination. Such foods include vegetables, fruits, and whole cereals.

3. Foods containing *vitamins.* Vitamins are substances about whose exact nature there is yet much to discover, but we do know that they are essential to good health and growth. They are found in different foods and are referred to by letters, such as vitamin A, vitamin B, vitamin C, and vitamin D.

Vitamin A is abundant in milk, butter, cod-liver oil, and the green leaves of plants. It is generally associated with color, such as red, yellow, and green. It is essential to proper growth and aids the appetite.

Vitamin B is sometimes split into two parts, B1 and B2, or else the second part is called vitamin G. These two vitamins help to prevent certain "deficiency" diseases or disorders, B1 for beri-beri and B2 for pellagra. Certain vital organs of animals like kidney and liver and the coverings of fruits and vegetables are rich in these vitamins. They are also found in good protein foods and yeast.

Vitamin C is found in *fresh* foods, especially in fresh, green vegetables and fruits. It has a tendency to disappear when food is kept too long or when heated. Vitamin C helps to prevent scurvy, another deficiency disease. It is valuable in promoting the health of the teeth and gums.

Vitamin D is generally found in oils and fats where it has been created by the action of sunlight. It is necessary for the proper formation of bones and teeth, and is sometimes known as the calcium-helper. It helps to prevent rickets, a disease of children in which the bones do not harden properly. It can be formed right in our bodies by the action of sunlight which falls directly on the skin.

4. *Water* and other beverages. Milk is an excellent food for supplying liquid to the body. Cocoa and chocolate have some food value. Tea and coffee are disturbing to the nervous system, and are undesirable for children.

A Balanced Diet:

A safe rule is to eat some of each kind of food, but not too much of any one thing. A balanced diet is one that contains proper amounts of body-builders, fuel foods, regulators, and proteins. If the diet is varied, it will likely contain all of the various elements, vitamins, and regulative foods that your body needs. Variety and moderation should be your key-words. Overeating should be avoided.

Reduction of weight by dieting or taking medicines is dangerous unless prescribed by a doctor. Carefully planned exercise is valuable in such cases, but it also produces a greater appetite for food.

Proper Preparation of Foods:

Food should be kept clean and pure. Good refrigeration is an aid to this. All foods to be eaten raw should be carefully washed or cleaned before eating. Proper cooking is valuable for other foods for the following reasons:

1. It makes food more attractive and more palatable.
2. It gives variety in diet.
3. It makes some foods easier to digest.
4. It kills germs.

For Effective Study:

1. Name the various kinds of foods classed according to their uses.

2. What are vitamins?

3. What is a calory?
4. Describe a balanced diet. Why is it important?
5. Why is cooking valuable in the preparation of food?
6. How can food be kept pure and wholesome?

V. THE DIGESTIVE SYSTEM

The Alimentary Canal:

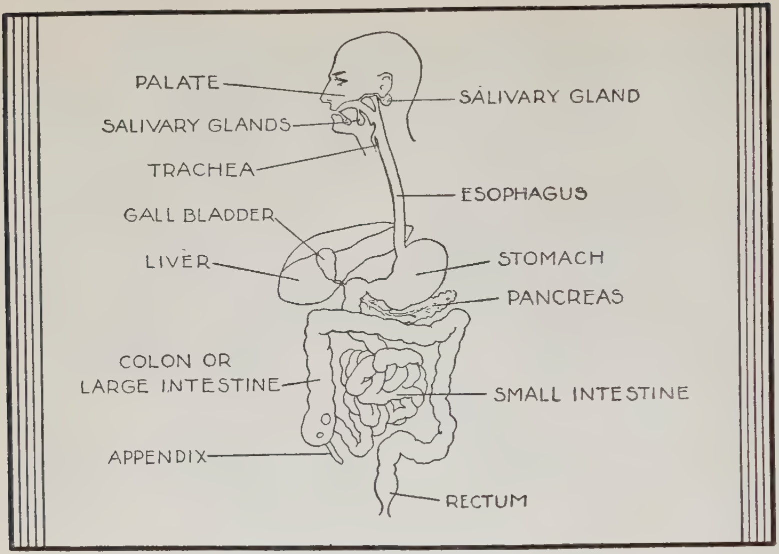
The *alimentary canal* is a series of organs beginning at the mouth and ending with the large intestine. It is about thirty feet in length and includes the mouth, throat, esophagus, stomach, small intestine, and large intestine.

In the mouth the teeth grind and tear the food into fine particles. The saliva from the *salivary glands* is mixed with the food as it is chewed, softening and moistening it so that it can be easily swallowed. At the same time the digestion of the starches is also begun.

When the food is swallowed, it is prevented from going into the *trachea* or windpipe by a little lid called the *epiglottis* that automatically closes the top of the windpipe as we swallow.

After the food is swallowed, it enters the esophagus, or gullet, and is pushed downward into the stomach by muscular rings. It enters the stomach through an opening called the *cardiac orifice.*

In the stomach the food is acted upon by the *gastric juice* that pours out from glands in the lining of the stomach. The gastric juice contains *hydrochloric acid* and two other substances (enzymes)



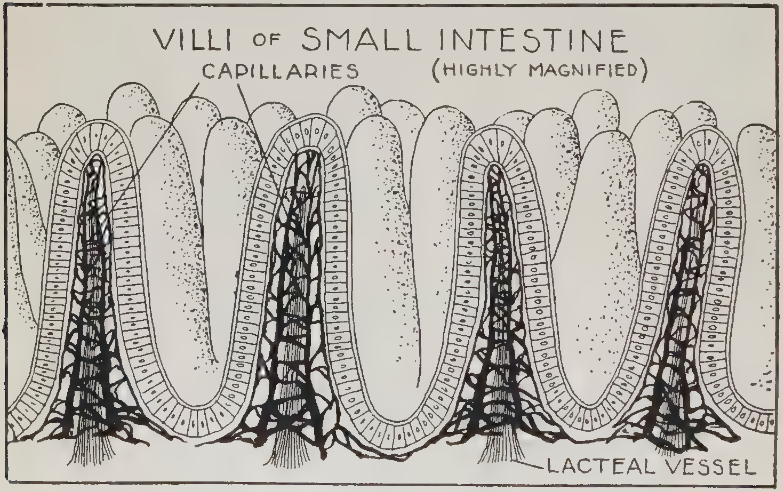
The Alimentary Canal

called *pepsin* and *rennin.* The hydrochloric acid creates an acid condition in the stomach that is necessary for the digestion of proteins that takes place there. The pepsin begins the digestion of protein foods, while the rennin begins the digestion of milk, changing it into curds. The changing of starch into sugar begun in the mouth is not continued in the stomach because the acid condition is not favorable to it. The muscular walls of the stomach contract and churn the food about, thoroughly mixing it with the digestive juices. Food, after an ordinary meal, remains in the stomach about two hours, depending upon the quantity and kinds of food eaten. Gradually the food passes through the other opening of the stomach (*pyloric orifice*) into the small intestine.

In the small intestine the partly digested food is acted upon by other digestive juices. The *pancreatic juice* from a gland called the *pancreas*, by means of several enzymes, changes starches and sugars into a form of sugar that can be used by the body as fuel. It contains the digestion of proteins begun in the stomach changing them into amino-acids that can be absorbed and used by the cells for growth and repair. With the help of the *bile* from the gall bladder, fats and oils are changed into *glycerin* and forms of fatty acid that can be absorbed by the blood and used as fuel. The *intestinal juice* from glands in the walls of the intestine helps with the digestion of proteins and sugars. In this manner the food is changed into nourishing substances that are absorbed into the blood and carried to the tissues. During all of this time, muscles in the walls of the small intestine keep the food in motion, mixing it well with the juices and gradually moving it along the course of its passage through the intestine. This generally takes four or five hours.

The inner surface of the small intestine is covered with small hair-like projections called *villi*. These villi contain tiny blood vessels called *capillaries* and other small tubes (*lymphatic ducts*) called *lacteals*.

These tiny vessels absorb the cream-like mass of digested foods. The sugars and amino-acids enter the blood in the capillaries, then the veins, pass to the liver, and from there finally go to the heart and are pumped around the body to the tissues and cells. The glycerin and fatty acids from the fats and oils are taken up by the lacteals and are emptied into



Villi of Small Intestine

the blood stream by the thoracic duct. (See page 307, lymphatic circulation.)

The undigestible and unabsorbed portion of the food remaining is passed along by muscular movement to the large intestine, from which it is excreted. This material enters the large intestine in a fluid state. A large part of the water is absorbed there together with small portions of digested food that may have escaped absorption in the small intestine. The remainder collects in the large intestine and is excreted at intervals by movements of the large intestine or bowel. About twenty hours is average time for passage through the large intestine. At the point where the large intestine joins the small intestine, there is a small finger-shaped appendage known as the *appendix.* Occasionally this organ becomes infected and painful. It should receive prompt medical attention. Taking a physic under such circumstances has often caused death. It is dangerous therefore to take a laxative to relieve pain in the abdomen. It may have dangerous or even fatal results.

The waste matter collected in the large intestine should be eliminated regularly. Prolonged retention results in a harmful condition known as *constipation.* To overcome this the following measures may be tried:

1. A glass of water before breakfast.
2. Going to the toilet at regular times, preferably right after breakfast.
3. Regular exercise, out of doors when possible.
4. For some people eating coarse, bulky foods as a part of their diet.
5. The use of drugs or laxatives is not desirable unless prescribed by a physician.

Aids to Digestion:

1. Wise selection of foods.
2. Chew foods thoroughly.
3. Avoid overeating.
4. Drink water liberally between meals.
5. Rest after meals.

The Liver:

The *liver* is the largest organ of the body, weighing normally between three and four pounds. It is located in the upper right part of the abdomen. It is really a large gland. Its uses are as follows:

1. It secretes the *bile* and stores it in the *gall bladder* for use in digesting food in the small intestine.
2. It stores and regulates the supply of sugar carried by the blood to the tissues. This stored-up sugar is in a form called "glycogen."
3. The liver assists in removing a form of waste from the blood known as *urea* from the *kidneys* and *bladder*. Urea is the waste product resulting from the breaking down of protein in the tissues.
4. The liver is an aid in removing and neutralizing other poisons formed within the intestine during the process of digestion.

The continued use of alcohol even in moderate amounts is harmful to the liver. It hardens and injures its cells, thus interfering with its important duties.

For Effective Study:

1. Name the parts of the alimentary canal.
2. Describe the transformation of food that takes place in each part.
3. Name some rules helpful for good digestion.
4. Name some wise rules covering:
   a. The appendix.
   b. The liver.
   c. Elimination.
5. Why should food be chewed thoroughly?

VI. THE MOUTH AND THE NOSE

The mouth and nose are important entrances or "gateways" to the body. They should receive careful attention. Any interference with normal breathing calls for a physician's examination.

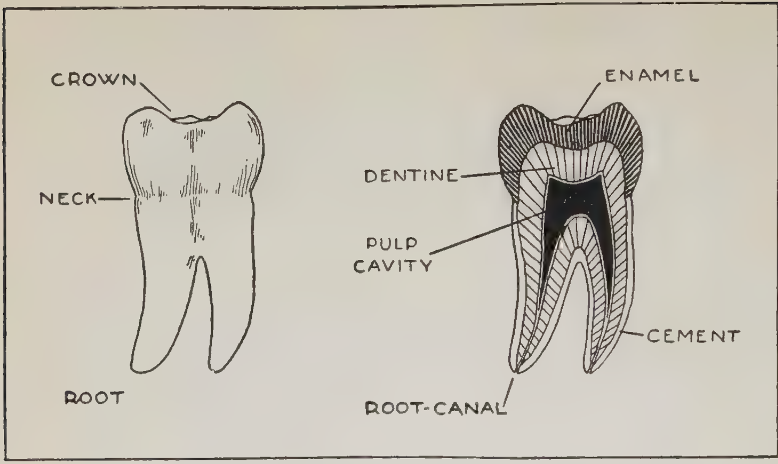
The Teeth:

The uses of the teeth are:

1. To cut and grind food.
2. To assist in making certain sounds in speech.
3. Important factors in personal appearance.

The structure of the teeth consists of the following:

1. Crown, the part above the gums.
2. Root, the part below the gums, holding the tooth in place.
3. Neck, the point where the root and the crown meet.



Structure of a Tooth

The teeth are composed of the following substances:

1. *Dentine,* a hard ivory-like substance of which most of a tooth is composed.
2. *Enamel,* the hardest substance in the body, protecting all of the exposed portion of a tooth.
3. *Cementum,* a hard bone-like substance that covers the dentine below the gums.
4. The *pulp* consisting of connective tissue cells, blood vessels, and nerves in the natural cavity or life-center of a tooth.

Growth:

Teeth form beneath the gums and gradually grow and force their way through. Our first twenty teeth are temporary. They gradually loosen and come out to make room for the second set or permanent teeth. There are thirty-two of these permanent teeth. They start to make their appearance about the age of six ("sixth-year molars"). By the age of thirteen or fourteen, twenty-eight have normally appeared. The last four, or "wisdom" teeth, generally appear between the seventeenth and twenty-first years.

Care of the Teeth:

1. Teeth, like bones, require much calcium or lime. Phosphorus and several vitamins, especially vitamins D, C, and A, are also needed. We should therefore supply the body with plenty of milk, green vegetables, and other foods containing these building and protective substances.

2. Teeth are benefited by exercise. Tough or medium hard foods that exercise the teeth and gums are beneficial.

3. Avoid biting very hard things or subjecting the teeth to extremes of heat and cold.

4. Prevention of decay. This depends to some extent upon body condition, diet, and exercise. Keeping the teeth clean also helps to prevent decay, because decay is started by the decomposition of small particles of food that remain between the teeth. This causes an acid to form that eats into the enamel and dentine.

5. Visit the dentist for regular inspections.

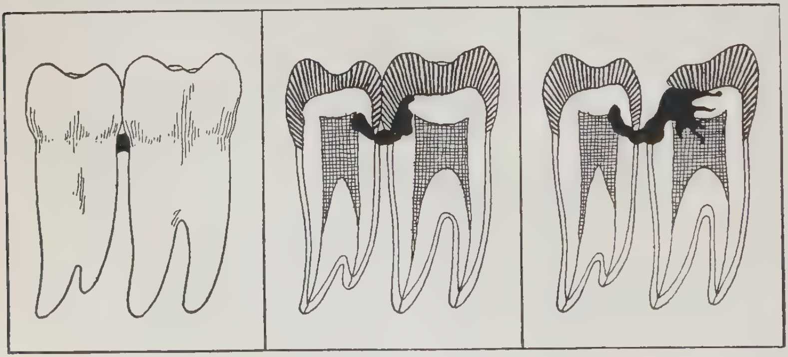
Cleaning the Teeth:

1. Use a moderately firm brush and twist or roll the handle, thus getting into the cracks between the teeth. Brush all the surfaces of all the teeth, inside, outside, and grinding surfaces.

2. Use tooth paste or tooth powder. Dental floss is useful at times. Mouth washes help to keep the mouth and teeth clean.

Prevention of Infection:

Disease germs sometimes find a place in the body where they can locate, grow, and cause trouble. Such a spot is called the *focus* (plural, *foci*) of an infection. Teeth, nose, and throat as entrances to



Spread of Decay

the body offer many such opportunities for germs.

1. *Decayed teeth:* Germs grow in the cavities. Remedy: Have the dentist repair them; then keep the mouth clean.

2. *Root Canal Infections:* These are sometimes called abscesses. Remedy: Removal of the infected tooth. Otherwise the germs of the infection may be carried around by the blood stream and lodge in some important organ or tissue. Heart trouble and other serious ailments have been traced to infected teeth.

3. *Pyorrhea:* This is a disease of the gums and teeth that causes body infections, as well as loss of teeth. Remedy: Dental treatment. It is sometimes necessary to extract the teeth concerned. Prevention is best. Keep the teeth and mouth clean.

4. *Infected Tonsils:* The tonsils are two soft, fleshy lumps or growths located at the back of the mouth near the entrance to the throat. Their surface contains depressions or *crypts* that form excellent lodging places for germs. *Tonsillitis* is an inflammation due to these germs. Infection of the tonsils may spread through the blood stream to joints, heart, or kidneys. Remedy: *Tonsillectomy* or removal of the tonsils. It is not a serious operation and often results in greatly improved health.

5. *Infected Sinuses:* A *sinus* is a cavity or hollow space in one of the bones of the skull. There are four pairs of them—in the cheek bones, forehead, behind the nose, and at the base of the brain. Each sinus has a tiny opening into the nose. Infections such as we have during a cold may thus get into the sinuses. Violent blowing of the nose sometimes

causes sinus trouble. This kind of infection often causes serious trouble. Remedy: Blow the nose gently, preferably one nostril at a time. Consult a physician, preferably one who specializes in nose and throat cases.

6. *Adenoids:* The two *adenoids* are soft pulp-like growths in the back of the throat. Young children often have enlarged adenoids. Sometimes they are so large that they interfere with breathing and so make their removal desirable. The operation is a minor one. The adenoids generally disappear as people grow older.

7. *Colds:* These are infections or inflammations of the membranes that line the nose, throat, and upper air passages to the lungs. They are infections and should receive careful attention. If neglected, more serious ailments may develop. Great care should be exercised to prevent the spread of colds through coughing, spitting, or sneezing.

For Effective Study:

1. What are dental "caries"?
2. What causes decay in a tooth?
3. How may the health of the teeth be guarded?
4. Name seven kinds of infection sometimes found in the nose, mouth, or throat.
5. Describe the proper treatment for each.

VII. THE BLOOD AND ITS CIRCULATION

All living things need food, water, and air. Waste products must be eliminated. In the human body, with its countless millions of cells, this problem also exists. Each cell as a living organism must be supplied with the necessities of life, and the wastes removed. This is done by means of a fluid called the blood circulating through blood vessels called *arteries*, *veins*, and *capillaries*. A pump called the *heart* keeps the blood circulating.

The Blood:

The circulation of the blood is closely related to health. A vigorous circulation promotes personal well-being. A weak circulation lessens the efficiency of the whole body. The blood helps to regulate the temperature of the body (see The Skin), and also gives a pinkish or a red color to certain parts of the body.

The blood is composed mostly of a watery fluid called *plasma*. Under the microscope, certain small bodies will be seen floating in this plasma. They are:

1. *Red corpuscles.* These are so small that a drop of blood contains several millions of them. They are round and flat like coins. A substance called *hemoglobin* in these red corpuscles carries the oxygen to the tissues. The carbon dioxide caused by the oxidation in the tissues is returned to the heart through the blood stream. Iron is an important element in the composition of the hemoglobin. Such foods as meat, eggs, whole wheat, oatmeal, spinach, and other green vegetables are especially rich in iron.

The Capillaries

A network of tiny blood vessels connecting the arteries and the veins.

Red Corpuscles of the Blood

These tiny bodies give up their oxygen and take up carbon dioxide in the capillaries.

White Corpuscles of the Blood

These "soldiers" of the body can pass right through the thin capillary walls to fight invading germs.

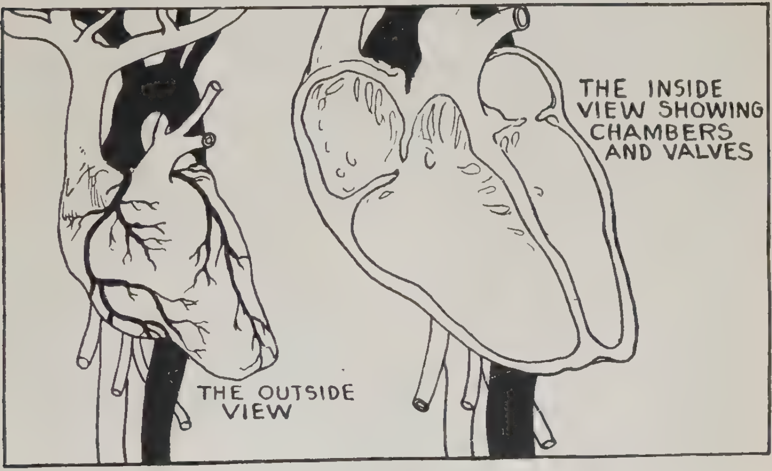
2. *White corpuscles.* These are of several varieties. Most of thom are larger than the red corpuscles. There are about 5000 to 7000 in a drop of blood. White corpuscles can go right through the walls of the capillaries. They attack disease germs and gather like the soldiers in an army wherever they are needed. Sometimes the white corpuscles are killed in their battle with germs. Much of the "pus" from sores or wounds is composed of the dead bodies of our gallant defenders, the white corpuscles.

3. *Platelets,* or "little plates." These are tiny round objects, much smaller than the red corpuscles and not so numerous. There are about 300,000 to a drop of blood. They are believed to

be important in stopping the flow of blood from a cut or wound by helping to form a *clot*.

The Circulation of the Blood:

The heart is a hollow organ about the size of one's fist. It is pear-shaped with the point or apex downward. It is divided into four sections, two on each side. The upper cavities are called *auricles* (*right* and *left*) and the lower ones *ventricles* (*right* and *left*).



The Heart

The dark red impure blood returning from the tissues laden with waste matter enters the heart by the right auricle. This contracts and sends the blood into the lower chamber, the right ventricle. From there the blood is sent to the lungs to be purified.

When the blood returns from the lungs, it enters the left auricle, passes into the left ventricle, and from there it is pumped out into the *aorta,* the large artery which starts it on its way through other arteries to all parts of the body. In the tissues are tiny blood vessels called capillaries. These supply nourishment, fuel, and oxygen to the cells, and receive in return waste matter. This causes the blood to change to a dark red color. From the capillaries the impure blood collects in the veins and returns to the heart.

The heart is supplied with check valves that prevent a backward flow of blood and loss of force. The two auricles contract at the same time, then the two ventricles, after which there is a slight pause during which the heart rests. This continues throughout our lives. During exercise the heart beats faster to supply the cells with their increased needs. After exercise is over, the heart generally slows down and returns to a normal beat—about seventy to seventy-five per minute in children, and seventy to seventy-two per minute in adults. You can test this by counting the pulse at the wrist, which shows the heart beat.

Arteries carry blood away from the heart. Arteries are tough and flexible, with muscular walls. This enables them to stretch with the pressure of the heart beat. The arteries grow smaller as they get farther from the heart, like the branches of a tree in relation to the trunk. The capillaries are found in all parts of the body except a few bloodless tissues like the hair and the nails. These tissues are nourished from their roots beneath the skin. The walls of the capillaries are so thin that the plasma of the blood can pass through them in order to give cells their nourishment. The white corpuscles may also pass through these walls. Veins return the blood to the heart. They gradually grow larger as they approach the heart, until all the blood returns to the right auricle through two large veins. As the pressure of the heart-beat is not so strong in veins, their walls are not so thick as those of arteries. Small valves in the veins prevent the blood from flowing in the wrong direction. Muscles also assist the blood to flow through the veins. Experiments indicate that the blood normally completes its circulation in less than a half minute, about twenty-three seconds.

Circulatory Systems:

The blood circulates in three distinct ways:

1. *The Systemic Circulation* in which the blood leaves the left ventricle of the heart and goes to the tissues with oxygen, nourishment, and fuel, returning again to the heart.

2. *The Lymphatic Circulation* in which some of the watery plasma of the blood leaves the capillaries to enter the cells and tissues. While it is outside the capillaries, this fluid is called *lymph.* Some of

this lymph returns again to the blood in the capillaries. The rest of it enters special *lymphatic capillaries* and *ducts* which collect lymph and return it to the blood by emptying it into a large vein near the heart.

3. *The Pulmonary Circulation* which carries the dark impure blood from the right ventricle of the heart to the lungs, from which it returns in purified form containing a fresh supply of oxygen to the left auricle of the heart.

Rules for Good Circulation:

1. Exercise strengthens the heart and the circulation. Walking and slow running are very beneficial. Overexercise and overwork injure the heart.
2. Rest and sleep are beneficial to the heart. When the body is resting, the heart has less work to do.
3. Tight waist-bands, belts, garters, and other articles of clothing often hinder circulation.
4. Proper posture is important. Improper posture often prevents organs, muscles, and other kinds of tissue from receiving a proper supply of blood.
5. Alcohol is a poison that injures the muscles of the heart and blood vessels. It also frequently causes more body heat to escape than the body can afford to lose. In cold climates, alcohol is especially dangerous for this reason.
6. Tobacco often causes irregular or fluttering

beating of the heart and at times even pain in the region of the heart. This disturbs normal circulation.

7. Violent emotions such as anger and fear cause extra work and strain on the heart. Causes of such violent emotion should be avoided.

8. Infections in other parts of the body may be carried by the blood to the heart or some other vital organ. Tonsillitis, abscessed teeth, chorea (St. Vitus' dance), rheumatism, and scarlet fever often leave damaged hearts behind them. Therefore all infections should receive careful medical attention. Avoid exposing yourself to contagious diseases. Build up good body resistance by practicing all the rules of personal hygiene.

First Aid in Bleeding:

Blood is a precious life fluid. The body tries to prevent it from escaping by *clotting* or *coagulation* when we bleed from a cut or wound. A sticky thread-like substance called *fibrin* forms the clot and seals the opening. A clean piece of gauze bound directly over the wound will often help the blood to clot. In severe or prolonged cases of bleeding, medical assistance should be secured.

When bleeding from an artery, the blood is bright red and flows out in spurts or jets. Pressure should be applied over the artery between the wound and the heart to shut off the supply of blood. This

Applying a Tourniquet

pressure may be supplied by the finger or by a tight band called a *tourniquet.* A piece of cloth, leather, or rope is twisted, using a stick to wind it, over a pad placed over the artery. As this pressure cuts off the entire supply of blood to parts beyond the tourniquet, it should be relaxed a little from time to time to allow some blood to circulate.

Blood from a vein is darker and flows out in a steady stream. To stop bleeding apply pressure between the wound and the extremities of the body. Bandage tightly to bring the edges of the wound together and assist clotting. For nose bleed pack the nose with clean (sterile) cotton or gauze. Tilting the head back often helps.

Sterilize all cuts and wounds with iodine or some other good *antiseptic*.

Removal of Wastes from the Blood:

These wastes are caused by:

1. The break-down of cells caused by activity or movement.
2. The waste products left in the blood by the burning of oxygen and fuel food in the tissues.

Such wastes are poisonous if permitted to remain in the body. The blood is purified and its wastes eliminated in the following ways:

1. The kidney and bladder. As the blood passes through the kidneys, waste materials are removed and passed on through tubes to the bladder, which stores it until it passes out of the body as the urine. Drinking plenty of water is helpful to the kidneys.
2. Through the pores of the skin, as perspiration.
3. Through the lungs with the expired air.

For Effective Study:

1. Compare the circulation of the blood to a transportation system.
2. Describe the composition of the blood.
3. How may bleeding be stopped?
4. Name some factors in good circulation of the blood.
5. Why is good circulation important?

VIII. AIR AND RESPIRATION

The oxygen used in the tissues of the body is taken from the air in the lungs. When the blood returns to the lungs, it brings carbon dioxide (a gas) for elimination from the body. Carbon dioxide gas is formed when fuel is oxidized to make heat and energy. *Respiration* includes those processes by which oxygen is supplied to the tissues, and carbon dioxide is removed from them. Part of it takes place in the lungs and part in the tissues.

We breathe air into the lungs. Breathing in is called *inspiration.* Breathing out is called *expiration.* Inspiration is caused by the enlargement of the chest cavity. This creates a vacuum into which air rushes. The enlargement of the chest is caused by muscles pulling the ribs upward and outward. A large flat muscle called the *diaphragm* also enlarges the chest in a downward direction. This causes the abdomen to expand slightly. Expiration is caused by a decrease in the size of the chest cavity as the ribs are lowered and the return movement of the diaphragm. This forces the air out of the lungs. It is like the working of a pair of bellows. Adults breathe about sixteen to eighteen times a minute, younger persons about twenty times. In play or work, more oxygen is needed by the tissues and we breathe faster to supply these needs.

Correct Breathing Habits:

1. *Exercise* is beneficial. It helps strengthen the

muscles used in breathing. Deep breathing exercises are often recommended for singers and public speakers.

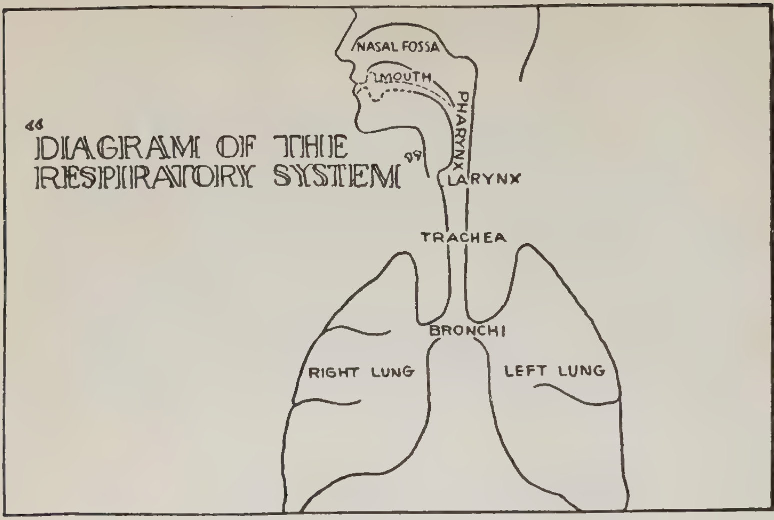
2. *Correct posture* is necessary in order to permit your chest to expand properly.

3. *Tight clothing* should be avoided. It may interfere with the movement of the chest and abdomen in breathing.

4. Special breathing exercises are not necessary. When we need more air because of extra work or exercise in general, the lungs react automatically and effectively.

Special Forms of Breathing:

Coughing is a sudden expiration of air from the lungs caused by an irritation somewhere in the respiratory passages. *Sneezing* is also a sudden expiration of air through both the nose and the mouth. Both coughing and sneezing are protective devices of the body to get rid of the cause of the irritation. At such times we should always remember to protect others from possible infection. *Hiccoughing* is concerned with the inspiration of air. It is generally caused by some irritation of the diaphragm caused by a digestive disturbance. It can sometimes be relieved by coughing, sneezing, or swallowing cold water. Pulling the tongue forward may bring relief. In prolonged attacks, a doctor should be consulted.



The Organs of Respiration:

The chest cavity is rather completely filled with two light elastic organs known as the *lungs.* There is one on each side of the body, right and left. Each lung contains a great number of tiny *air sacs* or *air cells.* The walls of these cells are thin and are plentifully supplied with capillaries. As the blood passes through these capillaries, the red corpuscles pass carbon dioxide into the air sacs and at the same time receive a fresh supply of oxygen.

Air enters the body through the nose or mouth. Breathing through the nose helps to warm and moisten the air and to clear it of impurities before it reaches the lungs. After passing through the nose or mouth the air reaches the *larynx,* or voice box, where the vocal cords are situated. These vocal cords are set in motion with the air of expiration to make many of the sounds used in speech and singing. Below the larynx is the windpipe, or *trachea.* The windpipe divides into two smaller tubes called *bronchi,* one going to each lung. These divide again and again, like the branches of a tree, into smaller passages called *bronchial tubes* which carry the air finally to the tiny air cells.

The lungs are covered with a thin smooth membrane called the *pleura,* which also lines the walls of the chest cavity. The pleura is moistened by a fluid which enables the two surfaces to slide over each other in breathing without irritation. Inflammation of the pleura is called *pleurisy.* It should receive prompt medical attention.

Respiration in the tissues has been described on page 307 under "The Circulation of the Blood."

Protection for the Lungs:

The lungs are very delicate organs and are carefully protected by ribs and other bones and by layers of muscles that enclose the chest cavity. The air breathed in often contains impurities, bacteria, dust, and harmful gases. The air passages leading to the lungs protect them to some extent.

These air passages are lined with *mucous membrane* which is moistened by a *mucous secretion.*

They also contain tiny hairs or *cilia* that wave back and forth. This combination of moist sticky surfaces and waving cilia helps to catch impurities and remove them from the air before it reaches the lungs.

Good Air:

Everyone enjoys fresh air such as we find at the seashore, in the mountains, and in the country. It makes us feel good and it is good for us. We should try to breathe only fresh air at all times, day and night, indoors and out of doors. The problem of securing good fresh air indoors is called *ventilation.* The conditions for good ventilation require that air indoors be of the proper temperature, with a certain amount of moisture, and should be moving. This requires considerable attention during cold weather. We should not permit the air to get too hot or too dry. In large buildings ventilating systems take care of this.

During cold weather try to keep the temperature for the air indoors about 70°. The source of the heat (stoves, registers, or radiators) generally keeps the air moving. In warmer weather the windows must be opened quite wide to force the air to circulate. A tea kettle on a stove supplies some of the needed moisture indoors during cold weather. Other devices on radiators or in furnaces are used also to supply this moisture during cold weather. Very dry air indoors dries up the moisture of mucous membranes in the air passages. This weakens our protection against dust and germs.

Dust in the air is dangerous and harmful. Those who work in occupations where there is much dust should wear masks to protect their lungs. House dust or street dust often contains disease germs. *Dry* sweeping and *dry* dusting stir up these germs and should be avoided. Use vacuum cleaners when possible and dust with a damp, slightly oiled cloth. Some gases are very harmful and workers in certain industries must wear gas masks for protection. Carbon monoxide, the gas from the exhaust pipe of gasoline motors (automobiles, especially) is very dangerous. Such a motor should never be run in a closed garage or shop. Doors or windows should always be open. A small amount can cause death. Everyone should be very careful about this.

Inflammations:

Since the air passages are so much exposed, the delicate mucous membrane often becomes inflamed or sore. The letters "-itis" at the end of a name of a disease indicates "inflammation of." So we have pharyng*itis*, laryng*itis*, bronch*itis*, and so on. Other ailments of the respiratory tract include colds, pneumonia, and tuberculosis. The upper parts of the respiratory tract are more subject to inflammaion or infection than the parts deep in the lungs.

Nevertheless, such infections often travel down and may have serious results. Sore throats and colds should therefore receive careful attention.

How to Prevent Colds:

1. Check their spread. Everyone should hold a handkerchief or hand over the nose or mouth when coughing or sneezing. Spitting on the sidewalks or in public conveyances is very dangerous.
2. Avoid use of common drinking cups, or exchanging partly eaten articles of food.
3. Stay away from crowded and poorly ventilated places when colds and other illnesses are about.
4. Avoid close contact with people who have colds.
5. Build up your body resistance by the practice of good health habits.
6. Avoid things that lower your body resistance, such as wet feet or insufficient rest and sleep.
7. Avoid wearing too much warm clothing indoors and avoid overheated rooms.
8. Cold vaccines are not always effective, but do seem to help many people.
9. Breathe through the nose.
10. Some people find cold baths in the morning helpful. Others splash cold water on their faces, necks, and chests.
11. Have diseased tonsils and enlarged adenoids removed.
12. Keep your nose clear and so supply good ventilation for the nose and throat.

Tuberculosis:

This is one of the world's most dreaded diseases. It is a germ disease, spread largely in the same manner as the germs of other respiratory diseases. For many years to get "consumption," or tuberculosis, meant a slow lingering death with little or no hope of recovery. Many, many people died of it, and frequently these people were young men and young women, or people in the prime of life.

For the prevention of tuberculosis one should keep up his body resistance. Overexercise, underweight, lack of exercise, repeated exposure, lack of fresh air and sunshine, poor working or living conditions, and overexhaustion from insufficient rest and sleep weaken body resistance. Practice all the laws of good hygiene. There is no sure remedy in the form of medicine, vaccines, or serum, for the cure of tuberculosis. However, many people have been cured or the disease checked by following carefully certain rules of healthy living. Chief among these are:

1. Absolute and complete rest.
2. Wholesome food.
3. Sunshine and fresh air, living and sleeping out of doors as much as possible.
4. Helio-therapy (sun treatments) or sun baths for the whole body.
5. A cheerful determination to get well.

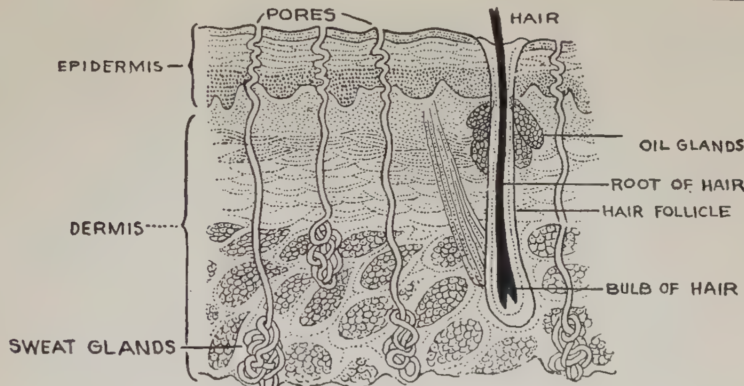
Much of the success of the program of treatments depends upon an early recognition or diagnosis of the actual presence of tuberculosis. A few general symptoms should be remembered and the advice of a competent physician secured whenever these conditions appear. Through the use of X-ray and other scientific tests, it is usually possible to discover the presence of the disease in its early stages. Some symptoms are:

1. Headache, nausea, and loss of appetite.
2. Loss of weight and cessation of growth.
3. Feeling tired oftener and more easily.
4. Night sweats, with fever.
5. Prolonged, chronic cough.

Tuberculosis sometimes attacks cattle, and may be spread by tubercular milk from infected cows. This form of the disease usually attacks the bones and glands of young children rather than the lungs. Drinking only pasteurized or certified milk helps to prevent this form of infection. Infected cattle should be destroyed.

For Effective Study:

1. What is meant by ventilation?
2. Name the parts of the respiratory system. Describe the purpose or use of each part.
3. What causes inspiration? Expiration?
4. What are the factors to be considered in good ventilation?
5. How may we guard against colds?
6. Name some of the symptoms of tuberculosis.
7. What measures should be taken for its prevention?
8. Name some things necessary for successful treatment of this disease.



HIGHLY MAGNIFIED
VERTICAL SECTION OF THE SKIN

IX. THE SKIN

Uses of the Skin:

1. Covers and protects the body.
2. Assists in regulating body heat.
3. Helps in the elimination of waste materials.
4. Plays a part in the senses of touch, temperature, and pain.

Structure:

The skin is composed of two distinct layers. The outer layer is called the *epidermis*, and is protective, being thicker in places where it is needed most. It has no nerves or blood vessels. The under part of the epidermis contains *pigment* or coloring matter. The amount of pigment varies greatly with individuals and with different races. This pigment darkens somewhat after exposure and is called tan. Beneath the outer layer of skin lies the true skin or *dermis*. It contains nerves, blood vessels, oil and sweat glands, and the roots of the hair and of the finger nails. It also contains nerve endings for the senses of touch, temperature, and pain. The skin grows by the formation of new cells where the outer and inner layers meet. These cells are gradually pushed outward.

Whenever the outer layer of skin is scraped off, new skin grows in its place. Cuts and wounds form openings for the entrance of dirt and germs. A clean skin lessens this danger. All cuts and wounds should be carefully sterilized with iodine or other suitable substance.

The Hair:

Hair is a specialized form of epidermis. Each hair stands in a little pocket or hair *follicle*. Little oil glands pour oil into this pocket and keep the hair moist, smooth, and glossy. The hair of some people is more oily than others and can be washed more frequently. Each person should work out a plan that will keep the hair in the best possible condition. Regular and vigorous brushing is beneficial. The hair grows by the formation of new cells until the root of the hair is injured or destroyed.

The Nails:

The nails also consist of specialized forms of the epidermis (outer skin). Each nail grows from a root under the skin. While this root remains uninjured, the nail will continue to grow. The nails give protection to the ends of the fingers and toes. They should be given special care in cleaning and trimming.

Regulation of Body Heat:

When too much heat is produced by the oxidation of fuel in the tissues, the blood vessels in the skin automatically increase in size and allow a greater volume of blood to come closer to the surrounding air. Excess heat in the blood then radiates through the skin into the atmosphere.

The sensation of perspiration by the sweat glands also helps in the regulation of body heat. The evaporation of this moisture uses up some of the heat of the body and thus helps to maintain a normal temperature. When the production of heat in the body is deficient, the blood vessels in the skin contract. This permits less blood than usual to come to the surface of the body, and thus reduces the loss of heat.

Clothing may assist or hinder the regulation of body heat. It should be changed according to the change in season, and sometimes according to changes in daily temperature when they are marked or extreme. Wet clothing causes an unusual loss of body heat and often helps to cause colds. Rubber articles of clothing should be worn in wet weather, but should always be removed when we are indoors, as they interfere with the proper regulation of body heat.

Proper bathing is an important aid to the regulation of body heat by the skin. Cold baths are stimulating to the tiny muscles of the skin, and help the skin to adjust itself more readily to sudden changes in temperature. This helps to prevent catching cold. The regulation of body heat is also assisted by keeping the pores of the skin clean so that perspiration will flow freely. Frequent use of warm water and soap will be beneficial in this respect.

As an Organ of Excretion:

The skin plays an important part in the elimination of body wastes. Each sweat gland has a tiny tube reaching out to the surface of the body, called a *pore*. From two to three pints of *perspiration* or *sweat* pass out of the pores each day. Perspiration consists largely of water and contains small amounts of body wastes and mineral salts. This emphasizes the need for keeping the skin clean. Play or work helps sweat glands to function and to relieve the kidneys of some of their work. We should drink plenty of water to replace the fluid lost by the body in perspiration.

A Healthy Skin:

A large part of the millions of dollars spent every year on cosmetics is wasted. A clear, healthy skin can generally be obtained by proper habits of living more cheaply and without the dangers that may attend the habitual use of cosmetics. Cosmetics may contain substances that irritate the skin. Proper food, outdoor exercise, and regularity in the hours of sleep and rest are far better.

Pimples are usually the result of infection in clogged up oil glands of the skin. These oil glands are often overactive between the ages of fifteen and twenty. This condition has a tendency to clear up as the age of maturity is reached. Treatment includes care in diet (avoiding starches and sugars and increasing the amounts of fruits and vegetables), together with plenty of exercise, sunshine, and bathing. Medical treatment is often advisable. Blackheads also indicate overactive oil glands. Don't guess at medical treatment. See a physician if the condition warrants drug treatment.

For Effective Study:

1. Name some of the uses of the skin.
2. Describe the differences between the dermis and the epidermis.
3. Why is bathing important?
4. How does the skin assist in the regulation of body heat?
5. Why is wet clothing unhealthful?
6. What is the best program of treatment for skin blemishes?

UNIT IX
SAFETY AND FIRST AID

Somewhere in your social studies notebook you probably have an outline showing a comparison of the way things are done today along with the ways in which they were done fifty or a hundred or more years ago. It may be that you called this outline "A Comparison of the Horse and Buggy Days with the Modern Machine Age." When you discussed these things and made these comparisons, did you think to include some of the changes in the hazards and some of the added dangers to life and limb that have resulted from these great changes in our ways of doing things and ways of living?

There are, of course, many hazards or dangers around us today that are not new or the result of our modern times. The cave man, no doubt, fell from high places and broke his bones or stumbled and sprained his joints. Dangers of drowning go back to the dim, distant past when waterways were the chief means of transportation through an unsettled or uncivilized country. Burns have always been associated with the use of fire. The use of fire dates back so far that even the ancient Greeks had a legend which sought to explain its first gift to mankind. Today we are exposed to these same dangers, but we have a great advantage over our ancestors when accidents happen, for we have the benefits of modern science in the prevention and treatment of injuries resulting from them. Many, many lives are saved today by a correct knowledge of just what to do and how to do it in the treatment of injuries.

Our modern age has brought us great advances in science and industry and added many comforts and conveniences to our lives. It has also brought added hazards to life and limb. The high speed of modern transportation and dangers connected especially with the use of motor vehicles cause thousands and thousands of deaths from accidents each year. Dangers from electricity are not exactly new, for deaths from lightning took place long before Benjamin Franklin showed that lightning and electricity were the same. Today, however, the widespread use of electricity in our homes and in industry have greatly multiplied the dangers from its use. In mills and factories fast moving machinery is an ever-present danger and calls for special devices to protect the workers from industrial accidents.

Many accidents are preventable. This makes safety efforts and safety campaigns worth while. It is helpful to know what dangers surround us and what precautions we can take to prevent them. That there is great need for safety practices and habits can easily be seen from a reading of accident reports from organizations such as the National Safety Council and insurance companies. These organizations make a continuous study of accidents of all kinds and publish valuable information.

Traffic Hazards and How to Avoid Them:

In recent years people are giving more and more thought to the dangers that come from the fast moving traffic upon our streets and highways. Great safety campaigns are being conducted. These include education in safety for pedestrians, or people who walk upon the streets and highways, as well as those who drive vehicles.

Where the Traffic Accidents Happen: In cities and towns persons are killed and injured by vehicles at street intersections and between intersections.

We should cross the street at intersections or other places set aside for this purpose. Accident reports show us that we need to be alert and careful at such places. We should faithfully obey the traffic signals and the traffic officers who are on duty to insure greater safety. We need to be especially careful when we start across a street, for accident reports show us that most of the deaths to pedestrians who cross a street take place during the first few steps away from the curb.

Do not walk diagonally across the street at an intersection. This is a frequent cause of accidents. Go straight across. It may be a few steps longer, but much safer.

When crossing streets at night take extra safety precautions. Remember that the vision of the pedestrian and the driver is reduced by the darkness.

When it rains, keep your umbrella raised high enough to see clearly in all directions from which dangers may come.

If you must cross a street between intersections, take care to keep out of the way of moving vehicles. Be very careful when stepping into a highway from behind a standing vehicle where you do not have a full view up and down the street.

In the country the open highways are great danger places for traffic accidents. This is due to the high speed of the cars and the lack of sufficient protective arrangements for persons who must walk along these highways. When you walk on country roads where there are no sidewalks, walk against the traffic. This means for you to walk on the left side of the road so that you will face the traffic coming toward you. This will give you a greater chance to protect yourself from danger. If you walk on a country road after dark, you should carry a lantern or flashlight or something which will reflect the light of an approaching car and give the driver a warning that you are there.

For those who ride inside the cars on open highways, it is well to know that the curves are the places where most highway deaths occur. High speed and a lack of sufficient knowledge of the curves in the roads play an important part in causing these accidents.

In order to avoid accidents when getting on or off cars and buses, face toward the front. Also be sure to wait until the vehicle comes to a full stop.

Do not catch rides on vehicles or play around railroad cars. No one of the many persons who have been injured while doing these things thought an accident would happen to him. Each person probably thought *he* was clever enough to keep out of danger, but somehow, suddenly, an accident happened. Avoid these dangerous forms of play.

The traffic on streets and highways also makes them dangerous places in which to play. Baseball, football, and a number of other games which require a lot of playing space should be played in parks, playgrounds, and athletic fields, rather than add the extra hazard of traffic accidents to these fine sports.

Bicycle riding on busy streets and highways is a dangerous practice unless great care is used. Bicycle riders should obey all traffic lights and traffic regulations. Ride close to the curb rather than out in the center of the street. Show by the use of hand signals when you plan to stop or to turn to the right or left. Be considerate of the safety of pedestrians, and keep your bell or horn in good condition and use it whenever necessary. Use a light or reflector on your bicycle after dark, for your own safety and the safety of others. Do not take unnecessary chances by trying to get through narrow places, or by hitching on other vehicles.

There are other dangers in streets and highways than those connected with the traffic on them. Fallen wires present a real danger because of the electricity that may be passing through them. Fallen wires should be removed only by those who realize these dangers and know how to protect themselves from them. A rope or article of clothing may be safely used to drag a dangerous wire to a safer place, if handled in a way to keep the person safe. Electricity does not pass through a rope or article of clothing as it does through a wire or piece of metal. Do not try to remove a live wire, that is a wire charged with electricity, unless an emergency demands that you do so. If you are not sure of the correct method of moving a live wire, let it alone and run for aid.

Safety in the Home:

Safety in the home is a coöperative affair. Each member of the family should take his or her share of the responsibility for making the home a safe place for all.

Falls are responsible for approximately half of the large number of home accidents reported each year. There are many kinds of falls that may occur.

Persons may fall from high places or from a ladder or a roof, or a high place in a barn. Take no unnecessary chances. See that the legs of a stepladder are securely placed. Do not lean out too far when up on a stepladder or any other kind of ladder.

Persons may injure themselves by falling over things. Keep things in their proper places, where persons can learn to expect them and be prepared to protect themselves from tripping over them. Persons may also be injured by falling down to a lower level. Many deaths and injuries are caused each year by falling down stairs. Always go down stairs carefully and make use of the railings that should be provided for your greater safety. Keep coverings of cisterns and wells in good repair so that there may be no accidents in connection with them.

Burns form another all-too-common form of injury listed with home accidents. Care should be taken to prevent fires when using such useful but dangerous things as matches, candles, lamps, lanterns, gas, electricity, gasoline, and kerosene.

Be certain that matches are really *out* before throwing them away. A flashlight is safer than a candle or oil lantern when looking for something in the dark. When using candles or lanterns, keep the flame away from curtains or anything that might catch fire easily. Take care to keep them from upsetting. It is a good safety precaution to keep from striking matches when you smell the gas. This will help to prevent an explosion and fire.

Electricity is a valuable servant in a household. It is used for lighting and for furnishing the power needed for many different kinds of labor-saving devices in the home. Dangers come from loose or defective sockets or worn insulation or protective coverings on the wire. Never neglect to have these dangerous conditions corrected at once, when discovered. Electric wires are sometimes responsible for fires, by becoming overheated when some one fails to turn them off when finishing with them or leaving them to answer the doorbell, and then forgetting all about them.

Gasoline, benzine, and kerosene should be kept in covered containers outside the house. The fumes or vapors from gasoline and benzine are explosive and great care should be taken with these substances.

Safety at School:

School officials usually give considerable attention to making schools safe places for the pupils that attend them. Buildings are largely fireproof and exits are wide and kept free from obstructions. Doors open outside to make them safer to use in a time of emergency. Fire drills are held regularly so that exits of the entire student body can leave the building quickly, quietly, and orderly.

As schools are places where large numbers of persons are gathered at one time, the pupils must conduct themselves with regard to their own safety and the safety of others. Obey the traffic regulations in the halls and on the stairs. They are planned with a view toward your greater safety. Use the apparatus in the gymnasium in the approved way and do not risk injury from trying to perform reckless stunts. Remember that the tools and machinery in the shops are possible sources of accidents. Use these articles as skillfully as possible, for skillful ways are safer ways. Act on the playground in ways that are considerate of the safety of others. Reckless running should be avoided and in this way prevent many injuries from bumps and falls.

Safety in Sports:

Every year we read of accidents that happen to persons taking part in some favorite sport. In warm weather swimming is popular. Knowing how to swim is an important aid in preventing accidental drownings. Knowing when to swim and where to swim are also important precautions. It is safest to wait for an hour or so after a meal before taking a swim. This precaution will help to prevent "cramps," a condition which is a cause of many drownings each year. Do not dive into places where you are uncertain about the depth of the water or where you cannot tell whether there are hidden rocks or stumps under the water.

Safety in Sports

In winter the dangers from drowning are present to skaters who take chances on thin ice or who do not obey warning signs that are posted at dangerous places. Coasting in places where there is traffic is also dangerous. The risks are sometimes greater than the pleaures of the sport. In such cases give up the pleasures until safer places can be found.

Firearms and Fireworks Are Dangerous Playthings:

Firearms are dangerous playthings at all times. Note in the newspapers how many times a person is accidentally killed or wounded by a gun that was not supposed to have been loaded. This occurs with grown-ups as well as with younger persons. Never point a pistol or gun at anyone, nor allow anyone to point one at you.

The use of fireworks carries with them the dangers from fire and explosions. There are some communities which forbid the general use of fireworks. They allow them to be set off only by persons who are trained to handle them safely. Where the general use of fireworks is allowed, take care to prevent accidents from them. Use them safely. For example if a firecracker fails to explode, it is safer to waste it than to pick it up and have it go off unexpectedly in your fingers. Set fireworks off only in safe places, where other persons or property will not be injured or damaged by them. Join heartily in campaigns for "A Safe and Sane Fourth of July," and help reduce the number of accidents.

FIRST AID

First aid is important for slight injuries as well as ones that appear to be much more serious. In very serious injuries immediate attention of a proper kind may be the means of saving a life. In apparently slight injuries the right kind of first aid treatment may prevent the development later of a very serious infection which might result in the loss of a finger or limb, or even in the loss of a life. In some industrial plants the worker is not permitted to judge whether an accidental injury is serious or not. He is required to go to the company's dispensary or accident ward for immediate treatment of *all* accidental injuries. The penalty for disobeying this rule is very likely to be the loss of his job.

One of the first requirements for a person who is to give first aid is the ability to keep calm and cool. When it is necessary to work quickly, do so in an orderly, business-like way. It will add to your effectiveness if you have had some practice in applying your knowledge of first aid. Know the parts of the body and the way they work, but also know just how to apply a splint to a broken bone, or give artificial respiration to an unconscious person. First aid classes are especially valuable for the practice they give in methods of helping the injured. As the injuries in these classes are only pretended ones, everyone can get practice in working in a calm, quiet, and collected way.

What to Do for Certain Injuries:

Scratches and Abrasions: These injuries present conditions in which the skin is broken. A scratch can be made by a sharp or pointed object. An abrasion is due to a violent scraping or rubbing of the skin, such as the result of falling down and sliding along a pavement or gravel road. First aid treatment should be directed toward cleansing the wound and the prevention of infection. If the wound is dirty, it can be washed gently with cotton moistened with tincture of green soap or with alcohol or clean water. After the surface is thoroughly dried and cleaned, apply iodine or other suitable germ-killing substance on the wound. Do not put a bandage over a wound that has been treated with iodine. A burn may result.

Cuts: In cases of most cuts the bleeding will be stopped in a reasonable time by the natural clotting of the blood. Clean out any visible dirt from the wound with cotton and tincture of green soap, alcohol, or clean water. Apply iodine or other suitable germ-killing substance. Follow up this first aid treatment with a visit to a physician to make sure that infection does not get a start.

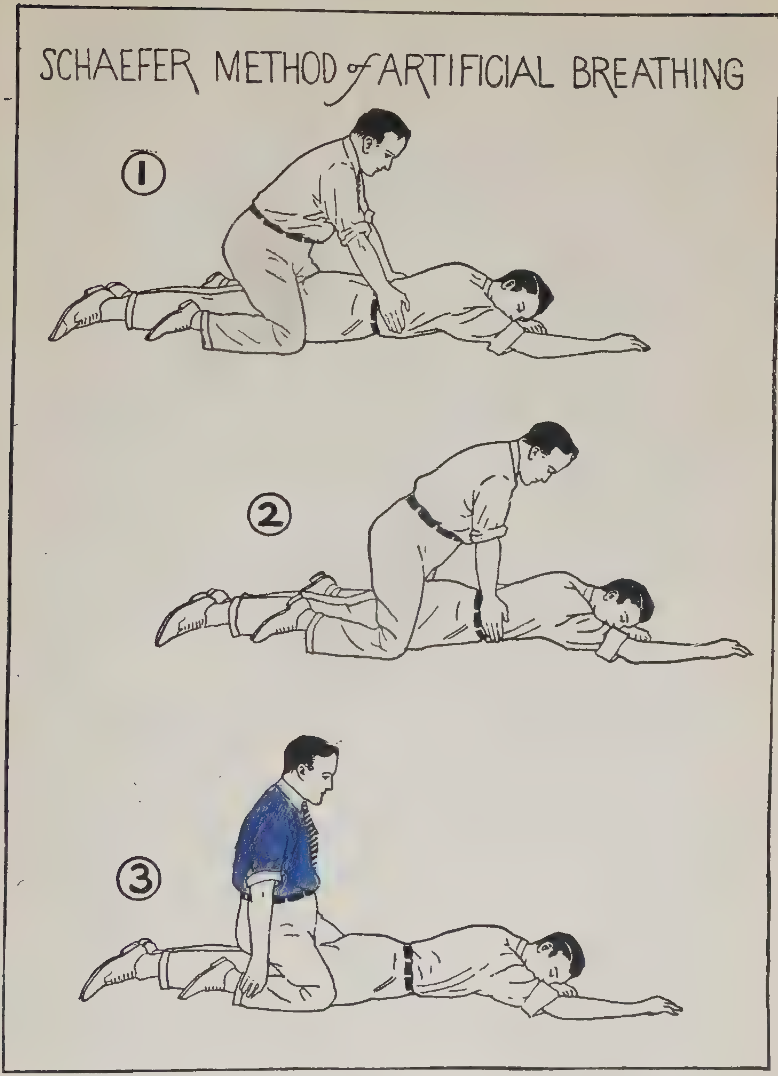
Cuts and wounds that injure arteries and veins are likely to cause bleeding that has to be stopped by the use of pressure upon the damaged blood vessel. A tourniquet is an effective means of applying the pressure. As in the diagram on page 310, this device consists of a pad placed over the blood vessel, and a band around the arm or leg which is tightened by twisting a stick until the bleeding stops. Remember that the tourniquet cuts off all the blood supply from the extremities of the part around which it is placed. Therefore a tourniquet should be loosened after a short time every fifteen minutes or so, to allow blood to circulate to the parts be-

Some Useful Forms of Splints

yond it. For bleeding from arteries, the tourniquet should be placed on the side of the wound that is nearest the heart. Blood from arteries will be bright red and escape in jets or spurts. For bleeding from veins, the tourniquet should be placed on the side of the wound away from the heart. Blood from veins will be dark red or purplish in color, and flow from the wound in a steady stream rather than in jets or spurts. Injuries so severe as to need a tourniquet should always receive prompt medical attention for the treatment of the loss of blood and shock that accompanies them.

Broken Bones: When a bone is broken or believed to be broken, it is well to decide whether or not the injured person can remain where he is until a doctor arrives. It is best not to move a person with a broken bone until expert medical attention is obtained. This will help to prevent sharp ends of the broken bone from tearing through the skin and adding to the injury. If the person can wait, make him comfortable and keep him warm until the doctor arrives. If a person with a broken bone has to be moved before the services of a physician can be obtained, provide some support for the injured parts. This can usually be done by the use of splints made of boards, strips of stiff cardboard, or even folded newspapers. Pad the splints with something soft to give the person added comfort. Make use of the X-ray to determine whether the bones are correctly set. This will prevent later deformities that follow improper treatment of such injuries.

Fainting and Unconsciousness following an injury are conditions that should have expert medical attention as soon as possible. Fainting can be aided by keeping the patient's head low, allowing more blood to return to the brain, as fainting is usually caused by a lessened blood supply to the brain. Unconsciousness following an injury should have quick medical attention. Send for the nearest physician at once. In the meantime keep the injured patient warm. If a doctor cannot be secured at once, carry the patient in a reclining position, on a stretcher if possible, to a hospital or physician. Apply artificial respiration, as described on page 341, when needed.


SCHAEFER METHOD of ARTIFICIAL BREATHING
1
2
3

There are several methods that can be used to restore or revive breathing in victims of accidents like gas poisoning, electric shock, drowning, lightning stroke. The most popular and successful method is called the "Schaefer Prone Pressure Method." This method is approved by the American Red Cross, the American Gas Association, National Electric Light Association, National Safety Council, United States Army and Navy, United States Bureau of Mines, United States Public Health Service, and many other organizations.

The rules of the United States Public Service for the application of the Schaefer Method of artificial breathing are as follows:

1. Lay the patient face down, one arm extended directly over the head, the other bent at the elbow. Turn the face outward and rest it on hand or forearm so that the nose and mouth are free for breathing. Figure 1, page 341.
2. Kneel, straddling the patient's thighs with your knees placed a little below the hip bones as shown in Figure 1.

   Place the palms of the hands on the small of the back with fingers resting on the ribs, the little fingers just touching the lowest rib. Keep the thumb and fingers in a natural position, and the tips of the fingers just out of sight. Figure 1.
3. While counting *one, two,* in one second intervals and with arms held straight, swing forward slowly so that the weight of your body is gradually brought to bear upon the patient. The shoulder

should be directly over the hand at the end of the forward swing. Figure 2. Do not bend the elbows.

4. Swing immediately backward, counting *three*, so that the pressure is completely removed. Figure 3.
5. Rest while counting *four* and *five*.
6. Swing forward again and continue artificial respiration until natural breathing is restored. Keep it up for three or four hours if necessary, or until a physician decides that the patient is dead.

Artificial respiration should be carried on at the place where the patient received his injuries. He should not be moved until he is breathing normally. He should be carried only in a lying position. Should it be necessary to move the patient before he is breathing normally, the artificial respiratory movements should be carried on while he is being moved.

If it is necessary to change the operator, the change should be made without losing the rhythm of respiration.

Recovery of natural breathing is often temporary. The patient should be watched and if natural breathing stops, artificial respiration should be resumed at once.

As soon as artificial respiration has been started, an assistant should loosen the clothing about the patient's neck, chest, and waist. Apply warmth to offset the loss of body heat. Do not give liquid stimulants by the mouth while the patient is unconscious. At such times there is danger of the liquid getting into the trachea, or windpipe.

After the patient revives, he should be kept in a reclining position to avoid undue strain upon the heart. Keep him covered up and as warm as possible. At this time, a stimulant such as a teaspoonful of aromatic spirits of ammonia in a small glass of water, or a drink of hot coffee or tea may be administered.

Burns are dangerous, as well as painful, injuries. Proper first aid treatment seeks to keep the air away from the injury and thereby lessen the pain. It is helpful to cover a burn with dry baking soda. This serves the double purpose of keeping out the air and counteracting or neutralizing the acid condition that results from the burn. Vaseline or olive oil is helpful for this purpose, and there are a number of commercial preparations that are useful for first aid treatment of burns. Do not bandage a burn in a way that will cause the bandage material to stick to the wound and cause added damage when it is removed. When large areas are burned, there is great danger from shock and expert medical attention should be obtained at once.

For Effective Study:

1. What is meant by traffic accidents? What are some valuable precautions which will help to prevent traffic accidents?
2. Describe safe ways to get on and off buses and cars.

3. What precautions should be taken by bicycle riders.

4. How can falls be prevented?

5. Name some dangers connected with the use of electricity.

6. What precautions should be taken to prevent accidents while swimming or skating?

7. What is meant by first aid? Why is practice in first aid measures helpful?

8. Describe methods of first aid treatment for cuts and wounds, scratches and abrasions, broken bones, burns, fainting and unconsciousness.

For Observation or Investigation:

1. Secure recent accident reports and study them for the valuable help they give in avoiding accidents.

2. Compare the hazards of today with those of the past. What superior advantages do we have today in the treatment of injuries resulting from accidents.

3. What are some frequent hazards in and around a school, and how may they be prevented?

4. Demonstrate first aid practices for common injuries.

5. Investigate and report danger spots or zones in and about your home and community. Show how accidents in connection with them may be prevented.

For Health Habit Formation:

Organize a Junior Safety Council. Many schools help to make their safety work more effective by the aid of a Junior Safety Council. Valuable information about this can be obtained from the *Handbook on Junior Safety Councils,* prepared and distributed by the National Safety Council, New York City. Instead of a Junior Safety Council, some schools use Safety Clubs, Safety Committees, or Safety Scouts for about the same purposes.

A Junior Safety Council is a group of pupils made up of representatives from the different classes in the school, the officers of the School Safety Patrol, and representatives of other groups in the school that are connected in some way with the work of safety. The Safety Council elects its own officers, and is under the general guidance of a member of the faculty of the school.

With the help of the Safety Council, it becomes easier to get all the pupils in the school thinking about safety problems of general interest, and also the particular dangers that are found in the school, in the neighborhood, and at different seasons of the year. The classroom representatives bring the results of class discussions to the Council for consideration, and they also take back to the classrooms the ideas and suggestions that are developed in the Council meetings.

An idea of the extent of the work of a Junior Safety Council can be obtained from the different committees that can be formed to carry on its work, and from some suggestions that are given in the *Handbook* for topics for monthly and special programs:

Suggested Committees:	*Suggested Topics for Meetings:*
1. Program.	Winter Sports.
2. Safety Patrol.	Electricity.
3. Accident Reporting.	Playground Safety.
4. Publicity.	School Accidents.
5. Inspection.	Bicycles.

The Junior Safety Council will also play an important part in representing the school in special drives and campaigns in the community, such as "Clean-Up Week," "An Orderly Hallowe'en," "A Safe and Sane Fourth of July," and many others.

The Junior Safety Council or some other safety group within the school or a classroom can be made a very useful part of the safety education work of the school community. It will take its place very naturally in a modern school with the other pupil committees or activity groups that help to make this part of school work interesting and helpful.

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USEFUL INFORMATION FOR PUPILS, TEACHERS, PARENTS

Everyday Resolutions on Health and Safety

Set a Goal—Have a personal standard of health and endeavor constantly to maintain it.

Form Health Habits—Good health habits of eating, elimination, sleeping, breathing, bathing, and posture will make your life happier and richer. Take care of your eyes, teeth, hair, and feet.

Correct Your Defects—Seek to find and remedy causes of all ailments. Have a regular health and a dental examination by reliable experts.

Daily Exercise—Exercise daily in the open air. Fresh air sharpens the mind. Master two games, an indoor and an outdoor. Have a hobby along some creative line as gardening, architecture, or mechanics. Plan your vacation carefully.

Rest—Get sufficient sleep with windows open; avoid over-sleeping. Learn to relax. Stand and sit erect.

Mental Hygiene—Avoid fear, worry, anger, over-excitement, and other emotional excesses. Cultivate laughter, optimism, and constructive thinking.

Stop, Look, Listen!—Help prevent accidents to yourself and others at home and on the street. Value life highly. Regard every crosswalk as a challenge. Obey traffic regulations. Get the safety habit.

(From Journal of the National Education Association.)

The School Lunch

If your school has a school lunch counter, be sure to use it. There you will get the best foods to keep you strong and healthy.

The following suggestive menus from *Farmers' Bulletin Number 712,* United States Department of Agriculture, Washington, D. C., will prove helpful in planning this important mid-day meal. This bulletin also contains additional suggestions and recipes for school lunches.

A.—Suggested menus for lunches prepared and eaten at home:

1. Eggs, boiled, coddled, poached, or scrambled; bread and butter; spinach or other greens; plain cake.
2. Beef stew with vegetables; crisp, thin tea biscuits; honey.
3. Dried bean or pea or peanut butter purée; toast; baked apple; cookies.
4. Vegetable-milk soup; zwieback; rice with maple sugar and butter, milk, or cream.
5. Potato chowder; crackers; jelly sandwiches.
6. Cold meat; creamed potatoes; peas; bread and butter; frozen custard or plain ice cream; plain cake.
7. Lamb chop; baked potatoes; bread and butter; sliced bananas and oranges; cookies.
8. Baked omelet with spinach, kale, or other greens; bread and butter; apple sauce; cake.
9. Milk toast; string beans; stewed dried fruit; cake.
10. Boiled potatoes; codfish gravy; bread and butter; lettuce; custard.

B.—Suggested menus for basket, or box lunches,—prepared at home and eaten in school:

Sandwiches with sliced tender meat for filling; baked apple; cookies, or a few lumps of sugar.

Slices of meat loaf or bean loaf; sandwiches; stewed fruit; small frosted cake.

Crisp rolls, hollowed out and filled with chopped meat or fish, moistened and seasoned, or mixed with salad dressing; orange, apple, a mixture of sliced fruits, or berries; cake.

Lettuce or celery sandwiches; cup custard; jelly sandwiches.

Cottage-cheese sandwiches, or a pot of cream cheese with bread-and-butter sandwiches; peanut sandwiches; fruit; cake.

Hard-boiled eggs; baking-powder biscuits; celery or radishes; brown-sugar or maple-sugar sandwiches.

Bottle of milk; thin corn bread and butter; dates; apple.

Raisin or nut bread with butter; cheese; orange; maple sugar.

Baked bean and lettuce sandwiches; apple sauce; sweet chocolate.

C.—Suggested menus for school lunches, prepared and eaten in school:

1. Vegetable-milk soup; crackers; rolls; fruit; plain cake.
2. Meat and vegetable stew; bread and butter; sweet chocolate.
3. Boiled custard; lettuce sandwiches; fruit; cookies.
4. Dried codfish chowder; crackers; fruit; maple-sugar or jelly sandwiches.

The School Doctor and the School Nurse

Many schools, especially those in cities, have school doctors and school nurses to help boys and girls, and to make friendly suggestions to improve their health.

Remember, they are your friends—they are trying to help you.

Generally they give a medical examination to each boy and girl at least once a year. If they find anything about you that needs attention, anything that should be fixed, it is important that you have it attended to right away.

An Inexpensive Quart of Tooth Powder

"If you secure a clean, dry Mason jar, quart size, nearly any druggist will put up the following formula for a tooth powder, at little cost. Do not use it immediately but shake it thoroughly, now and then, for the first twenty-four hours. This will mix the powders and permit the oils to have sufficient time to permeate all of the ingredients.

"When using, place some of the powder in a small, wide mouth bottle and then shake some of the powder onto the tooth brush that has previously been thoroughly wet. Keep the bottle and the Mason jar tightly closed.

Formula for Tooth Powder

Finest grade English precipitated chalk	½ pound
Powdered Castile soap	1¾ ounces
Light carbonate of magnesia	⅓ ounce
Oil of clove	46 drops
Oil of wintergreen	35 drops
Oil of sassafras	35 drops
Oil of peppermint	18 drops
Saccharine—finely powdered	4 grs.

Adapted from directions on Care of the Teeth, issued by City Board of Health, Bridgeport, Connecticut.

How to Make Lime Water

(For use as a tooth wash)

Five cents worth of coarse, unslaked lime, such as the masons use for coarse plaster, will keep a whole family supplied with the best kind of a mouth wash for a whole year. The refined lime that the druggist sells does not seem to have the same solvent action. Perhaps the refining process robs it of some of its virtues.

Secure from a paint store a lump of coarse lime and crush it into a fine powder. Place a half cupful into an empty quart bottle and fill nearly full with cold water. Thoroughly shake and then allow the lime to settle to the bottom of the bottle, which will take several hours. After it has settled pour down the sink as much of the clear water as you can without losing any of the lime, as this first mixing contains the washing of the lime. Again fill with cold water, shake well, and allow it again to settle.

Into an empty twelve ounce bottle pour the clear lime water, taking care not to stir up the lime in the bottom of the bottle; now place the quart bottle under the faucet and fill with cold water, shake thoroughly, and set it aside to use when the smaller bottle becomes empty. This process may be repeated until the half cup of lime has made five or six quarts of mouth wash.

The twelve ounce bottle is used as it is more easily handled at the wash bowl. After brushing and flossing the teeth, pour out a little of the lime water into a glass, and taking it into the mouth, force it back and forth between the teeth with the tongue and cheeks until it foams. If you rinse it long enough to make it foam it has then been in the mouth long enough to have a beneficial action on the teeth. After spitting it out rinse the mouth with clear water to take away the taste of the lime. If the lime water is a little strong at first, dilute it with clear water in the small bottle, half and half. It should be used clear and full strength as soon as the gums become hard and healthy from brushing.

Extract from directions on Care of the Teeth, issued by ***City Board of Health, Bridgeport, Connecticut.***

Health Education
Self-Testing Scale

A number of self-testing scales have been devised. The one presented on page 353 is simply constructed but rather complete in the health practices that are included.

It is a good practice to have a thorough physical examination by a competent physician at least once every year.

DEPARTMENT OF HEALTH EDUCATION

Self-Testing Scale

Give yourself 5 points for every item which you do. Add the scores and see if you can make a grade of 100.

1. I brush my teeth every morning and night.
2. I eat fruit every day.
3. I eat a cereal at breakfast.
4. I drink at least one glass of milk every day.
5. I drink several glasses of water every day.
6. I eat at least one "top-of-the-ground" vegetable every day.
7. I chew my food well.
8. I do not drink tea or coffee.
9. I do not drink from a glass anyone else uses.
10. I do not eat candy just before my meals.
11. I guard against constipation by going to the bathroom early every morning.
12. I try to maintain good posture.
13. I try to keep pencils, pens, and my fingers out of my mouth.
14. I try to keep my hands and nails clean.
15. I wash my hands before eating.
16. I take a complete bath at least once a week.
17. I play out of doors every day.
18. I sleep at least 8 hours every night.
19. I sleep with my bed-room windows open.
20. I always have a handkerchief with me.

TOTAL......

WEIGHT—HEIGHT—AGE TABLE FOR GIRLS OF SCHOOL AGE†

Height (inches)	Average weight for height (lbs.)	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years	11 Years	12 Years	13 Years	14 Years	15 Years	16 Years	17 Years	18 Years	Height (inches)
38	33	33	33													38
39	34	34	34													39
40	36	36	36	36*												40
41	37	37	37	37*												41
42	39	39	39	39*												42
43	41	41	41	41	41*											43
44	42	42	42	42	42*											44
45	45	45	45	45	45	45*										45
46	47	47*	47	47	48	48*										46
47	50	49*	50	50	50	50	50*									47
48	52		52	52	52	52	53*	53*								48
49	55		54	54	55	55	56	56*								49
50	58		56*	56	57	58	59	61	62*							50
51	61			59	60	61	61	63	65							51
52	64			63*	64	64	64	65	67							52
53	68			66*	67	67	68	68	69	71*						53
54	71				69	70	70	71	71	73*						54
55	75				72*	74	74	74	75	77	78*					55
56	79					76	78	78	79	81	83*					56
57	84					80*	82	82	82	84	88	92*				57
58	89						84	86	86	88	93	96*	101*			58
59	95						87	90	90	92	96	100	103*	104*		59
60	101						91*	95	95	97	101	105	108	109	111*	60
61	108							99	100	101	105	108	112	113	116	61
62	114							104*	105	106	109	113	115	117	118	62
63	118								110	110	112	116	117	119	120	63
64	121								114*	115	117	119	120	122	123	64
65	125								118*	120	121	122	123	125	126	65
66	129									124	124	125	128	129	130	66
67	133									128*	130	131	133	133	135	67
68	138									131*	133	135	136	138	138	68
69	142										135*	137*	138*	140*	142*	69
70	144										136*	138*	140*	142*	144*	70
71	145										138*	140*	142*	144*	145*	71

Age—years		6	7	8	9	10	11	12	13	14	15	16	17	18
Average Height (inches)	Short	43	45	47	49	50	52	54	57	59	60	61	61	61
	Medium	45	47	50	52	54	56	58	60	62	63	64	64	64
	Tall	47	50	53	55	57	59	62	64	66	66	67	67	67
Average Annual Gain (lbs.)	Short	4	4	4	5	6	6	10	13	10	7	2	1	
	Medium	5	5	6	7	8	10	13	10	6	4	3	1	
	Tall	6	8	8	9	11	13	9	8	4	4	1	1	

†Prepared by Bird T. Baldwin, Ph.D., Iowa Child Welfare Research Station, State University of Iowa and Thomas D. Wood, M.D., Columbia University, New York.

WEIGHT—HEIGHT—AGE TABLE FOR BOYS OF SCHOOL AGE†

Height (inches)	Average weight for height (lbs.)	5 Years	6 Years	7 Years	8 Years	9 Years	10 Years	11 Years	12 Years	13 Years	14 Years	15 Years	16 Years	17 Years	18 Years	19 Years	Height (inches)
38	34	34	34*														38
39	35	35	35														39
40	36	36	36*														40
41	38	38	38	38*													41
42	39	39	39	39*	39*												42
43	41	41	41	41*	41*												43
44	44	44	44	44	44*												44
45	46	46	46	46	46*	46*											45
46	48	47*	48	48	48	48*											46
47	50	49*	50	50	50	50*	50*										47
48	53		52	53	53	53	53*										48
49	55		55	55	55	55	55	55*									49
50	58		57*	58	58	58	58	58*	58*								50
51	61			61	61	61	61	61	61*								51
52	64			63	64	64	64	64	64	64*							52
53	68			66*	67	67	67	67	68	68*							53
54	71				70	70	70	70	71	71	72*						54
55	74				72*	72	73	73	74	74	74*						55
56	78				75*	76	77	77	77	78	78	80*					56
57	82					79*	80	81	81	82	83	83*					57
58	85					83*	84	84	85	85	86	87					58
59	89						87	88	89	89	90	90	90				59
60	94						91*	92	92	93	94	95	96				60
61	99							95	96	97	99	100	103	106*			61
62	104							100*	101	102	103	104	107	111	116*		62
63	111							105*	106	107	108	110	113	118	123	127*	63
64	117								109	111	113	115	117	121	126	130*	64
65	123								114*	117	118	120	122	127	131	134	65
66	129									119	122	125	128	132	136	139	66
67	133									124*	128	130	134	136	139	142	67
68	139										134	134	137	141	143	147	68
69	144										137	139	143	146	149	152	69
70	147										143	144	145	148	151	155	70
71	152										148*	150	151	152	154	159	71
72	157											153	155	156	158	163	72
73	163											157*	160	162	164	167	73
74	169											160*	164	168	170	171	74

Age—years		6	7	8	9	10	11	12	13	14	15	16	17	18	19
Average height (inches)	Short	43	45	47	49	51	53	54	56	58	60	62	64	65	65
	Medium	46	48	50	52	54	56	58	60	63	65	67	68	69	69
	Tall	49	51	53	55	57	59	61	64	67	70	72	72	73	73
Average annual gain (lbs.)	Short	3	4	5	5	5	4	8	9	11	14	13	7	3	
	Medium	4	5	6	6	6	7	9	11	15	11	8	4	3	
	Tall	5	7	7	7	7	8	12	16	11	9	7	3	4	

†Age is taken at the nearest birthday; height at the nearest inch; and weight at the nearest pound. A child is considered 6 years old at any time between 5½ and 6½ years.

The figures not starred represent exact averages in round numbers.

The starred figures represent smoothed or interpolated values.

GLOSSARY

This glossary is a short dictionary of a number of the words commonly used in health education. It will aid in the pronunciation and understanding of words that may be new to you or with which you need additional help. The definitions are brief. Fuller explanations will usually be found in the text on the pages that are indicated in the index.

Syllables and accent: In the word in the parentheses the syllables are separated to aid in pronouncing them. The syllable to be accented is marked thus ′. When there is more than one syllable in a word to be stressed, the principal accent is marked with a heavier line, thus ′, and the less accented syllable with a lighter line, thus ′.

Key to Sounds

ā as in āte, fāte
ȧ as in vȧ-ca′tion
â as in câre, pâr′ent
ă as in căt, ăm
ă as in in′fănt, fin′ăl
ä as in ärm, fä′ther
ȧ as in ȧsk, grȧss
ȧ as in ȧ-bove′, ȧ-bout′

ē as in ēve
ḗ as in ḗ-vent′
ĕ as in ĕnd
ĕ as in si′lĕnt, move′mĕnt
ẽ as in moth′ẽr

ī as in īce, sīght
ĭ as in ĭll, hab′ĭt

ō as in ōld
ṓ as in ṓ-bey′
ô as in ôr′der, lôrd
ŏ as in ŏdd, nŏt
ŏ as in ŏc-cur′, cŏn-nect′

oi as in oil, noisy
o͞o as in fo͞od, mo͞on
o͝o as in fo͝ot
ou as in out

ū as in pūre
ṻ as in ṻ-nite′
û as in bûrn
ŭ as in ŭp, ŭn′der
ŭ as in cir′cŭs

abdomen (ăb-dō′mĕn). The large cavity below the diaphragm, containing the stomach, intestines, liver, and kidneys.

abnormal (ăb-nôr′măl). Different from the normal, or what is usual, or expected; above or below the average.

abscess (ăb′sĕs). A collection of pus at some point in the body.

absorption (ăb-sôrp′shŭn). The process by which nourishing material is taken through the lining of the digestive system into the blood.

abstainer (ăb-stān′ẽr). A person who keeps from doing something, as one who does not use intoxicating liquors.

accommodation (ă-kŏm′ō-dā′shŭn). In connection with sight—the work of the eye in bringing rays of light from a nearby object to a focus upon the retina.

addict (ăd′ĭkt). One who has developed a habit, especially a bad habit.

adenoids (ăd′ē-noĭdz). Soft, fleshy growths that form in the passage between the nose and the throat, hindering the flow of air into the body through the nose.

alcohol (ăl′kō-hŏl). A colorless liquid made by fermentation, and forming the narcotic and intoxicating substance in beer, wine, and whiskey.

anatomy (ȧ-năt′ō-mĭ). The science that studies and explains the structure of the body and the relation of the parts of the body to each other.

anesthetic (ăn′ĕs-thĕt′ĭk). A substance which causes loss of feeling.

anopheles mosquito (ȧ-nŏf′ĕ-lēz mŏs-kē′tō). The mosquito which spreads malaria.

anthrax (ăn′thrăks). A serious disease usually found among cattle and sheep, but which can affect human beings.

antibody (ăn′tĭ-bŏd′ĭ). Substance in the blood which acts against toxins, or the bacteria producing toxins.

antidote (ăn′tĭ-dōt). A substance that offsets or neutralizes the effects of certain poisons.

antiseptic (ăn′tĭ-sĕp′tĭk). A substance which kills or makes harmless the germs which cause infection or decay.

antitoxin (ăn′tĭ-tŏx′sĭn). Substances formed in the body which have the power to neutralize toxins (poisons) that result from the growth of disease germs.

aorta (ā-ôr′tȧ). The great main artery through which blood leaves the heart on its journey around the body.

appendicitis (ă-pĕn′dĭ-sī′tĭs). Inflammation of a person's appendix.

appendix (ă-pĕn′dĭks). A worm-shaped tube growing out of the large intestines.

aqueous humor (ā′kwē-ŭs hū′mẽr). A watery fluid in front of the lens of the eyeball.

artery (är′tẽr-ĭ). One of the branching tubes through which blood flows from the heart to other parts of the body.

audiometer (ô′dĭ-ŏm′ē-tẽr). An instrument for the accurate testing and measuring of hearing.
auditory nerve (ô′dĭ-tō′rĭ). The nerve of hearing.
auricle (ô′rĭ-k'l). One of the two upper chambers of the heart receiving the blood that enters the heart.
autonomic system (ô′tō-nŏm′ĭk sĭs′tĕm). The part of the nervous system that regulates involuntary actions, such as those connected with the digestion of food, breathing, etc.

bacteria (băk-tē′rĭ-ȧ). Tiny plants, seen only through a microscope. The singular is **bacillus** (bȧ-sĭl′ŭs).
botulism (bŏt′ū-lĭz'm). Poisoning that results from the toxins of bacteria that infect preserved foods.
bronchi (brŏng′kī). The two main subdivisions of the trachea, or windpipe, which enter the lungs.
bubonic plague (bū-bŏn′ĭk plāg). A very dangerous contagious disease spread chiefly by rats and fleas.

caffeine (kăf′ē-ĭn). The stimulating drug found in coffee and tea.
calory (kăl′ō-rĭ). A unit used for measuring the heat and energy values of foods.
capillary (kăp′ĭ-lĕr′ĭ). A slender, hair-like tube—the smallest of the blood-vessels of the body, joining the arteries and veins.
carbohydrate (kär′bō-hī′drāt). A chemical substance made up of carbon, hydrogen, and oxygen. Principally starch and sugar.
carbon dioxide (kär′bŏn dī-ŏk′sīd). A heavy, odorless, colorless gas.
carbon monoxide (kär′bŏn mŏn-ŏk′sīd). A colorless, odorless, very poisonous gas, formed by the incomplete burning of the carbon in substances.
cardiac orifice (kär′dĭ-ăk ŏr′ĭ-fĭs). The opening through which food enters the stomach from the esophagus.
cartilage (kär′tĭ-lĭj). A soft, elastic tissue in the body.
caustic soda (kôs′tĭk sō′dȧ). A strong, alkaline substance, capable of destroying things by chemical action.
cellulose (sĕl′ū-lōs). The substance that forms the principal part of the tissue of plants, wood, paper, etc.
cementum (sē-mĕnt′ŭm). The bone-like part of a tooth which covers its roots.
cerebellum (sĕr′ē-bĕl′ŭm). The part of the brain below and behind the cerebrum.

cerebro-spinal system (sĕr′ē-brō-spī′năl sĭs′tĕm). That part of the nervous system made up of the brain, spinal cord and the nerves branching from them.
cerebrum (sĕr′ē-brŭm). The main part of the brain.
chlorine (klō′rēn). A poisonous, greenish-yellow gas.
cholera (kŏl′ẽr-ȧ) (Asiatic cholera). A disease which causes vomiting, cramps, extreme weakness, and often death.
chorea (kō-rē′ȧ). A nervous ailment accompanied by twitchings of muscles, also known as St. Vitus's dance.
choroid coat (kō′roid kōt). The middle, black covering of the eyeball.
chrysalis (krĭs′ȧ-lĭs). The stage in the life of an insect in which it is enclosed in a cocoon or case.
cilia (sĭl′ĭ-ȧ). Hair-like projections.
circulatory system (sûr′kū-lȧ-tō′rĭ sĭs′tĕm). The heart and blood vessels, arranged in a way that enables blood to reach every part of the body and return again to the heart.
clavicle (klăv′ĭ-k'l). The collarbone.
coagulate (kō-ăg′ū-lāt). To form into a compact, thick, dense mass; to clot.
cocaine (kō-kān′). A drug used to deaden pain and cause sleep. Prepared from the leaves of the coca plant.
cochlea (kŏk′lē-ȧ). A part of the inner ear in the shape of a coil of a snail shell.
concussion (kŏn-kŭsh′ŭn) (of the brain). A shock or injury caused by a blow upon the head.
connective tissue (kŏ-nĕk′tĭv tĭsh′ū). A tissue that binds together other tissues in nearly all parts of the body.
conscious (kŏn′shŭs). Aware of facts; mentally awake or active.
constipation (kŏn-stĭ-pā′shŭn). A condition of the bowels when movements are infrequent and difficult.
contaminate (kŏn-tăm′ĭ-nāt). To make impure or unfit for use.
convalescence (kŏn′vȧ-lĕs′ĕns). The time during which a person is recovering from an illness.
convex (kŏn′vĕks). Curving outward or rounded like the outside of a ball.
convolution (kŏn′vō-lū′shŭn). Irregular ridges on the surface of the brain.
corpuscles (kôr′pŭs'lz). Small cells that float in the blood.
cranial nerves (krā′nĭ-ăl nûrvz). Nerves connected directly with the brain.

cranium (krā′nĭ-ŭm). The skull or more especially the part of the skull which encloses the brain.
crypt (krĭpt). A cavity or depression, as in a tonsil where pus can collect.
Curie, Madame (Kū-rē′, Măd′ăm). French chemist who discovered radium.

deformity (dē-fôr′mĭ-tĭ). An irregular or wrong form of some part of the body.
delirium tremens (dē-lĭr′ĭ-ŭm trē′mĕnz). A mental disturbance caused by excessive and prolonged use of alcoholic liquors.
denatured alcohol (dē-nā′tûr-ĕd ăl′kō-hŏl). Alcohol that has been made unfit for drinking by the addition of some unpleasant substance.
dermis (dûr′mĭs). The sensitive inner layer of the skin.
diaphragm (dī′ȧ-frăm). A broad, flat muscle separating the chest cavity from the abdomen.
digestive system (dĭ-jĕs′tĭv sĭs′tĕm). The parts of the body connected with the digestion of food; the alimentary canal.
dilate (dī-lāt′). To make larger or wider.
diphtheria (dĭf-thēr′ĭ-ȧ). A dangerous, communicable disease in which whitish membranes form on the lining of the throat.
dysentery (dĭs′ĕn-tĕr′ĭ). A painful disease of the intestines.

elastic (ē-lăs′tĭk). Capable of returning to its original shape or size after being stretched.
elimination (ē-lĭm′ĭ-nā′shŭn). The process of sending out or expelling waste products from the body.
epidemic (ĕp′ĭ-dĕm′ĭk). A condition in which a disease spreads rapidly from person to person.
epidermis (ĕp′ĭ-dûr′mĭs). The outer layer of the skin.
epiglottis (ĕp′ĭ-glŏt′ĭs). A small lid-like plate of tissue which keeps food out of the windpipe when we swallow.
epithelium cells (ĕp′ĭ-thē′lĭ-ŭm sĕlz). Cells forming the skin, or any other tissue or membrane which covers the outside of the body or forms its inner lining.
equilibrium (ē′kwĭ-lĭb′rĭ-ŭm). A state of balance between opposing weights or forces.
esophagus (ē-sŏf′ȧ-gŭs). The tube which leads from the throat to the stomach. Also known as the gullet.
Eustachian tube (ū-stā′kĭ-ăn tūb). A tube connecting the middle ear with the throat.

excretion (ĕks-krē′shŭn). The process of getting rid of waste materials from the body.
expiration (ĕk′spĭ-rā′shŭn). The act of breathing out air from the lungs.

fatigue (fȧ-tēg′). Weariness resulting from work or exertion.
femur (fē′mẽr). The thigh bone.
fermentation (fûr′mĕn-tā′shŭn). A chemical change in a substance, such as that which causes milk to sour, cheese to ripen, cider to turn to vinegar.
fibrin (fī′brĭn). A thread-like substance formed in the clotting of the blood.
fibula (fĭb′ū-lȧ). The outer and usually the smaller of the two bones in the lower leg.
focus (fō′kŭs), plural **foci** (fō′sī). In connection with the sense of sight: to bring rays of light to a point on the retina. In connection with disease: a focus of infection is a place where bacteria are gathered in large numbers.
follicle (fŏl′ĭ-k′l). A small cavity, such as the little depressions out of which the hair grows.
fracture (frăk′tūr). A broken bone.
function (fŭngk′shŭn). The particular purpose for which a thing exists.

ganglion (găng′glĭ-ŭn), plural **ganglia** (găng′glĭ-ȧ). A mass of nerve tissue containing nerve cells.
gastritis (găs-trī′tĭs). Inflammation of the stomach.
gland (glănd). An organ of the body that secretes fluids, such as the saliva, gastric juice, etc.
glycogen (glī′kō-jĕn). A kind of starch found in the liver.

humerus (hū′mẽr-ŭs). The bone in the upper arm.
humidity (hū-mĭd′ĭ-tĭ). Moisture, dampness.
hydrocholoric acid (hī′drō-klō′rĭk ăs′ĭd). A strong acid formed from the combination of hydrogen and chlorine.
hydrophobia (hī′drō-fō′bĭ-ȧ). A serious disease accompanied by convulsions; also called **rabies** (rā′bĭ-ēz).
hygiene (hī′jēn). The science of the preservation of health; a system of health rules and practices.

immunity (ĭ-mū′nĭ-tĭ). The power of resisting disease; freedom from certain diseases.

impulse (ĭm′pŭls). A force which starts something into action.
incus (ĭng′kŭs). The middle one of the chain of three bones which stretch across the middle ear.
infection (ĭn-fĕk′shŭn). That which causes a disease; a disease or condition caused by being infected.
influenza (ĭn′flōō-ĕn′zȧ). A communicable disease, causing inflammation of the throat and bronchial tubes; more severe and serious than a cold.
inoculate (ĭn-ŏk′ū-lāt). To introduce weakened bacteria or toxins into the blood to cause the body to produce antibodies which protect against later attacks of the same kind of bacteria.
insanity (ĭn-săn′ĭ-tĭ). A condition of madness or being insane.
inspiration (ĭn′spĭ-rā′shŭn). The act of breathing in.
iris (ī′rĭs). The colored part around the pupil of the eye.
irritate (ĭr′ĭ-tāt). To excite, disturb.

lacteals (lăk′tē-ălz). Lymph vessels in the lining of the intestine, absorbing digested fats.
larva (lär′vȧ), plural **larvae** (lär′vē). The wingless and often worm-like form in which most insects hatch from the egg.
larnyx (lăr′ĭngks). The upper part of the windpipe containing the vocal cords.
lavatory (lăv′ȧ-tō′rĭ). A place for washing.
ligament (lĭg′ȧ-mĕnt). A tough band of connective tissue which holds bones together at a joint.
Lister, Sir Joseph (Lĭs′tẽr). A great English physician who developed means for sterilizing wounds.
lymph (lĭmf). A nearly colorless fluid in the body, circulating in the lymphatic vessels. It consists chiefly of blood plasma and contains colorless corpuscles.
lymphatic circulation (lĭm-făt′ĭk sûr′kū-lā′shŭn). The passage of lymph through the body in the lymph vessels, which are a system of tubes similar to the blood vessels for the blood.

malaria (mȧ-lâr′ĭ-ȧ). A disease marked by chills and fever, spread by the bite of the Anopheles mosquito.
marrow (măr′ō). A soft substance that fills the hollow interiors of most bones. It contains nerves and blood vessels.
medulla oblongata (mē-dŭl′ȧ ŏb′lŏng-gā′tȧ). The lower, back portion of the brain, tapering off into the spinal cord.
membrane (mĕm′brān). A soft, thin, flexible layer of tissue. See mucous membrane, pleura, periosteum.

meningitis (mĕn′ĭn-jī′tĭs). Inflammation of the tissues which surround the brain and spinal cord.
metabolism (mḗ-tăb′ṓ-lĭz′m). The process of nutrition; the chemical changes in living cells, resulting in their growth and repair and the production of energy for life activities.
microbe (mī′krōb). A tiny animal or plant, so small that it can be seen only with the aid of a microscope.
microscope (mī′krṓ-skōp). An instrument with a lens, used to make tiny things seem much larger than they really are.
morphine (môr′fēn). A drug made from opium and used to deaden pain or cause sleep.
mucous membrane (mū′kŭs mĕm′brān). The thin membrane that lines the nose, throat, and other passages that open to the surface of the body.

narcotic (när-kŏt′ĭk). A substance that lessens pain and causes sleep.
nausea (nô′shḗ-ȧ). Sickness in the stomach accompanied by a desire to vomit.
neurone (nū′rōn). A nerve cell.
neurotic (nū-rŏt′ĭk). A disease in the nerves.
neutralize (nū′trăl-īz). To counteract; to make something inactive.
nicotine (nĭk′ṓ-tēn). A very poisonous substance found in tobacco.
novocaine (nō′vṓ-kān). A name given to a form of anaesthetic—used to deaden pain.
nucleus (nū′klḗ-ŭs). A tiny life-center within a cell, necessary to its growth.
nutrition (nū-trĭsh′ŭn). The act of nourishing; the processes by which animals and plants make use of food elements for growth and repair of tissues.

olfactory nerve (ŏl-făk′tṓ-rĭ nûrv). The nerve of smell.
opium (ō′pĭ-ŭm). A drug which dulls pain and produces sleep; obtained from a certain kind of poppy.
optic nerve (ŏp′tĭk nûrv). The nerve of sight.
organ (ôr′găn). A part of the body that serves a certain purpose, such as the eye, ear, stomach, etc.
oxidation (ŏk′sĭ-dā′shŭn). The process of being combined with oxygen.
oxygen (ŏk′sĭ-jĕn). A colorless, tasteless gas found in the air. A constant supply is needed to keep us alive.

pancreas (păn′krē-ȧs). A gland which secretes the pancreatic juice to aid digestion of foods in the intestines, and also produces insulin.
parasite (păr′-ȧ-sīt). A plant or animal which lives in, on, or with some other living thing.
Pasteur, Louis (Pȧs′tûr′, Lōō′ĭs). Born 1822; died 1895. A famous French chemist who proved germs were a cause of disease.
Pasteurize (pȧs′tẽr-īz). To heat a liquid to a temperature where harmful germs are killed, without greatly changing the nature of the substance.
patella (pȧ-tĕl′ȧ). A small, movable bone forming the kneecap.
pellagra (pĕ-lā′grȧ). A disease believed to be caused by faulty diet. It is accompanied by intestinal and nervous disorders.
pelvis (pĕl′vĭs). The bony structure at the base of the trunk of the body. It also forms places of attachment for the thigh bones.
pepsin (pĕp′sĭn). A substance in the gastric juice, acting upon proteins.
periosteum (pĕr′ĭ-ŏs′tē-ŭm). A membrane covering the bones.
phalanges (fȧ-lăn′jēz). Bones in the fingers and toes.
phosphorous (fŏs′fō-rŭs). A chemical element. A yellowish-white poisonous substance. A small quantity, obtained from certain foods, is needed by the body for proper growth.
physiology (fĭz′ĭ-ŏl′ō-jĭ). The science which studies the work or function of the parts of living animals and plants.
plague (plāg). A severe contagious disease, or pestilence.
plasma (plăz′mȧ). The watery part of the blood; lymph.
pleura (plōōr′ȧ). A delicate membrane lining the chest cavity and covering the lungs.
plexus (plĕk′sŭs). A network, especially of blood vessels and nerves, which increases intercommunication among them.
pneumonia (nū-mō′nĭ-ȧ). A disease in which there is inflammation of the lungs, together with a collection of fluid in the lungs.
pollution (pŏ-lū′shŭn). The act of making impure.
protein (prō′tē-ĭn). An important food substance needed for the growth and repair of body cells.
protoplasm (prō′tō-plăz′m). The living substance in plant and animal cells. It is usually colorless and jelly-like.
ptomaine (tō′mān). A chemical substance formed in decaying matter, often poisonous.

pulmonary circulation (pŭl′mō̇-nĕr′ĭ sûr′kū̇-lā′shŭ̆n). The course of the blood from the heart to the lungs and back to the heart again.

pus (pŭs). The white or yellowish-white substance formed in sores, abscesses, etc. It consists of living and dead white corpuscles, bacteria, and tissue.

putrefaction (pū′trē̇-făk′shŭ̆n). The decomposition of animal or vegetable matter.

pyloric orifice (pĭ-lŏr′ĭk ŏr′ĭ-fĭs). The opening from the stomach into the small intestines.

pyorrhea (pī′ŏ̇-rē′ȧ). A disease of the gums. Pus is formed and the teeth often become loose.

quarantine (kwŏr′ăn-tēn). The time during which the movement of persons is restricted to prevent the spread of a contagious disease.

radius (rā′dĭ-ŭ̆s). The thicker and shorter of the two bones in the forearm.

Reed, Dr. Walter. A physician who proved that yellow fever is transmitted by the Stegomyia mosquito.

reflex (rē′flĕks). An involuntary body movement.

respiratory disease (rē̇-spīr′ȧ-tō′rĭ dĭ-zēz′). A disease affecting the organs of breathing.

retina (rĕt′ĭ-nȧ). The inner coat of the eyeball containing the ends of the nerve of sight.

sanitarium (săn′ĭ-târ′ĭ-ŭ̆m). A place where persons go for the treatment of illness, or to be restored to health.

scapula (skăp′ū̆-lȧ). The shoulder blade.

Schick test (Shĭk tĕst). A test in which a small amount of diphtheria toxin is injected beneath the skin to determine, from the appearance of the skin a short time afterward, whether a person is liable to develop diphtheria.

schlerotic coat (sklē̇-rŏt′ĭk). The tough, white outer coat of the eyeball.

secretion (sē̇-krē′shŭ̆n). The formation in the body of a new substance from materials contained in the blood; the substance formed, such as the saliva or gastric juice.

sensory nerve (sĕn′sō̇-rĭ nûrv). A nerve carrying feelings from different parts of the body to the brain or spinal cord.

septic sore throat (sĕp′tĭk). A severe form of sore throat, marked by fever and weakness.

septic tank (sĕp′tik). A tank or container in which body wastes are broken up by bacteria.
sheath (shēth). A covering.
sinus (sī′nŭs). A cavity or hollowed out space in a bone of the skull.
skeleton (skĕl′ē-tŭn). The bony framework of man or animal.
spinal nerve (spī′năl nûrv). Nerve connected with the spinal cord.
stamina (stăm′ĭ-nȧ). Vigor, power of endurance.
stapes (stā′pēz). The innermost of the three small bones that stretch across the middle ear.
stegomyia mosquito (stĕg′ō-mī′yȧ mŏs-kē′tō). The yellow fever mosquito.
sterilize (stĕr′ĭ-līz). To treat something in a way to make it free from germs.
stimulus (stĭm′ū-lŭs). Something that arouses an organ or tissue to action.
stupor (stū′pēr). A condition of the mind in which the senses or feelings are dulled or dazed.
systemic circulation (sĭs-tĕm′ĭk sûr′kū-lā′shŭn). The movement of the blood from the heart through the arteries, capillaries, and veins, and back to the heart again. On its journey around the body the blood supplies body cells with nutriment and oxygen and carries away waste materials.

tibia (tĭb′ĭ-ȧ). The inner, and usually the larger, of the two bones in the lower leg.
tonsil (tŏn′sĭl). A small gland on each side of the back part of the mouth.
tonsillectomy (tŏn′sĭ-lĕk′tō-mĭ). The surgical removal of the tonsils.
tonsillitis (tŏn′sĭ-lī′tĭs). Inflammation of the tonsils.
tourniquet (tōōr′nĭ-kĕt). A device to stop bleeding, such as a bandage or belt twisted tight by a stick.
toxin-antitoxin (tŏk′sĭn-ăn′tĭ-tŏk′sĭn). A combination of diphtheria toxin and diphtheria antitoxin injected into the blood to stimulate it to produce substances which protect the person against an attack of this disease. (See also **toxin** and **antitoxin**.)
trachea (trā′kē-ȧ). The windpipe, or tube leading to the lungs.
trichinosis (trĭk′ĭ-nō′sĭs). Disease caused in the intestinal tract and muscles by a tiny worm called trichina (trĭ-kī′nȧ).

tuberculosis (tū-bûr′kū-lō′sĭs). A disease, usually of the lungs, in which tissues are wasted away.

typhus fever (tī′fŭs fē′vẽr). A contagious fever caused by the bites of lice. It is a very serious disease marked by weakness and delirium.

vaccinate (văk′sĭ-nāt). To give a person a mild form of a disease in order to protect against a severe attack of the disease.

vaccine (văk′sēn). A substance containing germs which is injected into the blood in vaccination.

ventricle (vĕn′trĭ-k′l). One of the two lower chambers of the heart from which blood is pumped into the arteries.

vertebra (vûr′tē-brȧ), plural **vertebrae** (vûr′tē-brē). One of the small bones of the spinal column or backbone.

villus (vĭl′ŭs), plural **villi** (vĭl′ī). Finger-like processes of the mucous membrane of the small intestine which absorb digested food materials.

virulent (vĭr′ū-lĕnt). Extremely dangerous; deadly.

vital statistics (vī′tăl stȧ-tĭs′tĭks). Facts having to do with the number of births and deaths.

vitality (vī-tăl′ĭ-tĭ). Vital force, energy.

vitamin (vī′tȧ-mĭn). One of a class of substances found in most foods in their natural state. These substances are necessary to good health and growth.

vitreous humor (vĭt′rē-ŭs hū′mẽr). The clear, jelly-like substance which fills the part of the eyeball back of the lens.

X-ray (ĕks′rā). Rays of light with power to pass through most solids. They produce shadows upon photographic plates to form pictures which help in determining conditions inside the body.

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