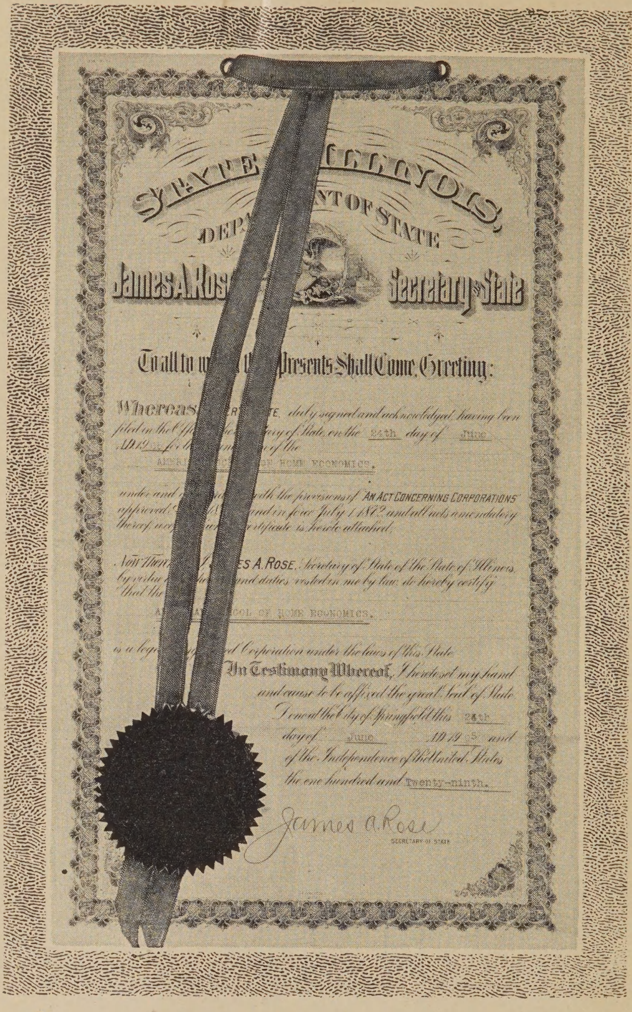
AMERICAN SCHOOL HOME ECONOMICS



STATE [illegible] ILLINOIS,

DEP[illegible]NT OF STATE

James A. Ros[illegible] Secretary of State

To all to w[illegible] th[illegible] Presents Shall Come, Greeting:

Whereas [illegible] ERT[illegible] TE, duly signed and acknowledged, having been filed in the Offi[illegible] the [illegible] tary of State, on the 24th day of June A.D. 19[illegible] for the [illegible] of the

AMERI[illegible] SCH[illegible] OF HOME ECONOMICS.

under and [illegible] with the provisions of "AN ACT CONCERNING CORPORATIONS" approved [illegible] and in force July 1 1872, and all acts amendatory thereof, a co[illegible] certificate is hereto attached,

Now Therefore, I, [illegible] ES A. ROSE, Secretary of State of the State of Illinois, by virtue of [illegible] and duties vested in me by law, do hereby certify that the

AM[illegible] AN [illegible] OOL OF HOME ECONOMICS.

is a leg[illegible] ed Corporation under the laws of this State.

In Testimony Whereof, I hereto set my hand and cause to be affixed the great Seal of State. Done at the City of Springfield this 24th day of June A.D. 19[illegible] and of the Independence of the United States the one hundred and Twenty-ninth.

James A. Rose

SECRETARY OF STATE

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HOME ECONOMICS

A COMPLETE HOME-STUDY COURSE

ON THE NEW PROFESSION OF HOME-MAKING AND ART OF RIGHT LIVING; THE PRACTICAL APPLICATION OF THE MOST RECENT ADVANCES IN THE ARTS AND SCIENCES TO HOME AND HEALTH

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TWELVE VOLUMES

NEARLY THREE THOUSAND PAGES, ONE THOUSAND ILLUSTRATIONS
TESTED BY USE IN CORRESPONDENCE INSTRUCTION
REVISED AND SUPPLEMENTED

CHICAGO
AMERICAN SCHOOL OF HOME ECONOMICS
1907

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VENUS DE MILO

PERSONAL HYGIENE

EDITED BY
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CHICAGO
AMERICAN SCHOOL OF HOME ECONOMICS
1907

CONTENTS

EDITOR'S NOTE

Arrangements were originally made to have this series of lessons on Personal Hygiene prepared by Professor Thomas D. Wood of Columbia University. An operation for appendicitis, resulting seriously, compelled him to abandon all work for nearly two years, consequently the preparation of the lessons was turned over to his co-worker, Dr. George L. Meylan, whose manuscript followed after some time. Meanwhile, the whole course had developed in length, breadth, and depth and the work on Personal Hygiene was found to be too elementary and not to fit into its particular niche in the enlarged scheme. As Dr. Meylan could not give the time for revision, he asked to be released from further responsibility of authorship.

After endeavoring in vain to induce half a dozen others to write the book in the time set, the editor was compelled to undertake the difficult task himself, with such assistance as could be obtained. Dr. Meylan's material has been drawn upon, especially in Part I, but the subject-matter has been rearranged and for the most part rewritten. All the up-to-date books on the subject—a meager list—have been consulted, and ideas borrowed freely.

For the latest facts in physiology I have depended mainly on *A Text-Book of Physiology* by Professor William H. Howell of the Johns Hopkins University, *Recent Advances in Physiology and Bio-chemistry*, edited by Leonard Hill, Pawlow's classic book, *The Work of the Digestive Glands*, and the ately published college text-book, *The Human Mechanism*, by Professors Hough and Sedgwick.

I wish to make grateful acknowledgment for help and suggestions given by Mrs. Ellen H. Richards and Miss S. Maria Elliott, to Miss Helen Louise Johnson for assistance in editorial work, and to Dr. Frank W. Allin of Rush Medical College for checking the technical statements in the text.

Chicago, December, 1906.

AMERICAN SCHOOL OF HOME ECONOMICS
3325 ARMOUR AVENUE
CHICAGO

January 1, 1907.

Dear Madam:

As the lessons on Personal Hygiene have been so long delayed, many of our students have about completed their courses. Nearly all the letters received giving the reason for slow progress speak of personal ill health or sickness in the family, and I realize now more clearly than ever before that these lessons should form the keystone in the arch of health which we are trying to build with our course.

I undertook the preparation of these lessons with full recognition of the difficulties of the subject. If I might have had two years instead of two months to write them, the result might have been more satisfactory to me. The words to carry conviction and compel action are hard to find.

Personal health is so necessary,-few things are worth while without it. It is above price and cannot be bought with money--it must be worked for like nearly everything else worth having. Its value is hard to realize until lost and then it may be too late. The tragedies, the sorrows, the heart aches that come from lack of knowledge and lack of self control in the matters of health are beyond reckoning.

I hope these lessons may be only the beginning of your study of personal health. Follow the "Supplemental Program" if possible. In problems of health the application of principles must always be a most personal one. Of course here as elsewhere it is a mistake to look for trouble--to expect things to go wrong. The hypochondriac never fails to find looked for ills. We must live in faith. Nature takes wonderful care of us if we will only give her co-operation.

Put yourself into your answers and give expression to your own ideas. Ask questions freely and so allow me to supplement the lessons. I may not be able to answer all your questions but perhaps can give a little more help. Of course advice in cases of illness cannot be given at "pen and ink distance."

Sincerely yours,

Maurice Le Bosquet

Instructor

Right Living

Live to accomplish something—not merely to exist.

To live means to eat, to work, to sleep, to be amused and refreshed after work.

Eat for satisfying legitimate hunger of the body cells —not only to please the palate.

Sleep for restoration of energy—see to it that such is the result.

Exercise is as essential as sleep—learn what and how much shakes out the dead ashes from the living coals.

Life processes go on best unwatched. "All the world's a stage"—enjoy the play.

Live for a worthy purpose—some incentive, some goal to reach keeps the traveller on the safe road.

Adapt habits to environments, control surroundings as far as possible to the great end—effective life.

Educate the young from the first to value life and health, to find happiness in right living.

Above all, believe that it pays to know the truth and to follow it.

Ellen H. Richards

PERSONAL HYGIENE

HYGIENE is the technical application of biology and physiology to the problem of health. The old dictionary definition of Hygiene, which stated it to be "that which has to do with the *preservation* and *restoration* of health" has of later years given way to a higher ideal, and we may define it now as "that which has to do with the *preservation* and *improvement* of health." **Definition**

Most people consider themselves well as long as they are not ill and do not consciously endeavor to better their physical condition, but those who have interpreted anew the definition of hygiene seek the higher ideal.

A most important factor in the study of health is an appreciation of the *value* of health. This means much more than merely to wish one's self well. It involves a realization that the first and most important *duty* is to be well. **Value of Health**

The second factor is the willingness to do anything that is necessary to acquire ideal health. Many are willing to be patient, to take time, money and trouble to *regain* the blessing of health once lost; few are found willing to do all this to attain a higher standard.

Economy of Health

The third factor is in a measure involved in the second, but needs to be stated more forcibly. It is the realization that the time and strength and money used for the improvement of health are not taken from greater or more necessary things, but that health is a fundamental necessity. Some do accomplish much in spite of physical limitations and many who seem to be fine physically have never achieved greatness elsewhere. But it remains that to do one's best it is necessary to be one's best.

Personal Responsibility for Health

Finally the personal responsibility for health should be appreciated. Health is the natural condition of the body. The organism is constantly endeavoring to maintain itself in this normal state and it is only when conditions are so unfavorable that the body cannot adjust itself to them that illness results and the organism demands rest for recuperation.

Statistics show that only ten per cent of mankind die from natural causes,—the wearing out of the machine through old age. It is safe to say that poor health and illness result in nine cases out of ten from *ignorance, carelessness,* or *intemperance* of some kind.

Most people have certain notions and theories as to the requirements for personal health, but very few have studied the subject systematically in the light of present-day scientific developments. Knowledge of personal hygiene is not yet considered an essential part of a liberal education.

Few people live up to the knowledge that they have of healthful living, but a falling short of ideals is common in all lines of human endeavor. What is needed is greater knowledge and *higher ideals.*

Preventable Diseases

Much illness results from carelessness, for all contagious or infectious diseases (communicable diseases) are preventable. As far as known, each case comes from some previous case, near or remote, so that all such illness may be attributed to carelessness and ignorance, chiefly perhaps of those who are ill or their attendants, but often through lack of ordinary precaution on the part of those contracting communicable disease. The body in perfect health is a fortress against the invasion of the germs of disease, but some seemingly trivial weakness may give the germs the chance to develop and affect their dread results.

Intemperance

Intemperance has many forms besides the over indulgence in alcoholic liquors. Intemperance in eating is probably as common and nearly as disastrous. We may be intemperate in work as in play.

Personal Limitations

The individual "strength of constitution" so called, differs greatly, it is true. Each one has his personal limitations and these should be studied, but a certain measure of health is possible for everyone who is willing to work for it, unless the attempt is made too late. Through childhood the mother is chiefly responsible for the health of the child, after which each individual is *alone* responsible for maintaining the degree of health that he has and improving upon it. That a poor constitution may be improved greatly and oftentimes developed into a vigorous one has been proved repeatedly. A notable example is that of President Roosevelt who when a youth was unpromising physically.

Health and Happiness

But as man is more than animal and has a mental and spiritual life as well as a physical life, these must be considered in any study of right living. As there can be no perfect happiness without physical health, so there can be no perfect physical health without the mental and spiritual health which gives happiness, and further, this higher health depends upon a true philosophy of life, a proper adjustment between work and recreation, some purpose in living, service, ideals.

The problem of right living is always one of adjustment and it is necessary to know as much about the body as possible to make the most perfect adjustment to the ever-increasing complexity of modern life.

In this series of lessons we shall study something of (1) The Human Machine, (2) The Running of the Machine, and (3) Care of the Machine.

THE HUMAN MACHINE

The human body is a living machine in that the function of a machine is simply to convert one kind of energy into another. This is precisely what the body does. Biology is concerned with the origin of this machine, physiology with the running of it.

The facts discovered in connection with the organic cell and protoplasm seem to hold the key to the interpretation of the life phenomena. Life itself is inexplicable. Yet what we believe to be true of the origin of the living machine assists us in the difficult task of properly adjusting this organism to its environment.

Nature of Life

If we compare a dead body with a living one, we find the form the same, the weight the same; if we analyze them chemically, we still find them the same. Yet we know there is an essential difference between the two and that difference is given by a wonderful something called life. A living body has the property of movement, takes in food and builds it into living tissue, reacts to its surroundings, maintains an even temperature, reproduces itself, and finally dies.

Organisms

All living things from the lowest to the highest forms are called organisms. One of the lowest forms of animal life is a little body found in muddy water, called the amœba. This small organism is barely visible to the naked eye and if looked at under the microscope appears like a tiny round mass of jelly.

But this very small body moves about, takes in food, changes that food into living substance, and grows; it responds if irritated; it reproduces itself, and finally it dies. This tiny mass, therefore, has all the properties of a living organism.

THE AMOEBA, A TYPE OF A UNICELLULAR ORGANISM

Unit Cells

If we cut the amœba into several pieces, we find that each part is like every other part. This represents the simplest possible living thing capable of an independent existence. It is a single cell. The study of the amœba is interesting because the human body is developed from a single cell called an ovum which is very similar to the amœba. The process of development may be divided into three stages.

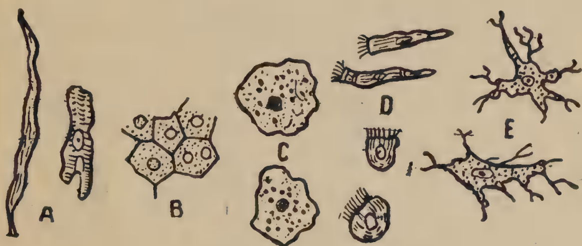
Development of the Ovum

In the first stage the ovum or cell divides into two cells and each again divides into two until there are many cells all alike, which are held together and form a mass something like the little round parts making up a raspberry. Up to this point each cell is like every other cell.

The change that takes place in the second stage has been likened to the transformation of a savage into a civilized man. The savage lives an independent life; he procures his own food, makes his clothes, builds his hut, and fights his own battles. Little by little, one man finds that he can build huts better than other men and he builds a hut for another man who is a successful hunter, and exchanges the hut for food. In the same way one man is very skillful in making clothes and he makes the clothes for a man who makes very good tools. Gradually differentiation of labor takes place; that is, one man learns to do one thing well and does that only, while other men do the things for which they are best fitted.

Differentiation of Labor

A condition very similar to this division of labor takes place in the second and third stages of the de-



BODY CELLS.
A, Muscle Cells; *B*, Liver Cells; *C*, White Corpuscles; *D*, Ciliated Cells; *E*, Nerve Centers or Cells.

velopment of the full grown man from the mass of similar cells. At the first stage, each cell is like the savage who does everything for himself. As the cells grow and multiply they begin to show some differences and the end of the second stage shows three distinct kinds of cells which may be denoted as the outside, middle, and inside cells.

During the third stage the process of division of labor by differentiation of cells continues and there is developed gradually the final specialized cells, each having some particular work or function to perform. Some are bone cells, some are muscle cells, others liver cells, nerve cells,—every kind of cell necessary to a complete organism.

The Organs

A group of one kind of cells doing the same work is called an *organ,* and the body is composed of various organs. The heart, the stomach, the lungs, the muscles, and the brain are all organs, each having its particular and definite work to do in maintaining life.

Returning now to the comparison of the human body to the conditions of modern civilization,—we know that with the far-reaching specialization of the various occupations, the welfare and happiness of the people depend on each class of workers doing its share. When there is a great strike, as for instance, when all coal miners stop working, homes and factories which must have coal for fuel are much disturbed and suffer greatly. In the same way, if all the bakers or butchers go on strike, much trouble and distress is caused to society.

Inter-relation of the Organs

Similar conditions exist in the human body. Each organ has a particular work to do and the well-being of the body as a whole depends upon the proper working of each and all the organs. When all do their work well, we have in the body the condition known as health. When some of the organs are impaired and their work is poorly done, we have the condition known as disease. It is essential, then, to know the principles underlying the proper working of all the organs in order that we may keep them in a condition favorable to the body as a whole.

Health of the Cells

The health and efficiency of the various cells depend on (1) proper nourishment, (2) functional activity, and (3) free discharge of waste matter. All the organs and functions of the body have a share in supplying these conditions. The organs of digestion and respiration supply the body with nourishment; the organs of elimination carry off waste matter; the muscles furnish the necessary functional activity; the blood serves as a vehicle for nourishment and waste matter, and all the organs are governed by the nervous system.

Health of the Body

We have seen that if any of these organs performs its work inadequately, the condition of health is impossible. The reason that so many people are in the condition of imperfect health is that the human body depends for its health on its environment; that the environment best suited to its needs is one of simple active outdoor life, and that civilization has so modified man's environment that his life is complex, sedentary and indoors. These conditions are unfavorable to perfect health.

Evolution of the Body

It has taken thousands of years of evolution to develop the human organism to its present state—its adaptation to an active outdoor life, but in the last hundred years civilization has brought about such radical changes in man's environment that it is at present difficult for his body to adapt itself to the new demands. The marked decrease in the amount of muscular exercise, the enormous changes in shelter and food, the great increase in nervous activity, necessitate great modifications in the various functions of the body. That most of the functional disorders common to our city population would be easily remedied by a change to a simple, active, outdoor life, is shown by the marked improvement in health which takes place when a man or woman spends a summer camping out.

Degrees of Vitality

From the standpoint of health, people may be divided into three classes. In the first class are those who possess a large amount of vitality or resistance to disease. They maintain good health under all circumstances—hard work and unhygienic surroundings have no apparent effect upon them.

In the second class are those who are well and strong when living under favorable conditions of work, air, food, exercise and rest, but who fall ready victims to epidemics and easily affected by adverse conditions.

The third class, small in number, includes all persons having inherited or acquired weakness who are incapable of a high degree of health, even when surrounded by the most favorable conditions.

Most people belong to the second class. They thrive when the environment is favorable, but are easily affected by bad air, poor food, overwork, and other external circumstances.

Health, then, may be said to depend on two main factors, (1) the strength, vitality or constitution of the individual, and (2) the environment in which the individual is placed.

Factors in Health

A natural question is: What is constitution and how may it be improved? The constitution or vitality of an adult depends on two things, heredity and nurture. It is a common law of nature that children of healthy parents are much more likely to be strong and vigorous than the children of weak, sickly parents. It has also been demonstrated that children brought up under favorable conditions of air, food, bathing, exercise, rest and play, are likely to grow up healthy and vigorous even with poor inheritance.

Health also depends on the *immediate* influence of environment. A man or woman who has inherited a vigorous constitution from his parents and has been brought up under favorable conditions of life, may ruin his health in a short time by exposing himself to an unhealthy climate, overwork, bad air, poor food, filth, worry or dissipation.

Environment and Care

In these lessons we shall study the important functions of the body and the conditions most favorable to them. In all this we should keep in mind that in our attempt to enhance the influences which improve the health, we are not studying simply to increase the efficiency, usefulness and happiness of the individual but we are building permanently by increasing the vitality of the fathers and mothers of future generations.

STRUCTURE OF THE BODY

The many dissimilar parts of the body, such as bones, muscles, nerves, lungs, etc., upon close examination may be resolved into the elementary structure called tissues. The body, then, is composed of solid tissues and fluids.

Tissues Microscopical examination of any tissue shows that it is composed of the living physiological units called cells and the cells of any tissue are similar in structure and function. These are the fundamental structural elements, and it is by the combination and transformation of these, and material derived from them, that all the tissues, seemingly so different, are formed which make up the structure of the human body.

The bones which give the fixed figure and form as well as support to other organs; the ligaments and cartilage connecting the bones; the muscles which make motion possible; the organs of nutrition, secretion and excretion; the nervous tissue, and that composing the organs of the special senses, are primarily made up of cellular tissue corresponding to the frame-work of any building with its intricate steel, brick, mortar and board formation.

Fluids The fluids are intimately connected with the life of the structure. If they become stagnant or contaminated, trouble ensues. Upon their purity and renewal life depends. These fluids are the blood or circulating medium; the fluids connected with the process of assimilation such as lymph; the digestive juices, as saliva, the gastric, pancreatic; and the excretory fluids.

Divisions of the Body

For purposes of classification the body may be separated into head, trunk and limbs. The head may be sub-divided into skull and face; the trunk into chest or thorax and the belly or abdomen. The arms are sub-divided into upper, fore-arm, wrist and fingers, roughly corresponding with thigh, leg, ankle and toes.

The thorax or chest is separated from the abdomen by a peculiar partly fleshy, partly membranous organ called the diaphragm. The alimentary canal lying in front goes through the diaphragm and is composed of œsophagus, stomach and intestines. The abdomen also contains the kidneys, liver, bladder, pancreas and spleen. The thorax contains the heart and lungs.

The cavity of the skull connects with the spinal canal. This cavity contains the brain which is continuous with the spinal cord, the brain and spinal cord constituting the cerebro-spinal system.

BONE

Structure of Bone

Bones are made up of osseous tissue which consists essentially of animal matter similar to connective tissue impregnated chiefly with calcium salts which give rigidity. In general, a bone is a hard, tough body, flexible and elastic within narrow limits, but breaking if pressed too far. When a long bone is broken across, it is found not to be a solid mass of ossified tissue, but to contain a cavity filled with a mass of connective tissue, called the medulla or marrow. This medullar cavity extends through the shaft or bone, but as it reaches a joint becomes sub-divided by bony partitions and shows numerous smaller cavities. The walls of this cavity are seemingly dense, but are traversed by a net work of narrow vessels known as the Haversian canals which have intimate association with the nutrition, hence with formation of the bone.

STRUCTURE OF BONE, SHOWING CANALS AND THE LIVING CELLS (THE BLACK SPOTS)

Kinds of Bones

There are two kinds of bones classified as to their origin: (1) *Membrane* bones developed from fibrous tissue including most of the bones of the head, (2) *Cartilage* bones developed from cartilage, including most of the bones of the skeleton.

The growth of bone takes place largely in two places, at the *epiphyseal* line or cartilage between the shaft and head, and at the outside covering or *periosteum.*

Development of the Bones

In the embryo "centers of ossification" appear in these membranes and cartilages and calcium salts are deposited to form bone. In long bones usually there are three centers of ossification, one for the shaft and one at each end. These grow toward each other but do not completely unite until the skeleton nears the adult size. Consequently in childhood there is danger of fracture at this line of union since it is cartilage and not fully developed bone.

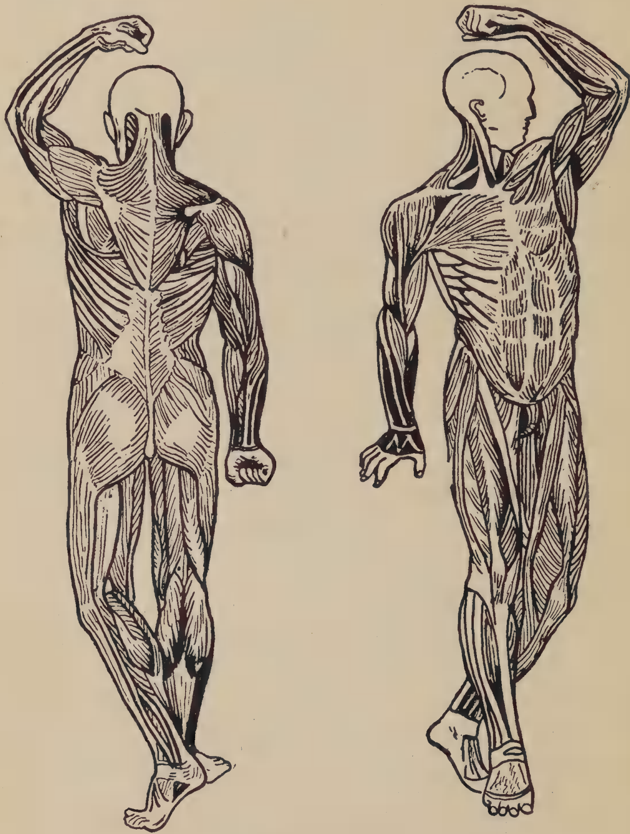
Living Part of Bones

The periosteum is the essential living and growing part, much like the inner bark of a tree. During the growing period especially, new bone is constantly being laid down on the outside, thus increasing the size of the bone, while destruction is going on within, hollowing out the center. In youth the building process exceeds the destruction. In old age the building has nearly ceased and destruction continues until bones become very brittle. When these bones are broken they unite with great difficulty.

MUSCLE

Bones, cartilage and connective tissue form the framework of the living machine. The origin of the energy manifested by this machine, we will consider later. Its active power is largely manifested in the form of motion or movement, in which the voluntary muscles or "organs of the will" play a large part. There are certain cells exhibiting amœboid movement, and ciliated cells which also produce partial movements of the human body, but the various kinds of muscles are of prime importance in its various acts.

We are familiar with muscles in the form of red meat from the butcher shop. Muscles constitute about one-half of the body in bulk. There are two main



EXTERNAL LAYER OF MUSCLES OF THE BODY

classes of mucles, the voluntary which are under the control of the will, and the involuntary which do their work independently of the will. In general the voluntary muscles are attached to bones and for this reason are sometimes called skeletal muscles. They are about 500 in number. The involuntary muscles are found in the organs of the body, as in the walls of the stomach, intestines, and blood vessels. Their particular function is to assist in the work of the various organs by moving their contents, as illustrated by the movements of the stomach and intestines during the process of digestion.

Fibres and Tendons

If a single muscle is examined carefully, it is found to be made up of a number of bundles of red fibres bound together by means of white connective tissue. At each end of most of the voluntary muscles is a strong white cord—a tendon, which serves to connect the muscle to the bone. Every muscle is supplied with nerves and blood vessels which ramify throughout the bundles of fibres.

The special property of the living muscle is that of contractility,—the power of shortening in length while it increases correspondingly in width. The two ends of a muscle being attached to separate bones, the shortening produces motion. This action leads to those motions which make locomotion and other activities possible.

The muscles are found passing over all the joints, one or more on each side, thus making it possible to move the joint forward and backward. In some places, as in the shoulder joint, the arrangement is such that the arm can be moved in all directions. The muscles which bend a joint are usually three or four times as strong as those which straighten it. This fact is easily demonstrated by comparing the strength of the muscles used in closing the hand with those used in opening it. Muscles which are used for heavy work tend to increase in size and strength, and also to shorten. Unused muscles become small and weak and tend to lengthen.

Muscles Hold the Bones in Position

The proper relation of one bone to the other in a joint depends on a definite relation between the length and the strength of the muscles which bend and those which straighten the joint. If the muscles which bend the joint are overdeveloped they shorten and stretch the extensor muscles. This gives a bent or crooked position of the joint, as illustrated in the half closed hand of the manual laborer, resulting from the constant grasping of tools, or the stooping attitude of the farmer from bending over in hoeing and other farm work. The same crooked position may result from great weakness of the extensor muscles even when the flexors are not overdeveloped. Furthermore, joints tend to maintain the position in which they are held most frequently. The drooping head, round back and protruding abdomen of the weak and undeveloped are all too familiar.

This condition is the result of general muscular weakness, and lengthening of the extensor muscles, particularly of the muscles on the back of the neck and chest, the abdominal walls, the hips, and the knees.

The proper relation between the flexor and the extensor muscles of the various joints is essential to beauty of form and grace of movement in the human body. When this relation exists the muscles being of exactly the proper length and strength they are balanced.

THE NERVOUS SYSTEM

The nervous system is the governing mechanism of the body. It controls and regulates every activity of the body, brings the individual into conscious relationship with external nature by means of sensation, motion, language and all the mental manifestations.

The cerebro-spinal nervous system consists of the brain, the spinal cord and the nerves.

Every organ and part of the body is connected with the brain by means of the nerves. Every movement we make is the result of muscular contractions which have been ordered or stimulated by the brain.

A Nerve Cell

A nerve consists of the nerve center, located in the brain, spinal column, or ganglia, from which extends the nerve fiber. The nerve centers are the sending and receiving stations—the fibers, the wires. We do not know just what a nervous impulse is, but it seems to be electrical in nature, although the nervous impulse travels much more slowly than the electric current.

The Brain In a general way the brain consists of nerve centers which have for their function the regulating of the various activities of the body. There is, for instance, a center regulating eyesight, another has to do with hearing. In the same way there are centers for speech, smell, breathing, coughing, the beating of the heart, the secreting of the various glands, the movement of each group of muscles, and all the other activities of the body.

Special Centers The nerve centers in the brain are numerous and their functions very complex. For example, when a muscle is exercised vigorously, it requires an increased supply of blood and its sensory nerves carry a stimulus to a particular center in the brain. This center sends stimuli to the centers which regulate the breathing and the beating of the heart, and these centers, in turn, send stimuli through motor nerves to the heart and muscles of respiration to increase their activity. All the muscles and other organs are connected in a similar way with the various centers in the brain by means of the nerves.

Kinds of Nerves A nerve fiber carries impulses only in one direction, to a center or from a center. In general the nerves which carry stimuli from the parts of the body to the brain are called *sensory nerves,* and the nerves which carry stimuli from the brain are called *motor nerves,* because nearly all the stimuli coming from the brain produce movement or activity.

Nature of Nervous Impulses

All nervous impulses are thought to be alike. They vary only in intensity and in the method of stimulation, thus the nerves in the retina of the eye are sensitive only to light; those in the inner ear, to sound. If it were possible to change the nerve fibers about, so that those coming from the eye were connected with the centers which interpret hearing and vice versa, we would, as has been said, "hear the lightning and see the thunder." It is a common experience that a person who has lost a foot or arm still interprets stimuli of the nerves which formerly came from the lost member as if the foot or hand were still present.

Voluntary Nervous System

Most activities are under the control of the will. When we get up from a chair or carry a glass of water to the mouth, we call it a conscious act because the stimuli to the various muscles involved originate in the will. But if every act depended on the will for its instigation and direction we would remain helpless as an infant. The development and training of the nervous system results in many acts becoming automatic. The child learning to walk takes months of repeated conscious effort to learn to stand, and several more months to learn the movements of walking. Gradually the act of balancing, and the movements involved in placing one foot in front of the other, are performed unconsciously or automatically, and the child is able to walk, and later to run, without any conscious effort. In the same way we learn to speak, to eat, to put on our clothes, to write, and to make a great many complicated movements which at first require conscious effort, but gradually are performed automatically.

Automatic Acts

The back of the brain and the spinal cord have for their particular functions the regulating of these automatic acts, and this results in a tremendous saving of time and energy. If it were not for this provision, we should spend most of our time and energy in dressing, for the fastening of every button and hook would require many conscious efforts on our part. Every new movement has to be repeated a great number of times as a conscious effort before it can be directed by an automatic center.

Reflex Acts

There is still another class of nervous reactions not under the control of the will, called reflex acts. A wink is a typical reflex act. A sudden strong light causes the eyes to close before we have time to think about it, or even to prevent it. Reflex acts are largely associated with the protection of the body from harmful conditions. Too strong light or dust irritating the eye causes the lids to close; heat coming in contact with the hand causes the arm to be snatched away; a pin pricking the sole of the foot causes the leg to be drawn up quickly. All these movements take place with great rapidity and without conscious effort. The irritant stimulates the sensory nerves in the part; the stimulus is carried to a sensory center; from there, another stimulus is sent to the proper motor centers, and these in turn send stimuli to the muscles which by their contraction protect the part from injury.

Sympathetic or Ganglia Nervous System

Besides the central nervous system, there are numerous little bodies or nervous tissue called *ganglia* which are for the most part independent of the brain and spinal cord, although connected with them. There are two chains of these ganglia in front of the spine and others in the heart and other organs, all of which send out numerous nerve fibers. They are connected with the activities of the organs not under the control of the will like the heart, the blood vessels, the stomach and other digestive organs, and in fact all involuntary activity. This is what is called the sympathetic nervous system.

In many places in the body, numerous nerve fibers interlace, forming *plexuses,* especially around the blood vessels. The great plexus of nerve fibres in the abdomen is called the "solar plexus."

Stimulation and Inhibition

Many of the organs controlled by the involuntary system have two sets of nerves opposite in their action; for example, one set of nerves accelerates the heart beats, another retards, or "inhibits," action; in the stomach, one set brings about the secretion of the gastric juice, another is inhibitory.

In health all this marvelous complexity of nervous organization is in perfect co-ordination. The nervous system is wonderfully protected in all parts of the body, for it controls the growth and function of all the cells.

THE SKIN AND CONNECTIVE TISSUES

There are various complicated classifications of the tissues. It is enough for our purposes to divide them arbitrarily into skin or protective covering, and connective tissue, the latter term covering many subdivisions.

The Skin

The skin consists of layers of tissue of varying thickness which cover the whole body. If we examine a piece of skin in cross-section, we find on the surface a thin layer of hard, flat cells without nerves or blood vessels. This outer surface is called the epidermis, is composed of minute particles of horny matter and is constantly being shed. The sensation of touch and the effect of temperature on the surface of the body are greatly diminished in intensity because of this covering, as it contains no nerves or blood vessels. The great sensibility of the under skin when the outer covering is removed, is illustrated by the practice of a famous burglar who was able to open bank safes by pressing the ends of his fingers, from which he had removed the outer skin, against the lock on the safe and thus feeling the clicks as the knob was turned.

Dermis

The under skin or dermis is filled with a meshwork of nerves, blood vessels and glands. While it is dense and fibrous, if wounded gives rise to pain and easily bleeds.

Mucous Membrane

At the margins of the various apertures of the body is a layer of skin, redder, more sensitive, and continually moistened by a fluid which it exudes. This is *mucous membrane* and lines all interior cavities. This is a skin and consists of two layers now called the dermis and the epithelium.

The ducts of the glands in the dermis pierce the outer skin, but the nerves and blood vessels are all below the epidermis.

Glands of the Skin

There are two kinds of glands in the outer skin, the sweat glands which secrete water and waste matter dissolved in perspiration, and the oil glands which secrete an oily material useful in keeping the skin soft and pliable.

Sweat Glands

The sweat glands are very numerous. They are eliminating perspiration continuously, but most of it dries on the skin without giving a sensation of moisture. It is only when these glands are stimulated to great activity by vigorous muscular exercise, nervousness, emotion or heat, that the sweat accumulates in drops which perceptibly moisten the skin. These glands in an adult secrete on an average about one quart of perspiration in 24 hours, and a much larger quantity in hot weather.

Temperature Regulation

The sweat glands serve to regulate the temperature of the body. Under active muscular exercise in the heat of summer, or in overheated rooms, large quantities of blood flow through the capillaries of the skin, the sweat glands are stimulated to greater activity, and the sweat poured out of these glands serves to cool the body by evaporation. Evaporation, as we know, requires a large amount of heat.

Experiment. Rub a drop of ether, alcohol, or gasoline on the back of the hand. The skin is chilled by the evaporation. A like quantity of water in evaporating will carry away much more heat, but as the volatilization is not so rapid the cooling is not so noticeable.

The process is reversed when the body temperature is too low and the surrounding air is very cold. Under these conditions the capillaries in the skin contract, very little blood flows through them, the sweat glands almost cease their activity and a very small amount of heat is lost from the body by evaporation. The normal activity of the skin therefore is an important factor in maintaining health and preserving energy.

Sebaceous Glands and Hairs

The oil glands are found all over the body except in the palms of the hands and the soles of the feet. Each gland is located at the root of a hair and opens into the depression in the skin or hair follicle which contains the hair. The hairs are so small and short in many places that they are practically invisible. When a cold draft strikes the skin suddenly, we have what is called "goose flesh," due to the contraction of a tiny muscle near the bottom of each hair follicle which causes the hair to straighten up or "to stand on end." The amount of oil secreted by these glands varies in different persons, and in different races. It is well known that negroes have much more oil in the skin than whites. A certain amount of oil is essential to the health of the skin and to keep it soft and pliable.

Complexion

In the deeper part of the dermis is found a coloring matter which determines the complexion. The amount varies greatly in different individuals and in different races. A dark skin is due to the presence of a large quantity of this pigment in the dermis. Negroes have a very great amount of coloring matter, whereas persons with fair complexions have very little. Freckles are caused by the accumulation of pigment in spots. The amount of pigment in the dermis cannot be altered by the application of medicinal preparations or the taking of medicine internally. The various facial preparations advertised to bleach and beautify the skin consist of some form of scented pomade usually containing arsenic. Such preparations are harmful. The arsenic does not decrease the amount of pigment in the skin, it simply interferes with the circulation of blood in the capillaries and produces a certain pallor characteristic of arsenical poisoning.

Fat in the Skin

In the deeper layer or dermis, and just beneath it, is found a layer of fat. The amount varies greatly in different persons at different ages, and in the sexes. This fat protects the body from cold, rounds out the form and serves as reserve fuel supply for the body. The angular form of thin persons and the wrinkles of old age are largely due to a diminution of fat under the skin.

The skin varies in thickness in different parts of the body. On the eyelids and most of the covered parts of the body the skin is quite thin, but on the palms of the hands, the soles of the feet, and the scalp, it is often very thick. This is especially true of people who do manual labor and walk or stand all day. Under these conditions the skin thickens to protect the delicate parts beneath from the constant pressure on the surface. This thickening becomes excessive and causes great pain when the pressure or friction is too long continued, as when a callous is formed on the hand by doing manual work, or a corn on the foot by wearing too small or ill-fitting shoes.

The nails and hairs, like the callous, are only modifications of the skin, serving for protection of exposed and delicate parts of the body.

Cartilage

In early years many parts of the supporting framework which later became bone consist of cartilage. The infant softness comes from the cartilaginous condition of many bones, these being known as the temporary cartilages, as later ossification will take place and the cartilaginous be replaced by true bony tissue.

In certain portions of the body, however, the cartilaginous or permanent tissue remains such through life unless calcified or hardened and made unyielding by deposits, as often happens in old age.

In its pure form, cartilage is flexible and elastic, and contains few blood vessels and living cells.

Connective Tissue

The connective tissue constitutes the final group of the supporting tissues and has many diversions, from a white fibrous variety mainly connected with muscles and joints to the jelly-like connective tissue making up the vitreous humor of the eye.

THE SENSE ORGANS

Something of the structure of the organs which support the frame-work of the living machine, the bones and connective tissue, has been described. Those which move it, the muscles and cerebro-spinal nervous system, have been briefly considered. There remains to touch upon, the sensory organs, before considering those which are more intimately connected with the "running of the machine."

Sensation

There are only certain organs which convey the various impressions from without. Any surface of the body may be sensitive to, or "feel" the sensation of heat or of cold, but only certain portions of the body are capable of reporting sound, light, or smell. Therefore, those organs which put us in some particular relation with the outer world are termed sensory organs.

Sense Organs Develop the Brain

Since between these sense organs and the sensory centers, the brain, the nervous impulses are the only means of communication, it is of prime importance that the nervous system be a perfectly working part of the human machine. It is of course important that the special sense organs of sight, sound, smell and taste be highly developed, educated and healthy, but it is through the sense of touch and motor activities as well as what we call thought that the higher nervous organization of man has been evolved. It is through the sense and motor activities that man has been able to modify his primitive instinct. It is through the education of the senses that man is raised above the animal. In many animals the special senses of sight, hearing, taste and smell are more highly developed than in man, but in no animal does the ability to make complicated movements approach that of man.

Sense End Organ

The fundamental part of every sense organ is what may be termed the *end* organs. These are masses of highly sensitive tissue so placed as to be normally acted upon by one of the modes of motion met with in the external world. This end organ must have a sensory nerve fibre connecting with a nerve center in the brain. Seeing and hearing are the two most specialized senses and will be considered separately. The others are the sense of touch, the senses of heat and cold, the senses of smell and taste, the sense of pain, the muscular sense, and what may be termed common sensation, as hunger, thirst, fatigue, restlessness, and the like.

Tactile Senses

The sense of touch which is really the pressure sense is located in the skin and mucous membrane. It varies in acuteness in different portions of the body, being most marked at the tip of the tongue, fingers, and lips. The tactile impression is a very necessary one in education and should be developed far more than is usually the case, and those who, like Helen Keller, are both deaf and blind receive all their education through the tactile sensations.

Temperature Sense

According to the older view, the temperature sense as well as the sense of pain was thought to be a part of the sense of touch. It is now known, however, that in the skin there are distinct and separate nerve endings for heat, for cold, and for pain, as well as for pressure. The distribution of the hot and cold spots on the skin can be localized by passing a hot and a cold wire successively slowly over any part of the skin, as on the back of the hand.

Sense of Pain

The nerve endings for the sense of pain are most numerous in the skin. The internal sensations of pain are usually referred indefinitely to some part of the surface of the body—for the heart to the region of the shoulder blades, for the intestines to the back, from the stomach to the end of the sternum.

Muscular Sense

We are not usually distinctly conscious of muscular sensibility. Our ideas of weight and resistance, although depending in part on the sense of pressure, are largely determined by the muscular sense. Judgment of distance depends on visual impression combined with the contraction of the ciliary muscles in focusing, especially for near objects. The muscular sense is thought to have much to do with the proper contraction of the muscles and thus becomes important in all voluntary movements. It is probable that through the muscular sense is received the impression of fatigue.

Sense of Smell

The sense of smell is located in the mucous membrane lining the upper part of the nasal cavity in which the olfactory nerves are distributed. Its important function is to guard us against the breathing of impure air.

Sense of Taste

The sense of taste may be a highly specialized sense and is so needful a part of the acts of nutrition that it

SECTION OF THE NASAL CAVITY, OLFACTORY NERVE INDICATED

should be considered a most important sense. It is localized mainly in the mucous membrane covering the upper surface of the tongue.

Primary Taste Sensations

The sensation of taste may be resolved into four primary tastes—sour, sweet, bitter, and salty. All our sensations of taste are the result of the mingling of these primary tastes with the sense of smell. Many of the so-called tastes are in reality given through stimulus of the olfactory nerves. This is largely so in the case of fragrant fruits, the bouquet of wines, and in fact all substances of which we say that the taste and smell is alike. The expired air, passing over the food, carries some of the delicate ethers across the olfactory nerves, thus we have a combination sensation of taste and smell. This fact is recognized when one has a bad cold; many things "do not taste." Holding the nose is a common practice when disagreeable medicines must be taken.

As we shall see later when considering gastric digestion, taste and smell have a marked effect on the flow of the gastric juices so that we need to cultivate these senses, and pay more attention to their proper function than is often the case.

THE SENSE OF SIGHT

Structure of the Eye

The eyes are in some ways the most important organs in the body. The eye consists of the eye-ball and the optic nerve. From the front of the eye-ball to the retina at the back, the light passes through a small, transparent body called the lens which answers the same purpose as the lens in a camera in making an image. The retina corresponds to the photographic plate and the lens focuses the image upon it. Normal vision depends on the proper distance between the lens and the retina. In focusing a camera, the lens is moved back and forth until a point is found where the distance between the plate and the lens is just right to give a clear reflection. Clear vision depends upon the same principle, except that the lens in the eye is not moved backward and forward from the retina, but the shape or curvature of the lens is changed, thus giving the same result.

Accommodation The change in the shape of the lens is accomplished by a little muscle called the ciliary muscle which, by pulling on the suspensory ligament, changes the shape of the lens according as we wish to look at an object near or far away. This mechanism for focusing the eye on objects at various distances is called accommodation.

The Iris Another structure on the eye-ball, called the iris, is important. It is a little curtain-like arrangement placed in front of the lens and serves to regulate the amount of light entering the eye. The change in the size of the opening, or pupil, may be seen by placing the hand on the eye for a few minutes and then removing it quickly, when the pupil will appear very large but will soon become much smaller as it is exposed to the light. The pupil is largest when we open our eyes in the dark, and smallest when we look at a bright light.

Defects of Vision In many persons the shape of the eye-ball is such that perfect vision is impossibie. The eye-ball is sometimes too long. When this occurs, the clear image falls in front of the retina, and in order to see clearly it is necessary for the ciliary muscle to be in a state of constant contraction. This causes eye strain with its many disagreeable symptoms. This condition is called near-sightedness or myopia, and is corrected by wearing a concave lens in front of the eye.

The opposite condition, or far-sightedness, is caused by the eye-ball being too short and the clear image falling behind the retina. This may be corrected by a convex lens in front of the eye.

In old age the elasticity of the lens become impaired and it cannot be sufficiently contracted to bring

CURVATURE OF THE EYE-BALL
A, Normal. *B*, In Near-Sightedness. *C*, In Far-Sightedness.

near objects into focus, so that convex glasses are required.

Astigmatism

Another very common defect of sight is astigmatism. This is due to irregularity in the curvature of the cornea, which prevents a clear image in all parts of the retina. To correct this a cylindrically ground lens is necessary.

In many persons the two eyes are not alike. One eye may be defective while the other is normal, or the two eyes may have similar or opposite defects.

Eye Strain

Eye strain results from over-exertion of the ciliary muscle. Some of the most common symptoms are pain in the eyes, a headache located on the forehead or in the back of the head, and inflamed eye-lids. Disturbance of the appetite, indigestion, and even nervous prostration may result from long continued eye strain. When any of these symptoms are felt the eyes should be examined carefully by an oculist and suitable glasses worn.

The eyes are moved upward and downward, from side to side, or rotated, by means of small muscles which hold the eye-balls in the sockets. Both eyes should move exactly together and in the same direction. When some of the muscles in one eye are too weak to do their work properly, squinting results. By operating on the muscles the proper balance between the muscles of one eye-ball and those of the other may sometimes be re-established.

Color Blindness

Color blindness is inability to distinguish all the colors. In most cases it is limited to inability to recognize red and green, but occasionally the defect extends to yellow and blue. Those who are unable to distinguish these colors see them all gray. There is no cure for this condition, but a certain amount of improvement is possible by education.

Care of the Eyes

To preserve the eyesight it is necessary to avoid excessive use of the eyes in work requiring close application, reading and sewing in a poor light, reading matter printed in small type and on glazed paper, and reading in the cars. When reading at night the pages should be held in such a position that there is no reflected glare from the paper.

If the eyes begin to smart or burn when reading or sewing they should be rested by looking away, and if this symptom reappears after reading or sewing for a short time only, the eyes should be examined by an oculist.

Lighting

The light as far as possible should fall on the page or work from above and behind; thus when writing, the light should fall from the left side to avoid a shadow cast by the hand. There should be a shade over the source of artificial light and the room should have general illumination as well as the reading light.

Reading in street cars and railroad trains is injurious because the light is frequently poor and the jolting necessitates rapid accommodation of the eyes which very soon tires out the ciliary muscles and produces eye strain. As there is a definite relation between good eyesight and general health, no efforts should be spared to maintain a normal condition of the eyes.

Foreign Bodies in the Eye

Nature has provided considerable natural protection for the eyes. They are located in deep, bony sockets and receive additional protection from the nose, the eyelids, and the eyelashes. Injury to the eyes often results from foreign bodies entering the eye or blows received on the eye-ball. A cinder or other foreign substance on the eye-ball may cause much pain and considerable inflammation. If the foreign body is a piece of steel or anything sharp and hard which has fallen against the eye-ball with great force, it may penetrate and produce permanent injury. Very serious results from foreign bodies and wounds on the eye-ball are caused by injury to the cornea, leaving scar tissue after the wound is healed.

A cinder or a speck of dust in the eye may be removed with the corner of a clean handkerchief by drawing back the upper lid gently. If the speck is imbedded in the eye-ball, the services of a physician should be secured at once.

Cataract Cataract is not a growth on the eye, as is often believed, but an opacity or loss of transparency of the lens. It is an affection of old people, with no apparent cause except old age. This trouble can be cured permanently by removing the optic lens—an operation which is not very serious.

Tears The lachrymal gland is a small gland located in the outer corner of the eye and secreting a clear fluid for the purpose of lubricating the eye-ball. This fluid flows down the tear passage at the inner corner of the eye to the nose. The lachrymal gland secretes normally an amount of fluid just sufficient to keep the eyes lubricated. Emotional excitement, irritating gases, inflammation of the eyes, and eye-strain stimulate this gland to greatly increased activity.

The size and shape of the opening between the eyelids has much to do with the expression and with the beauty of the face. The size of the eye-balls does not vary greatly in different persons, but the appearance of large eyes which is considered an element of beauty is due to the long opening between the lids.

The eyelashes are subject to a disease called "bleareye" or red lids, in which the roots of the lashes are inflamed, the edges of the lids become swollen, most of the lashes fall, and when new ones grow they are short and frequently grow inward, causing much irritation and pain. This disease does not respond easily to treatment and in every case an oculist should be consulted.

Eyebrows

The eyebrows consist of muscles, thick skin, and hairs. Abundance of hair, mobility, and the shape of the eyebrows are important features in determining the expression of the face. The growth of the hair on the brows is subject to the same limitations as the hair on the scalp and should receive the same care.

THE SENSE OF HEARING

The Ear

The ear is a very important organ but it usually receives much less attention and care than the eye. That part of the ear which is seen is the least important. If we look in the canal of the ear we see a curved passage ending in a very thin pink membrane, which closes the inner end of the canal. But if we could look through this membrane, commonly called the ear drum, we should see a small cavity, the middle ear, containing three little bones connected with each other, resting at one end against a small body shaped like a shell.

All these parts, the external ear, the external canal, the ear drum, and the three little bones, serve the purpose of receiving sound waves and conveying them to the delicate auditory nerve which ends in many little nerve fibres in the well-shaped body in the inner ear.

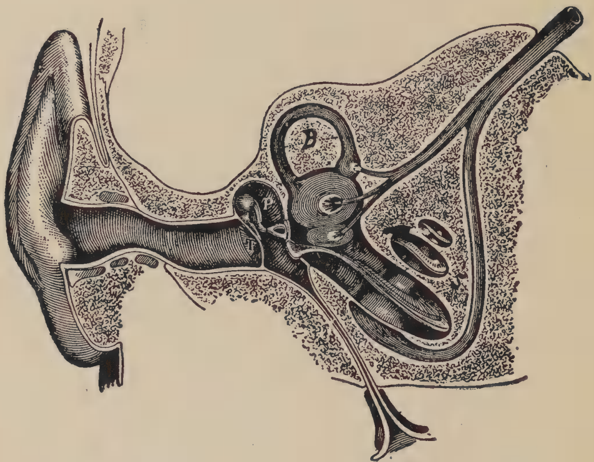


DIAGRAM OF THE EAR

The "auditory canal" is about an inch long, ending in the drum membrane *T*. The "middle ear" *p* contains the three small bones which transmit the vibrations of the membrane; *B*, Semi circular canal; *S*, Cochlea; *E*, Eustachian Tube.

The auditory nerves receive impressions of sound from the vibration of little bones and transmit the impressions to the brain.

Semicircular Canals

In the little body of the inner ear is a small cavity containing a liquid. The function of this little cavity is to help to maintain our equilibrium; it is really a kind of spirit-level which helps us to determine our relation to the horizon. There is a nervous connection between this little spirit-level and the stomach. When we lose our bearings, as for instance when we are on a ship, rocking and pitching, it is believed that the symptoms of nausea known as seasickness are caused by a disturbance of this little spirit-level in the ear.

Eustachian Tube

The cavity of the middle ear is connected with the back part of the nasal cavity by a small passage about the size of a goose quill, called the Eustachian tube. The walls of the middle ear, the Eustachian tubes, and the nose are all lined with mucous membrane. A very common trouble in our climate is a catarrhal inflammation of the mucous membrane. As the nose is the most common seat of this affliction, the connection between the nose and ears is exceedingly important, because cartarrh spreads easily from one organ to the other. Often deafness results from catarrh of the middle ear and every precaution should be taken to prevent inflammation of the post-nasal space.

The disease not infrequently spreads from the nose to the ears as a result of the common habit of sniffing salt water to relieve a cold in the head or as a treatment for chronic catarrh. The act of sniffing has a tendency to draw secretions from the nose into the ears. The use of a nasal douche or oil atomizer is far better for the nose and there is no danger of injuring the ears.

Acute inflammation of the ears which not infrequenty results in an abscess is a condition fraught with much danger. If the abscess involves the "mastoid cells" in the round hard bone behind the ear, there is always a possibility that it may break into the brain cavity and result in death.

Earache When a child complains of earache, a hot water bag should be placed over the painful ear and a doctor sent for at once.

Foreign Bodies in the Ear It happens quite often that children will put beans or other foreign bodies in their ears and be unable to remove them. In such a case no attempt should be made to remove the foreign body by prying it out with a toothpick or button-hook. The best thing to do is to send for a physician at once. If it is positively known that the foreign body is not a vegetable, the following procedure may be tried: Make a solution of soap and warm water, put it in a fountain syringe, hang the syringe a foot above the child's ear and allow the water to flow in the ear. This treatment would be very dangerous if the foreign body were a bean or pea because the water would cause the vegetable to swell and give intense pain.

Ear Wax Another most disagreeable condition of the ears is when a mass of hard wax accumulates near the drum; this causes much pain and the sufferer hears all sorts of loud noises. The treatment for this condition is exactly the same as for the removal of a foreign body. It is sometimes necessary to continue the use of the syringe for twenty or thirty minutes before the wax is sufficiently softened to be washed out by the water. This condition is very common and may not give pain but simply make one a little hard of hearing.

The ear canal should be kept clean by rolling the corner of a soft moist towel and wiping the wax and dust which accumulates in the ear. Hair-pins, button-hooks, and toothpicks should never be used to remove wax from the ear, for there is danger of injuring the delicate ear-drum.

Deafness

Deafness results from various causes. Catarrh, measles, and scarlet fever are often followed by deafness of one or both ears. The ears of patients suffering from any of these diseases should be watched carefully.

Having very briefly considered the human machine and the means by which its relations to the external is established, we will next take up the "running of the machine."

TEST QUESTIONS

The following questions constitute the "written recitation" which the regular members of the A. S. H. E. answer in writing and send in for the correction and comment of the instructor. They are intended to emphasize and fix in the memory the most important points in the lesson.

PERSONAL HYGIENE

PART I

Read Carefully. This is so essentially a personal subject that many of the questions are made personal. To obtain the greatest benefit from these lessons such questions should be answered fully. It will be desirable if possible to supplement the text by reading some of the books mentioned in the program for supplemental study. Your questions should enable the instructor to supplement the text. Write on one side of the paper only and leave space between answers.

1. To what extent have you studied the subject of personal health before reading these lessons?
2. On what factors does personal health depend? In your own case, which is the most important?
3. What can you say from your personal standpoint of the value of health?
4. What are the fundamental living units of the body? How are they combined and how is their life governed?
5. Describe the structure of a bone; a muscle; a nerve.
6. What are the functions of the nervous system? Answer fully.
7. Through what means is the brain developed?
8. How should the eyes be cared for? What attention do you give to your own eyesight?
9. Describe the ear. How may deafness be brought about?
10. What is the aim of personal hygiene?
11. What questions have you to ask?

Note.—After completing the answers, sign your full name.

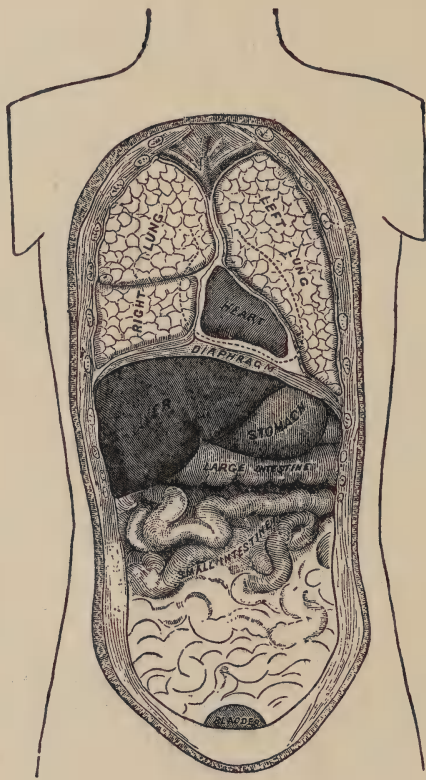


DIAGRAM SHOWING POSITION OF LARGER ORGANS IN THE BODY.

PERSONAL HYGIENE

PART II

Running the Machine

THE living body cannot create energy. It can only, in common with other machines, use the energy provided, and transform it into other forms of energy — heat energy, mechanical energy, and, perhaps, electrical energy. Food is, as we know, the fuel of the human machine, but it is only by combining with *oxygen* that the nutriments of food can yield their store of energy to the body.

Source of Energy

The primary source of all terrestrial energy is the light and heat coming from the sun, except the small amount from the internal heat of the earth and that from the tides. This energy is stored up by plant life—by the greenery of nature. It is only by means of the *chlorophyl* of green leaves that the energy in light and heat can be used to *build up* the complex compounds which are *broken down* by animals and plants in the construction of their cells, and in maintaining life. Every life process, vegetable and animal, except the action of the chlorophyl, uses this stored energy and dissipates a part chiefly in the form of heat. Thus, the human machine uses the energy from the sun, stored up in food, for maintaining its bodily temperature, for muscular work, for the digestion of food, for thinking, even.

Transformation of Energy

All forms of energy are easily transformed into heat. For example, energy from the sun may be stored up by the corn plant in seed, part of the grain may be transferred into the flesh of an ox, and the meat consumed by man as food. Through the energy of this food a man may carry a stone up a mountain. In rolling down the mountain side, the energy of position of the stone is changed into heat through friction. Thus the energy stored up from the light and heat rays of the sun, through a devious path, is changed again into heat. The scientists suppose that the ultimate end of all forms of energy will be "uniformily diffused heat." The part that each one of us has to play in this mighty cycle is to make the best possible use of the energy given him to transform.

Use of the Energy

Of the energy supplied to the body in food, only about 20 per cent can be used for external work, as in walking, the lifting of weights, or riding a bicycle. The remainder leaves the body as heat. Some of the energy leaving the body as heat is first used in internal work, *i.e.*, in circulating the blood, in the digestion of food, etc. By far the largest part of the energy is expended in maintaining the temperature of the body.

Heat Losses of the Body

The U. S. Department of Agriculture has determined, in the respiration calorimeter, the outgo of energy from the human body under various conditions. (See *Food and Dietetics*, pages 32-52.) The results for an average sized man per hour are given as follows:

HOURLY OUTGO

Average (154 lbs.)	Carbon Dioxide (gms.)	Calories	Foot Tons
Man at rest (asleep)	25	65	100
Sitting up (awake)	35	100	154
Light exercise	55	170	262
Moderate exercise......	100	290	447
Severe exercise........	150	450	694
Very severe exercise....	210	600	926

Note. — A calory is the qantity of heat required to increase the temperature of 1 kilogram of water 1° Centigrade (or about a pound of water 4° F.) .This is equivalent in mechanical energy to about 1.54 foot-tons. A foot-ton is the energy required to lift one ton a foot high against gravity.

With body weight greater or less than 154 pounds. the energy outgo would proportionally be greater or less, disregarding unusual fat.

Mechanical Efficiency of the Body

The efficiency of the body in performing external work varies greatly in different individuals and at different times. Some persons may be capable of doing twice as much work as others on the same amount of food. A tall, thin person loses more heat (and so energy), proportionally, than one with a more compact body, because of the greater skin surface compared to weight. When all the organs are in perfect condition, the efficiency of the body is high. Indeed, the mechanical efficiency of the well-trained body is higher than that of most machines — a locomotive for instance can use only about one-tenth of the energy supplied to it in coal.

But muscular efficiency is not the highest human efficiency; mental efficiency is of a higher order. This, too, depends upon the proper workings of all parts of the machine—on right living. Although the human body is a machine—a self repairing automobile—it is dominated by the mind, and has imagination as well as reasoning powers. So in considering the body as a machine, we must not forget that mental conditions may make mechanical rules false.

Work of the Organs

The organs of the body which convert food into nutriment are the *alimentary*. Those which convey this nutritious material to all parts of the machine are the *circulatory*, and those which eliminate waste matters are the *excretory*. The *respiratory* organs play a double part, being both eliminators of waste and importers of the most necessary factor in all this process—OXYGEN.

Work of the Nervous System

All this intricate machiney, however, would be of little value without the engineer. The machine would stand idle and rust away without the co-ordinating action of the nervous system. The nervous system stands as does the engineer regulating the functions of the organs, demanding food for the machine, discriminating in kinds and amounts. It guides the muscles, directs the digestion of food, the circulation of the blood, the excretory and respiratory processes. All these processes are dependent upon the normal healthy condition of the nervous system, which is, therefore, of paramount importance. Yet, this is intimately related with the healthy condition and normal action of *every* organ of the living machine, and, as we know, the over lord of the nervous system is the brain, the mind.

DIGESTION OF FOOD

The function of digestion is to render food soluble and capable of being absorbed into the blood, and thus brought to all the cells of the body.

The ailmentary canal is lined throughout with mucous membrane, which is much modified in parts. It is supplied with two layers of muscles (the stomach three) and covered with the serous membrane, which serves as protection, and for lubrication.

Mastication

Mastication is the only voluntary part of digestion, and that doubtless would be better performed if it was not under the control of the will. As the time of solution is dependent on the fineness of the particles to be dissolved, mastication is an important part of digestion. It is only necessary to note the difference in time required to dissolve large and fine crystal in water to appreciate this fact. The time of complete solution is dependent on the size of the *largest* crystal or mass.

Saliva

During mastication food is moistened with saliva, which is secreted by three sets of salivary glands—the *parotid* in the cheek, the *sub-maxillary* at the side of the tongue, and the *sublingual* under the tongue.

The quantity and composition of the secretion varies with the character of the food being eaten. With dry food the flow is abundant, and the saliva contains the *ferment* ptyalin, which is capable of changing cooked starch into maltose and dextrine.

Enzymes or Ferments

These ferments or enzymes are very important in affecting chemical transformations of both animal and vegetable life. Their action is similar to that of so-called "catalytic" bodies—substances which by their presence bring about, or greatly hasten, chemical changes, but which, apparently, do not enter into the chemical actions themselves. A familiar example of catalysis is the changing of starch into glucose by boiling it for some time with a small amount of acid. There is just as much acid at the end of the action as at the beginning, and if it could be extracted and used over and over again, an infinite amount of starch might be transformed into glucose with a very small amount of acid. Now, if the acid had acted on an alkali, certain metals or oxides, it would combine with it and the acid would no longer exist *as acid.* It is thus apparent that the action in catalysis is quite different from the more common chemical action. Moreover, it is clear that calalysis is a most economical means of effecting chemical change.

A large quantity of an enzyme will make the action more rapid than a smaller amount, but the small amount would do the work if given sufficient *time.* The action of the enzymes is specific, that is, one kind of ferment affects only one kind of a chemical change.

Salivary Digestion

To return to salivary digestion. The saliva is slightly alkaline in reaction and ptyalin cannot work in an acid medium. As the stomach secretions are acid, it was formerly thought that salivary digestion was of little importance, but it is now known that the food may remain in the large end of the stomach for an hour or more before it becomes acid, and so the digestion of the starch begun in the mouth may continue in the stomach.

Secretion of Saliva

The saliva also dissolves part of dry food, giving it taste, and as we shall see later, the sense of taste has a marked effect on the flow of the gastric juices.

The secretion of saliva is controlled by the nervous system, the higher nerve centers having considerable effect, for it is an every-day experience that the sight, the smell, or even the thought of savory food may "make the mouth water." On the other hand, strong emotion or fear may stop the secretions and the mouth becomes dry.

Ptyalin

When dry food is taken into the mouth, the saliva is rich in ptyalin, which comes most abundantly from the parotid glands. If the food contains much water, the secretion is meager and contains little of the starch converting ferment. This indicates that starchy food, such as bread, will have a better chance to be thoroughly digested if eaten dry. While the various actions in digestion support one another, still it is important that each stage be complete for perfect digestion.

Mastication and insalivation have long been recognized as impotant. The Gladstone rule of twenty-five chews to each mouthful of food is familiar, and more recently, Fletcher and his followers have claimed that most of the ills which flesh is heir to may be corrected by long continued mastication. While "Fletcherizing" may not accomplish all that is claimed for it, yet the necessity for thorough mastication can hardly be over-estimated. Rapid eating usually means overeating, for it has been shown conclusively that when food is eaten slowly and masticated thoroughly, a less quantity is demanded by the appetite. It is safe to say that at least one-half of the digestive disturbances common to the American people result from the "bolting" of food.

The saliva also contains mucin, the constituent which gives it the ropy appearance. This helps to lubricate the food and make the act of swallowing easy. In swallowing, the food passes over the trachea, which is closed by the epiglottis. The opening to the nasal space is closed by the soft palate. The food reaches the stomach through the œsophagus.

The Stomach

The stomach is a muscle covered, pear-shaped sac situated under the diaphragm, with the large end towards the heart. The œsophagus entrance, called the *cardia*, is closed by a circular muscle, and the outlet into the small intestines is guarded in a similar manner by the *pylorus*. When fully distended, the stomach holds from three to five pints, but when not occupied by food it is collapsed.

The herbivorous animals have two stomachs, one chiefly for storage and the other in which more active digestion is carried on. In the same way, the human stomach is divided into a comparatively inactive and an active part. The pyloric end is the part chiefly concerned in movement and digestion, the larger end, called the fundus, serving to hold the food and make meals possible.

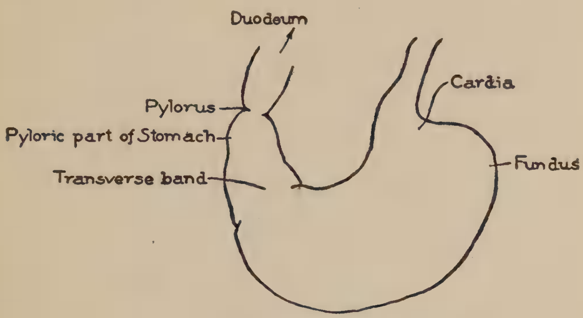


DIAGRAM OF THE STOMACH
(After Howell.)

The stomach is lined with numerous glands, which secrete the ferments, *pepsin*, *rennin*, and may be other ferments and hydrochloric acid. The pepsin glands are found in all parts of the lining, but the glands which secrete hydrochloric acid occur chiefly in the central portion of the stomach. The pepsin, in an acid medium, digests the proteids of food (the lean of meat and fish, albumen, casein of milk, gluten of wheat, legumin of beans and peas, etc.), changing **Gastric Juices** them into peptones or peptoses, which are soluble. The connecting tissues, which hold the globules of animal fats, are dissolved, and fats, which at bodily temperature are in a liquid state, are liberated. It was formerly thought that the fats were not digested at all in the stomach, but recent experiments show that finely divided fats—emulsions, like milk and the fats in the yolk of egg, are digested to some extent.

Beyond the coagulation of milk, the action of rennin is not known.

Movements of the Stomach

In the pyloric end of the stomach, wave-like contractions take place—in the human stomach once every 2 or 3 minutes. This mixes the food with the gastric juices, and helps to liquefy it. As the food reaches a semi-liquid condition of about the consistency of pea soup, the pylorus opens from time to time and small jets of the liquefied and partially digested food enter the small intestine. The large end of the stomach exerts a steady pressure on the food so that the active end is given a new supply. When the entire contents of the stomach becomes acid, the digestion of starch for the time being ceases. The whole process of stomach digestion occupies from three to six hours, after which time the pylorus opens and allows any insoluble substance remaining to pass into the intestines.

Control of Gastric Secretions

The cause of the flow of the gastric juices is an important consideration. Formerly it was thought that the mere presence of food in the stomach was sufficient to bring about the necessary secretions, but by means of some wonderfully ingenious experiments on dogs, the Russian physiologist, Pawlow (Pav́-lov), has proved that this is not so. He introduced easily digested food, like egg albumen, into the stomach of a sleeping dog and found that it remained unacted on for hours, even after the dog was awakened. He stimulated the walls of the stomach mechanically in every possible way, and showed that no secretion followed. When, however, a hungry dog was even shown a piece of meat, after a waiting period of about five minutes, the gastric juices began to flow abundantly. The smell or the eating of foods by a hungry dog always produced active secretions, even though the food did not reach the stomach. The flow was in proportion to the *desire;* that is, greater when the dog was hungry and greater for well-liked foods. This secretion Pawlow called the "appetite juices," or the "psychic juices."

Appetite or Psychic Juices

Chemical Excitants

Only a very few substances were found to stimulate the secretion through their *chemical composition* —the most active being extracts of flesh, and to some extent water and milk, and gelatine slightly. The secretion brought about chemically was not nearly so great in amount or so long continued as that stimulated by the appetite through senses of taste and smell.

These psychic juices, once started, are in quite large amount, increasing for an hour or so, and then diminishing. Pawlow found that after the psychic juices begin to digest the food, the *substances formed* caused an increased quantity of secretion, the composition depending upon the character of the food being digested—proteid food causing an increase in the quantity of pepsin, starch being without effect, and fats decreasing the amount somewhat.

Composition of Psychic Juices

Moreover, he found that on a given diet the *psychic* juices were always of about the *same* composition—a composition suitable for the food being eaten, that is, on a meat diet the secretion of pepsin was more abundant than on a bread and milk diet.

On changing, say, from a meat diet to a bread and milk diet, the change in the composition of the psychic juices was a gradual one. This indicates that a radical change of diet should only be made *gradually*.

These epoch-making discoveries emphasize the importance of appetite. Its importance has long been known from the experiences.

"Now, good digestion wait on appetite, and health on both!"—*Macbeth*.

Importance of Appetite

Pawlow's work, however, proved that former experiments which seemed to show that the flow of the gastric juices was excited mechanically were incorrect. This error led to the practice of paying chief attention to ease of digestion in selecting foods when there was digestive disturbance. While digestibility must be considered in such cases, it is not enough to take the easily digested foods, for even they might not be properly digested unless *eaten with enjoyment.* Food, then, should be appetizing, it should be taken slowly and tasted to the utmost, it should be eaten under agreeable conditions and the mind should not be so occupied with other matters that the food is swallowed almost unconsciously.

Products of Stomach Digestion

The food leaves the stomach, a small part at a time, in a semi-fluid, partly-digested condition. The starch has been partly changed into maltose and dextrin, the proteids into peptones, the connecting tissues dissolved, the fats liquefied and finely divided. The process has been mainly a preparatory one.

Although there is some absorption in the stomach, it is of minor importance. Alcohol, some salts and some drugs are rather quickly absorbed there and enter the circulation.

Digestion in the Small Intestine

The most important part of digestion takes place in the small intestine. This is a tube from 20 to 25 feet long and about one inch in diameter. It is lined throughout with glands, and has a muscular covering, which keeps the contents constantly in motion.

The movements of the small intestines are of two kinds—one which mixes the contents and the other which moves the contents forward. These movements may be illustrated as follows: Fill a rubber tube with water and tie both ends. With the fore fingers of each hand curved around the tube, press slowly and alternately, first with one hand and then with the other. This gives a backward and forward movement. Multiply this arrangement a few hundred times and the condition in the intestine is exemplified. Now run one finger slowly along the

MOVEMENTS OF THE SMALL INTESTINES

A, First position. *B*, Second position. Alternate movements give the backward and forward movement of the contents.

whole length of the tube; this gives the forward movement called peristalsis.

Intestinal Ferments

The first portion of the small intestine leading from the stomach, is called the duodenum. Near its beginning enter the secretions of the pancreas—the most important digestive fluid of the body. This is strongly alkaline and yields at least three ferments. (1) *Trypsin*, which changes the proteids into peptones and these into simpler substances containing nitrogen, and others which do not contain nitrogen. It is much more active than the pepsin of the gastric juices, *except in dissolving connecting* *tissue*. (2). *Lipase*, a fat splitting ferment which separates the fats into fatty acids and glycerine. (3) *Amylopsin*, much like the ptyalin of the saliva, which, like it, changes starch into maltose and dextrin, but much more actively. Rennin is secreted, also.

The Bile

Very near the entrance of the pancreas is a duct, which brings a fluid secreted by the liver—the bile. This is in part a waste product from the blood. It is stored in the gall bladder until needed for digestion. The bile increases the power of the fat splitting ferment of the pancreas, and helps to dissolve some of the soaps formed when the fatty acids combine with the sodium carbonate in the alkaline juices.

Intestinal Secretions

The glands in the walls of the small intestine itself give a secretion which contains a number of ferments, one of which Pawlow has called a "ferment of ferments." This greatly increases the activity of the proteid ferment in the pancreatic juice. Another of the ferments converts the maltose and dextrin formed from starch into dextrose. Two others change cane sugar into dextrose and levulose and milk sugar into dextrose and galactose. It is necessary for the carbohydrates to be converted into simple sugars to be useful in nutrition. Still another ferment acts on the peptones, changing them into simpler bodies.

The intestinal secretions also contain a very interesting substance which, when acted upon by the acids of the gastric juice, forms a substance which enters the blood and stimulates the secretions of the pancreas, and possibly the bile. Thus, indirectly, the regularity of digestion and expulsion of the contents of the stomach controls the secretion of the very important pancreatic juices.

Absorption Active absorption takes place in the small intestine. The surface is very greatly increased by minute filaments called *villi*. Each contains blood vessels and a lacteal. The digestive products of proteids and carbohydrates are absorbed into these blood vessels and the fatty acids and soaps by the lacteals. The veins of the villi enter the portal vein, which passes to the *liver*, where the products of digestion undergo further changes before entering the general circulation. The liver converts a portion of the sugar into *glycogen*, storing it for future use and maintaining a constant percentage of sugar in the blood. The products of the fats—soaps and fatty acids, absorbed by the lacteals, are to a large extent immediately made into fats in the walls of the intestine. The lacteals unite into larger vessels, which finally combine into the thoracic duct, from whence the fats pass into the general circulation near the heart.

How and why absorption takes place in this manner is beyond present knowledge. Here, as elsewhere in the body, substances must pass through membranes. There are no holes. The living cells have the power of selective absorption and control the process, although the physical laws of diffusion and osmosis must operate to some extent.

Large Intestine

The entrance into the large intestine is guarded by a circular valve. The large intestine, or colon, is about five feet long and two inches in diameter. It is divided into an ascending, transverse and descending portion, and joins the rectum by the *sigmoid flexture*. The movements of the large intestine are somewhat similar to those of the small intestine, but less frequent. No enzymes are secreted here, but those already mixed with the food continue active. A mucus-like substance is secreted, which serves for lubrication. The food entering the large intestine is of about the same consistency as when it left the stomach, absorbtion balancing secretion in the small intestine.

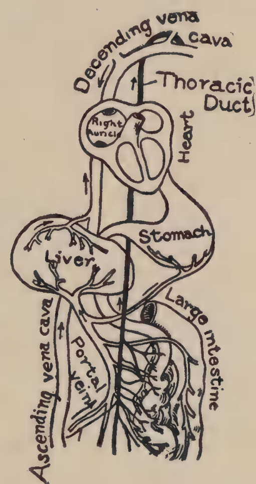


Diagram of the Circulation from the Digestive Organs.

Absorption in the Colon

Absorption takes place more actively than secretion in the large intestine, and the contents gradually become solid and are expelled into the rectum. The nutriments absorbed take the same course as from the small intestine, the fats to the lacteals, the sugars, etc., to the portal vein and liver.

Bacterial Action in Digestion

The action of bacteria in digestion remains to be considered. All foods contain bacteria — some in immense number. (See *Household Bacteriology.*) While solid food is being stored in the large end of the stomach, the bacteria act on the carbohydrates to some extent, but cannot affect the proteids ordinarily present in food. If stomach digestion is unduly delayed, carbon dioxide and other gases may be formed, which cause belching and flatulence. In normal conditions, the contents of the stomach soon become acid from the hydrochloric acid, which destroys nearly all kinds of bacteria and renders the few that remain inactive.

The contents of the small intestine are neutral, or slightly alkali, and fermentation of the sugars may take place, also putrid fermentation of the peptones, unless they are absorbed promptly. Conditions in the large intestine are favorable for the growth of bacteria and putrefaction of proteid materials goes on. Substances are formed which, if absorbed in small quantity, are disposed of in the liver and promptly secreted in the urine. If, however, there is much undigested or unabsorbed nitrogenous material, or if it remains for too long a time, toxines may be formed which, entering the blood, cause headache, and the condition conveniently termed "bilious."

Bacteria Unnecessary

The statement has been made that the action of bacteria is necessary for digestion, but this is probably incorrect, for some of the animals of the arctic regions have no bacteria in the intestines. It is possible that certain bacteria may act on cellulose, which the digestive juices of man are not able to affect, and render some of it digestible. Bacteria are always present in both the small and large intestines, but in the conditions of health they do no harm.

THE BLOOD

Composition of the Blood

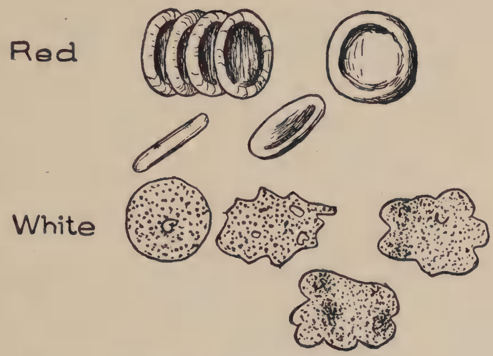
The digestion of food keeps the blood supplied with materials used by the body for heat and energy, for repair, and for building. All the substances needed by the body for this work are contained in it. In addition, nearly all the waste products, gases and solids, form a part of the blood on their way to the organs of elimination. It is apparent that the composition of the blood must be very complex.

Plasma and Corpuscles

Under the microscope the blood is seen to consist of a nearly colorless fluid called the *plasma* and numerous corpuscles, the red and white. A drop of blood contains about 500 million red corpuscles and 500 thousand of the white corpuscles. The red corpuscles are concave discs and contain a substance—*hemoglobulin*—which gives the red color to the blood. With this substance oxygen forms a loose combination and the function of the red corpuscles is to carry the oxgyen absorbed in the lungs to each and every cell, to be used in combining with the nutrients of food and yield the energy necessary for cellular activity. The red corpuscles are formed in red bone marrow.

White Corpuscles

The white corpuscles are not all alike, but may be roughly classed as the *leucocytes* and the *lymphocytes*. The leucocytes are formed chiefly in the white marrow of the bones. They, like the amœba, have the power of independent movement, and can even penetrate the walls of the capillaries and move between the cells. They repel or destroy bacteria or other foreign bodies, which may be introduced among the cells. The lymphocytes are formed in the lymph glands and perhaps in the spleen.



BLOOD CORPUSCLES

They are thought to aid in the absorption of fats and peptones, and help in the coagulation of the blood.

Blood Plates

The blood also contains very minute bodies called the blood plates. These are about one-tenth the size of the red corpuscles. It is thought that they aid in the coagulation of blood, beyond which their function is unknown.

The blood equals about $\frac{1}{13}$ the weight of the body — about twelve pints in volume. The plasma contains 90 per cent water, 7 or 8 per cent proteid material, 0.1 to 0.2 per cent of sugar, a smaller quantity of fat, mineral salts, and a very great many other substances which, though small in proportion, are vitally necessary to the body.

Ductless Gland

Among the substances present in the blood in minute quantities are the secretions of the so-called *ductless glands.* The thyroid glands, situated in each side of the neck, contribute a secretion necessary for nutrition. Their complete removal leads to mental and physical deterioration and usually to death. The adrenal bodies, found near each kidney, secrete a substance necessary to maintain muscular tone, especially of the muscles in the walls of the small arteries. Death results from their removal. There are other small glands which also produce substances necessary for health. Numerous small bodies imbedded in the pancreas add to the blood an internal secretion absolutely necessary for the oxydation of sugar in the cells of the muscles and glands.

THE CIRCULATION

The blood is the connecting medium between all the organs of the body. The circulatory apparatus consists of the heart, arteries, capillaries, veins and lymphatics. The large arteries from the heart divide and subdivide until they become capillaries in the tissues. These are so numerous that a needle cannot be inserted anywhere in the flesh without piercing some. The capillaries unite into the veins which carry the greater part of the plasma and all of the red corpuscles back to the heart.

Lymph

Part of the plasma passes through the thin walls of the capillaries and actually surrounds the cells. Here it is called *lymph*. *Each cell of the body is bathed in lymph.* The lymph, then, consists of blood minus the corpuscles and plus the products of cellular activity, which naturally varies with the kind of cells. The lymph between the cells drains back towards the heart through small vessels which originate blindly in the tissues. These *lymphatics* unite into larger vessels and finally empty into the right lymphatic and the thoracic duct, which pour their contents into the larger vein near the heart. Thus the blood leaves the heart through the arteries, passes through the capillaries and returns to the heart through the veins and lymphatics.

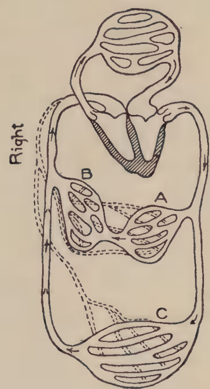


DIAGRAM OF THE CIRCULATION.

A. Capillaries of the digestive organs. *B.* Of the liver. *C.* Type of various systems of capillaries as in the leg, kidneys, brain, etc. *L.* The lungs. Dotted lines represent the lymphatics.

The Heart

The heart is a double muscular force pump, which keeps the life-giving stream of the blood in motion. Each contraction of the heart forces a jet of blood from one side through the arteries leading to all the organs, and from the other side to the lungs. This throb or "pulse" can be most conveniently felt at at the thumb side of the wrist.

The course of the circulation is from the right side of the heart through the capillaries of the lungs, back to the heart, and from the heart through the arteries to the capillaries of all the other organs of the body, and back to the heart by various paths through the veins and lymphatics.

The walls of the arteries are strong and elastic. The pressure of the heart-beat dilates them and their contraction continues to force the blood forward between heart pulsations.

Rate of Flow

The flow of the blood is very rapid—about twenty feet a second in the arteries and large veins, but slow in the capillaries. The time required for a particle of blood to make the complete circuit of the body is about twenty-three seconds, on the average. It naturally takes longer for the blood to make the circuit through the foot than through organs near the heart.

The whole volume of the blood passes through the organs of the body, the kidneys for instance, a number of thousand times a day, thus bringing a constant supply of nutriment and rapidly carrying away wastes.

Nervous Control of Heart Beats

The heart is an automatic organ, and continues to beat when supplied with blood even when all nerve connection with other parts of the body is severed.

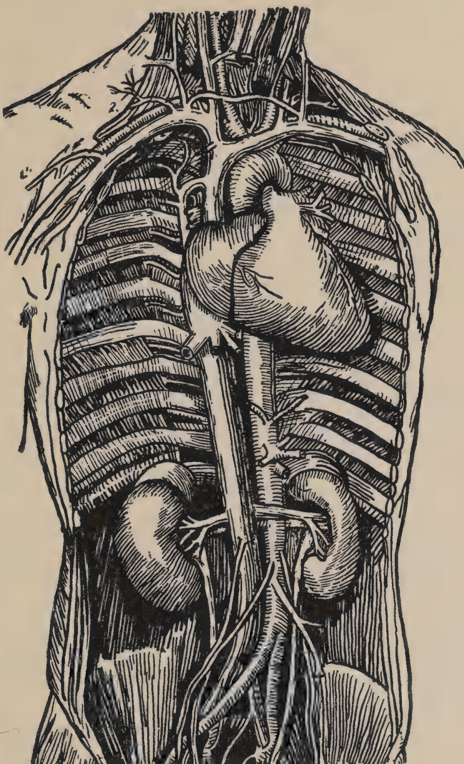


DIAGRAM OF THE HEART, LARGE ARTERIES AND VEINS, SHOWING KIDNEYS.

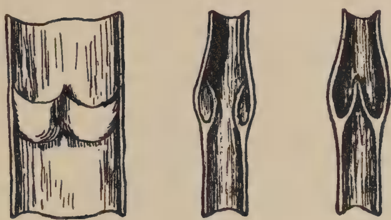
Some of the salts in the blood keep up the action, probably by stimulating nerves in the heart itself. It also has two sets of nerves coming from the cord and from the back of the brain. One set of nerves called augmentor nerves or accelerator nerves, increases the rapidity and power of the heart-beats; the other set produces the opposite effect, decreasing the rapidity of the heart-beats. These are inhibitory nerves and their action is called "inhibition."

Distribution of the Blood Supply

The proportionate supply of blood which each organ of the body receives is regulated by the constriction and dilation of the small arteries. The muscular walls of the arteries are supplied with two sets of nerves—the vasco-constrictors and the vasco-dilators. When an organ is active, the arteries dilate, giving it a larger supply of blood. As the total quantity of blood is not sufficient to give all the organs the maximum quantity, the blood supply to other organs is diminished. This fact has many practical applications. When the digestive apparatus is active, some of the blood is drawn from other organs. If a heavy meal is taken, the blood supply to the brain may be lessened, and drowsiness result. In hot weather much blood flows to the skin, and mental work is more difficult. Active muscular exercise draws blood away from the internal organs, so violent exercise should not be taken directly after a heavy meal, for the stomach will not receive a sufficient blood supply for active secretion. If the surface of the body is cold, the blood vessels supplying the skin contract, forcing an abundant flow of blood through the brain, under which condition it is difficult to go to sleep.

Accessory Means of Circulation

While the heart is the chief means of moving the blood, that in the veins and especially in the lymphatics is impelled towards the heart by two other



A B C

SECTIONS OF VEINS

a. Split open showing Pocket Valves. *b.* Valve open. *c.* Valve closed.

means, the most important being respiration. At each inspiration, when the air is drawn into the lungs, there is at the same time a suction produced in the blood vessels and lymphatics of the chest. The alternate expansion and contraction of the chest and abdomen would simply make a backward and forward movement in the veins, if their walls were perfectly free, but the veins and lymphatics contain valves which allow the blood to flow towards the heart, but prevent its return. In the same way periodic contraction and hardening of the muscles forces the blood out of the veins towards the heart, and the valves prevent its return; thus deep breathing and muscular exercise are important aids to a good circulation of the blood and lymph.

The Blood and Illness

The very intimate relation between the blood and every part of the body gives it a large share in all matters of health and sickness. For this reason it was believed for a long time that disorders of the blood were the cause of disease. When a person became sick, it was thought that an evil spirit or some impurities had found access to the blood, and that a cure could only be effected by removing them, hence the custom of blood letting, practiced for many years. Of course, this treatment served only to weaken the patient, and those who recovered were cured in spite of, rather than because of, blood letting. The blood itself is never the *cause* of illness, but in many forms of disease, particularly the chronic and protracted forms, and in all cases of general debility, it is reduced in quantity and altered in quality. The most common example of this condition is anæmia, in which the red corpuscles are reduced in number and their ability to carry oxygen is impaired.

Anæmia

The cause of anæmia is generally lack of muscular activity and fresh air. If moderate out-of-door exercise is taken every day, with plenty of sleep, the appetite is increased, more food is eaten and digested, and the blood is gradually restored to its normal condition, and all symptoms of weakness disappear.

The old idea of impurities in the blood still survives, and is the foundation for the belief that the blood needs to be purified in the spring by taking purgatives and all sorts of "spring medicines." The real cause of lowered vitality, weakness and "that tired feeling" is found in confinement to overheated rooms, late hours, too much food, and lack of out-of-door exercise during the winter months.

RESPIRATION

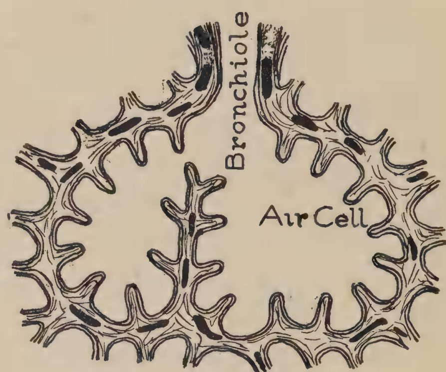
Use of Oxygen in Nutrition

In the "running of the machine" we have considered how the blood is supplied with nutriment and how it is transported to the cells, but for cellular activity *oxygen* is as necessary as nutriment. A fire cannot be kept up without oxygen any more than without fuel. Because the oxygen of the air is everywhere present and invisible, this is not so apparent. The nutriments are useless to the cells without the oxygen to combine with them, and through the chemical union set free the energy necessary for all life processes. Oxygen is the most imperative requirement of the body. Food may be withheld for a week or more and drink for days, but if we are deprived of oxgyen for but a brief interval, life is extinguished.

It it then the *cells* which use the oxygen, the lungs serving only to absorb, and the blood to transport it.

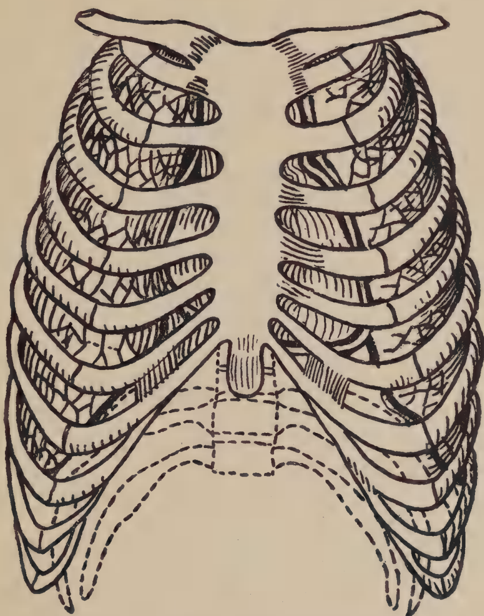
Respiratory Organs

The two openings of the nose unite above the back of the mouth in the space behind the soft palate, called the *nasopharynx*. The nasal space is a high arched dome, having the roof of the mouth as a base. The passages are divided and subdivided into a



AIR CELLS OF THE LUNGS
Redrawn from *The Human Mechanism.*

labyrinth, all lined with mucous membrane. In going through these passages the air inhaled is warmed to the body temperature, and for the most part, freed from dust and accompanying bacteria. The fine hairs in the nostrils strain out much of the dust, and the remainder is caught on the moist surfaces. Certain ciliated cells propel the dust towards the openings of the nose. Through the larynx the air passes to the trachea, which divides into two branches called bronchi, one going to each lung. The bronchi divide and subdivide, terminating ultimately in small air sacs, having exceedingly thin walls and many cap-



POSITION OF THE HEART AND LUNGS

illaries. Through these thin walls takes place the absorption of oxygen by the plasma and red corpuscles and the elimination of carbon dioxide from the plasma to the air.

The Lungs The lungs contain normally about 200 cubic inches of air. In ordinary quiet breathing we take in about 30 cubic inches and by forced inspiration we may take in an additional 100 cubic inches. We can expel by forced expiration about half the contents of the lungs. If we never use but a part of our lung capacity, the more distant air sacs lose tone and may become closed. This is one of the reasons why deep breathing is necessary.

Breathing Inspiration is accomplished by the muscles of the chest and the diaphragm. The chest muscles increase the depth and breadth of the chest by lifting the breast bone and the ribs. The diaphragm, which is a thin dome-shaped muscle forming a partition between the chest and abdomen, flattens out to some extent and increases the length of the chest. This produces a partial vacuum, which the air rushes in to fill.

The proper method of breathing is of great importance. With men whose clothing often restricts the chest movements, abdominal or diaphragmatic breathing predominates. With women upper chest breathing is usually made necessary by the restriction of the waist from corsets. The natural method of breathing is both abdominal and intercostal.

Adenoids Growths in the nose, as adenoids, may restrict the free passage of air to the lungs and thus make mouth breathing necessary. Nature intended that air should be taken in through the nose and any interference of the nasal passages should be remedied.

It is a common expression that "oxygen purifies the blood." It is true that the carbon dioxide, water and a small amount of other waste matter are eliminated during expiration, but oxygen in uniting with the nutriments of food in reality *vitiates* the blood.

Oxygen Carriers

The plasma is made up chiefly of water which has little capacity for dissolving oxygen so the red corpuscles, with their hemoglobulen, are the chief transporters of oxygen. The hemoglobulen in the presence of oxygen forms a combination, *oxy-hemoglobulen*. This, when it reaches the cells which have used up the oxygen dissolved in the lymph surrounding them, gives up a portion of its oxygen to the surrounding plasma and lymph, whence it is absorbed by the cells. On the other hand, the lymph and plasma have a considerable capacity for dissolving carbon dioxide and quickly absorb that product formed when the oxygen combines with the carbon of nutriments during cellular activity. On reaching the lungs, the plasma loses a portion, but not all, of its carbon dioxide. Arterial blood still contains some carbon dioxide and the red corpuscles and venous blood still contain some oxygen.

Value of Deep Breathing

Under all ordinary conditions the blood has a sufficient supply of oxygen. Deep breathing, or muscular exercise, or even increasing the proportion of oxygen in the air does not cause the blood to absorb more. The value of deep breathing and exercise is not in giving the blood more oxygen, but in making the circulation more rapid by increase of the number and power of the heart beats. Exercise is about the only natural way of increasing the rapidity of the blood stream, thus making the removal of all waste matter more effectual. Deep breathing, as we have seen, is important in keeping the lungs in good condition and in helping the return of the blood from the veins and lymphatics to the heart.

Effect of Impure Air

The carbon dioxide in expired breath is not in itself poisonous, and recent researches have seemed to show that the organic matters in expired air are not so poisonous as formerly supposed; however, the evil effects of breathing vitiated air are painfully apparent. The harmful effects are probably in the depressing effect on the nervous system rather than in actually poisoning the tissues. Every one knows the effect of fresh, out-of-doors air. We need to get out of doors every day, rain or shine, for as long a time as possible. Man was intended for an out-of-doors animal. Certain burrowing animals, like the woodchuck, may be able to thrive on impure air, but not man at his best. Consumption and pneumonia are essentially house diseases.

Ventilation

The necessity of providing by ventilation a constant supply of fresh air in our houses and especially in sleeping rooms is treated in *Household Hygiene*, and need not be spoken of further. In the winter, good ventilation adds to the fuel bill, but we would not knowingly buy food containing even a small amount of harmful substances to save ten or even twenty per cent of the cost. Why, then, begrudge the money spent for the more important necessity of the body — pure air? We are very dainty about many things, but why breathe "second-hand air" without a qualm?

NUTRITION

We now come to the question of how the cells of the body make use of the nutrients of food and oxygen brought to them by the blood. Much is known as to the results of the life processes, but a great deal yet remains to be found out about the exact process itself.

Metabolism

Digestion, absorption, assimilation — the building-up process is called *anabolism*, the destruction of nutrients and breaking down of tissues, *katabolism*, and both processes taken together, *metabolism*.

Nutrients

Of the five nutrients — water, salts, proteids, carbohydrates and fats — water and salts yield little or no energy to the body. After use they are excreted in much the same form as they were absorbed. They are, however, an essential part of all living cells.

Water in Nutrition

Without the bones, the body is made up of over three-fourths water, the fat free muscles and glands 87 per cent, the blood nine-tenths. Water is necessary in all life processes for dissolving substances, in the digestive juices, and for carrying away wastes. Water is lost from the lungs, and skin, but more through the kidneys — a total of about three pints daily in ordinary weather and double the amount in hot weather. The loss is made good in part by the oxydation of the hydrogen, contained in all foods, to water. This may supply about a pint a day. The remainder must be made up by the water in food and by the drinking of water. Water is especially necessary if the diet is high in proteids as some of the products of proteid disintegration are not very soluble. Except in rare disease conditions, there is no danger of drinking too much water, but there is *grave* danger in drinking too little.

Salts in Nutrition

Salts form a part of all living matter, vegetable and animal. The chief salts present in the body are chlorides, phosphates, sulphates and carbonates of sodium, calcium, magnesium, and iron with some others. Common salt — sodium chloride — is the only one purposely added to food, chiefly to bring out flavor. There seems to be an especial craving for it if the diet is largely made up of vegetables. We habitually use more salt than is needed by the body. The excess is secreted in the urine for the most part but the sweat and tears contain a little.

The hydrochloric acid of the gastric juices is made chiefly from sodium chloride, the sodium part of the salt serving to form the carbonate of soda of the pancreatic and intestinal secretions.

In addition to bone formation, the calcium salts are necessary for the coagulation of the blood and the clotting of milk, and with common salt and potassium chloride in the blood, they keep up the regular beat of the heart.

Iron is a necessary part of the hemoglobulen of the red corpuscles. Nearly all vegetables contain iron, but spinach has an especially large proportion of it. Meats and the yolk of egg contain a considerable amount.

In any ordinary diet the body receives a sufficient supply of the salts. Some of them must be present in organic compounds to be of use.

Composition of the Nutrients

The three remaining nutrients, proteids, carbohydrates and fats, all contain carbon, hydrogen and oxygen, but the proteids also always contain nitrogen and sulphur and sometimes phosphorus and iron. The fats have a much smaller proportion of oxygen so they can combine with a larger amount. For this reason they yield over twice as much heat and energy when oxydized as the carbohydrates or proteids.

Use of Proteid Foods

As the living cells are composed almost entirely of proteid material, except for water and a small amount of salts, it is apparent that the body must have food containing nitrogen and sulphur for making good the loss of cell substance which is constantly taking place during activity, and the young require proteid material for the growing tissues. It has been proved many times that without proteid food all animals starve, even if there is an abundance of the other food principles. Moreover, the nitrogen must be in the form of true proteids — the gelatinoids (often called albuminoids) of which gelatine is a type, and the extractives, although they contain nitrogen and sulphur, cannot take their place. On the other hand, life may be maintained without serious trouble on proteid foods alone, showing that they may furnish heat and energy as well as repair wastes.

Liebig's Theory

As the muscles contain such a large proportion of proteid, Liebig set forth the theory about fifty years ago that proteids were the only source of muscular energy. It has since been conclusively proved by Voit and many others that this was a wrong supposition, and that heat and energy may be supplied by carbohydrates and fats as well as by proteids.

Elimination of Nitrogen

A marked difference between the proteids and non-nitrogenous foods is the fact that the nitrogenous part of proteids, at least, is eliminated by the body as fast as it is consumed; that is, if three ounces of proteid is consumed daily, nitrogen equal to that in three ounces of proteid is eliminated. If the proteid feed be increased to four ounces a day, the nitrogen excreted corresponds to four ounces. It has been found that the body will maintain this "nitrogen equilibrium" on widely varying amounts of proteid in the diet, provided the other constituents are in sufficient amount; and in general that the nitrogen excreted is *irrespective of muscular exercise being taken*. This does not hold in very severe exercise long continued, during which some of the body nitrogen is used, more being eliminated than consumed.

In going from a low proteid diet to a high proteid diet there is at first a small apparent storage of nitrogen material. This is lost, however, when the diet is changed back to one lower in proteid. The body seems to have little power of storing proteids. If the supply is deficient, it uses its own body proteids. In starvation and in certain diseases the larger muscles waste away, some of their proteid being used to repair cells more necessary for life, as the cells of the heart muscles and nerve cells, and some for supplying heat and energy.

Elimination of Carbon and Hydogen

If the consumption of carbohydrates and fats be increased, on the other hand, there is no proportionate increase of their waste products, but an increase of *muscular exercise* markedly increases the excretion of carbon dioxide coming from the carbon of food products. See page 49.

Storage of Food Materials

When more food is eaten and absorbed than is needed to supply energy and heat, the excess is stored as glycogen and fat. As we have seen, the starches, sugars, and gums are changed by digestion into dextrose, or other simple sugars, and as such absorbed by the intestine, passing first through the portal vein to the liver before reaching the general circulation. The liver, with the help of an enzime, changes a portion of the dextrose into *glycogen* — animal starch. This is changed back again into sugar as it is needed in the body, a constant proportion of sugar in the blood of the general circulation being maintained. Glycogen is also stored in the muscles and some of the other tissues of the body.

Experiments have proved beyond a doubt that carbohydrates in excess of bodily needs may be transformed into fat and stored as reserve food supply.

Use of the Fats The fats absorbed by the lymphatics are used at once if needed. If the food digested and absorbed is in excess of bodily requirements, fats and the carbohydrates transformed into fat are stored, sometimes between the cells themselves but usually in the connecting tissue, especially that surrounding the abdominal organs and that directly beneath the skin.

The transformation of glycogen into sugar is a very simple one, so this serves as an immediate reserve food supply. It is not known just how the fats are used, but they are taken up by the blood, wherever they are stored, and transported to the part of the body needing fuel.

Oxidization in the Body The oxidation of the sugar by the cells is by no means a simple union of oxygen with the carbon and hydrogen, forming directly carbon dioxide and water. The process is in several stages governed by different enzimes. It is stated that sugar is first changed to lactic acid and this to alcohol, which is finally oxidized to carbon dioxide and water.

How the Cells Use Nutrients One theory is that the nutriments of food are first built into the cells before being oxidized, but most authorities now agree that it is more probable that the cells make use of the nutriments constantlys urrounding them in the lymph in the same way as the yeast cells use a solution of sugar surrounding them when they oxidize it in their life process.

Reserve Energy

The muscles and glands are not entirely dependent on the immediate supply of nutrients and oxygen brought by the blood. For example, the leg muscles of a frog, removed entirely from the body and its blood extracted, may be made to contract a number of times if the nerves are stimulated by an electric current. The contractions gradually grow weaker with successive applications of the current until they cease. Carbon dioxide and other waste products are given off.

It is not known in what form this energy is stored, but the substance must be in chemical nature something like the explosives in which the oxygen is held in some loose way so that it is able to unite with the carbon and hydrogen of the substance, when a spark or heavy blow starts the action. In the muscles of the body it is the nervous impulse which starts the chemical process.

Use of the Energy of Oxidization

We are not accustomed to think of the oxidation of carbon at a low temperature as we are so familiar with common forms of rapid combustion at a high temperature where light is produced. We are also accustomed to think of heat as being the only form of energy produced by oxidation, but in the electric battery we have an instance of the energy of chemical union being changed in part into heat and in part into electricity. The body cells use the energy of chemical union of nutrients and oxygen in many ways. In the muscles it is apparent in movement. In the glands the energy is used to transform some of the contents of the blood into its peculiar secretion. In the nerves the energy is transformed into a nervous impulse, and so on. Just how this happens is one of the many mysteries of life processes.

The use of the carbohydrates and fats by the body cells is fairly well understood. They contain only carbon, hydrogen and oxygen, and their *ultimate* waste products are known to be carbon dioxide and water.

Volt's Theory of the Use of Proteids

The proteids are much more complex chemical bodies. The exact way in which the atoms are combined in the molecule is not known of any of them. The way the proteids are used by the body has been a subject of a great deal of study and controversy. One theory is that they are *all* built into the living cells before being used, but, as we have already said, this seems improbable, because of the very rapid excretion of waste products of proteid soon after they are absorbed. The theory of Voit is that they are used from the blood for heat and energy by the cells in much the same way as the sugar, and that the cells use proteids in *preference* to sugar and fats. This has led to the common teaching that other nutrients — the gelatinoids, carbohydrates and fats — are "proteid sparers," in the order named.

Folin's Theory

Recent experiments and analyses made by the physiological chemist, Dr. Folin, at the McLean Hospital, Waverly, Mass., and other workers have led to the bringing forth of a new theory as to the role played by the proteids in nutrition.*

Formation of the Proteid in the Blood

The cells *must* have a certain amount of proteid to make good their substance lost during activity. In digestion the proteids are changed into soluble peptones and simpler bodies, but no peptones are found in the blood. It is thought that the proteids of the blood are built up in the walls of the intestines during absorption. The blood and lymph are richly supplied with proteid material from which, without doubt, the cells make good their loss and new cells are formed.

Nitrogen and Sulphur Split Off

Dr. Folin's experiments seem to show that only a *small proportion* of the nitrogen of the proteids taken in the food reaches the general circulation as proteid, but that most of the nitrogen and sulphur portion is split off during digestion and elsewhere, the nitrogen products changed chiefly to urea in the liver, and the urea and sulphur compounds eliminated from the blood by the kidneys soon after.

Urea contains nitrogen, carbon, oxygen and hydrogen. It is a substance somewhat similar to ammonium carbonate, to which it is easily changed outside the body.

* See article in *Food and Dietetics*, page 196.

The remaining part of the proteid substance — the carbon, hydrogen and oxygen — is changed, perhaps, to sugar and used like sugar. At least, it is known that proteids may yield glycogen. According to Folin's theory, then, the body uses little or no proteids, *as such*, for heat and energy, but their nitrogen and sulphur part is at once split off. The remaining part *only* — the carbon, hydrogen and oxygen — being of use to the body, except for a comparatively small part of that in an ordinary diet which makes good the proteid of the blood used for cellular repair and growth.

Cellular Proteid Destroyed

On a diet of starch and cream, containing practically no proteid, he found that the daily excretion of nitrogen products for an average size man corresponds to about 20 grams of proteid. From this and further experiments he is led to believe that the 20 grams of proteid — about ¾ of an ounce — represents the daily proteid waste of the living cells.

If Folin's theory is correct, and it seems to have been accepted by recent writers, the proteid required for the needs of the adult body *to repair wastes* is much less than was formerly supposed.

Experiments by Professor Chittenden lead to somewhat the same conclusion. While Voit and others taught that about 118 grams of dried proteid are needed daily by an adult man weighing about 150 pounds, Chittenden's experiments have shown that health may be maintained, for months at least, on from 30 to 50 grams of proteid daily.

Low Proteid Diet

Whether or not it is desirable to maintain the body on low proteid diet is another question. The experience of past ages cannot be lightly cast aside. The amount of proteid food recommended by Voit, Atwater and others in standard dietaries is taken from the quantity consumed, on the average, by people free to choose. In some diseases, like consumption, experience has proved that high proteid feeding is very beneficial. On the other hand, the products of proteid destruction are more harmful to the body *if they accumulate*, and their removal involves more labor on the part of the excretory organs than the elimination of the carbon dioxide and water produced when fats and carbohydrates are used.

Uric Acid Formation

The consumption of *meat* increases the amount of uric acid and other "purin bodies" formed, and this is undesirable in diseased conditions like rheumatism and gout. There is no evidence that such diseases are *caused* by uric acid. The proteids of eggs, milk, grains, nuts, peas and beans, do not increase the formation of uric acid. Uric acid is a normal waste product of cellular disintegration. It varies in different individuals. In birds it is the chief excretory product of nitrogen.

Proteids Cannot be Stored Must be Destroyed

There is no conclusive evidence at present that proteids may be converted into fat. It is known that they may be changed to some extent into glycogen, but the body can store only about seven ounces of glycogen, consequently if the body has the maximum quantity of glycogen, it must use up — oxidize — the proteids eaten and digested in excess of the comparatively small amount necessary to repair cellular waste. It has been found that increasing the proportion of proteid, if the diet is liberal, *does increase the amount of oxygen consumed, carbon dioxide eliminated, and consequently the output of heat of the body, even if there is no increase in muscular work.*

In other words, with the body at rest more heat will be produced and given out on a liberal diet made up largely of meat and other proteid foods than on a liberal diet composed chiefly of starch, sugar, and fat.

It might be stated here that the splitting off of the nitrogen and sulphur from the proteid probably involves the production of a little heat, and that to form sugar or glycogen from the residue some oxidation is necessary; this would account for some of the increased heat production on a diet made up largely of proteids.

Proteids Increase Total Oxidization

Not only is the carbon and hydrogen of proteid oxidized nearly as fast as it is assimilated, but there is apparently greater *total oxidation* in the body. That is, assimilation of proteids stimulates oxidation of the carbohydrates and fats. Just how much this stimulation amounts to cannot be said now. It is probably greater if the external temperature is high. The United States Department of Agriculture, in its nutrition investigations with the respiration calorimeter, is working on this problem, and the results of the experiments will be available shortly.

There is, then, a marked difference in the way the carbohydrates and fats on the one hand and proteids on the other react in the body. The consumption of carbohydrates and fats is somewhat like the consumption of coal in a hard coal fire. Adding more coal (fats and carbohydrates) does not increase the amount of combustion to any great extent. Oxidation is increased only by increasing the draft (increasing muscular exercise). The proteids are more like some easily combustible stuff, like shavings. When put on the fire (absorbed) they are immediately consumed even if the draft is not changed, and in burning, they cause more of the coal (carbohydrates and fats) to be consumed.

To sum up, the present theories as to the use made of the proteids in the body are about as follows:

Summary of the Use of Proteids

(1) The amount of proteid required for cellular repair is much less than formerly supposed. Moderate muscular activity does not seem to increase perceptibly the cellular proteid destroyed.

(2) Under ordinary conditions, the body has little ability to store the proteids taken in food as *proteid*, nor the residue after splitting off the nitrogen and sulphur as *fat*.

(3) The body must use up the proteid digested about as fast as it is absorbed, excreting the nitrogen chiefly as urea and oxidizing the carbon and hydrogen to carbon dioxide and to water.

(4) Increasing the proportion of proteid in a *liberal* diet increases the heat output of the body and, especially if the external temperature is high, stimulates the oxidation of all the food materials.

TEMPERATURE REGULATION

Man with the higher animals is able to maintain approximately constant temperature through a wide range of external temperature. In the hottest day of summer or the coldest day of winter, the blood registers between 97.5° and 99.5°F. (See *Home Care of the Sick*, page 43.)

Cold Blooded Animals

The so-called cold blooded animals — frogs, turtles reptiles, fishes — do not have this power of temperature regulation. Their blood is the temperature of their surroundings or only a few degrees higher. In the cold winter months such animals and some of the fishes "hibernate." Some animals, like the bear and woodchuck, that maintain an even temperature in summer, hibernate during the winter months. They retire to some sheltered place and sink into a deep sleep. Life processes gradually sink and the temperature of the blood lowers to about that of the surroundings. They take no food, but live on their accumulated fat.

Through our ability to keep the body usually at a higher temperature than the surroundings we are able to maintain activity throughout the year, even in the coldest climate, when otherwise we would have to remain in a half-alive condition through the cold season, like the bear.

Production of Heat

The question arises, how is the heat of the body obtained, and second, how is it regulated? The activity of all the cells produces heat in addition to their peculiar functions. Heat is always one of the products of life. The muscles cannot transform *all* the energy of the chemical union of oxygen and the food materials into the power of contraction. Only 25 or 35 per cent of *digested and assimilated* food can be so used, the remainder being changed into heat. The actively working glands produce much heat; the liver during activity may reach 107°F, but the rapidly circulating blood distributes the heat fairly uniformly, although that coming from the lungs to the heart is about one degree cooler than that from the general circulation. The skin rarely has a temperature over 93°F, and may of course become frost bitten if exposed to severe cold.

Muscular Tone

The work of the internal organs and the friction in the circulation of the blood gives considerable heat, but not enough to maintain the vital temperature of the body *at rest*. This is supplied by a slight unconscious contraction in all the skeletal muscles and the muscles which contract the small arteries. They are under slight tension or "tone" brought about by successive nervous impulses. During cold weather this unconscious muscular tension or tone is greater, giving a greater production of heat. This accounts for the stimulating effect of cold. As the external temperature is lowered, the muscular tension increases and it finally becomes apparent in shivering.

The heat of the body is lost on the average as follows:

1. By urine and feces................	1.8 per cent
2. By expired air: Warming of air....	3.5 " "
Vaporization of water from lungs	7.2 " "
3. By evaporating from skin.........	14.5 " "
4. By radiation and conduction from skin	73.0 " "

Heat Regulation

We regulate the heat losses to some extent by wearing thicker or thinner clothing, according to the weather, but the chief means of getting rid of a superabundance of heat is through perspiration and the regulation of the flow of the blood to the skin. When active muscular exercise is taken or during hot weather an excess of heat is produced; then the capillaries of the skin dilate, more blood flows near the surface and some of its heat is lost through conduction and radiation. If this is not sufficient, perspiration becomes much more active. The evaporation of liquids, especially water, absorbs and carries away in the vapor a very large quantity of heat. Perspiration only becomes visible when it is secreted faster than it is evaporated.

On a warm day with the temperature, say at 90°F, even when sitting still, the secretion of the perspiration is active and the blood vessels of the skin are dilated to their fullest extent. As the temperature falls, perspiration becomes less abundant and at about 70° F. almost ceases. Below 70° F. the blood vessels begin to contract, forcing the blood to the interior of the body. At about 60° they have contracted as much as possible and the body has done its utmost to *prevent* the loss of heat. To keep up the temperature of the body more heat must be supplied through muscular activity or warmer clothing must be put on.

Moving air carries away heat rapidly, both by convection and by increasing evaporation.

Effect of Humidity

The amount of moisture in the atmosphere makes a great difference in the heat loss from the body. Moist air is a much better conductor of heat than dry air. On a winter's day when we say the air is cold and "raw", we mean that it contains a large proportion of moisture, and so conducts the heat away from the body rapidly. On a summer day, the air is "sultry" or "muggy" because it holds nearly all the moisture which it is capable of taking up, the perspiration cannot evaporate from the skin rapidly and the body is more liable to become over-heated

Ideal Temperature

In our houses a temperature between 68° and 70° F. is the ideal; then, with ordinary clothing, the blood is evenly distributed between the skin and the internal organs, and there is comparatively little perspiration.

The dangerous temperature is between 65° and 60° F.* If while sitting quietly in a room the tem-

* *The Human Mechanism*, page 201.

perature gradually falls below 65°, the blood vessels of the skin are contracted more and more and the blood is forced into the internal organs and membranes, and the congestion may result in colds or other troubles. If the drop in temperature is gradual it may be unnoticed, whereas a sudden drop would be at once apparent and one would immediately proceed to increase the temperature or put on more clothing.

It is equally dangerous to go from a room temperature of 75° to 80° into the cold. (See *Chemistry of the Household*, page 19.)

ELIMINATION

The waste products of the human machine are its most dangerous enemies. Elimination is fully as important as alimentation and respiration.

Food Wastes

We have seen that the undigested part of food, and the waste portion of some of the digestive secretions, accumulate in the lower part of the colon. Here putrefaction goes on actively. The longer the wastes remain in the colon the more active becomes the decomposition by the bacteria. Some of the products, especially of proteid decomposition, are poisonous. As we have seen, the chief function of the large intestine is absorption. Food, even, is sometimes administered through rectal enema. It is apparent, then, that the accumulated wastes should be eliminated promptly. For most persons unloading of the rectum should take place daily.

Neglect of this internal cleaning is much more disastrous than failure to clean the skin, for the skin is practically non-absorbent, while in the colon absorption takes place constantly. A pasty complexion indicates defective internal cleansing more often than lack of care of the skin.

It is surprising how many people, especially women, neglect this function. The vice of constipation is very prevalent among people whose occupation is sedentary. In addition to rectal troubles, such as piles and hemorrhoids, neglect leads to headache and various minor disorders.

Constipation

The remedy for constipation is not by drugging, but by the removal of the underlying cause, and especially in establishing good habits. Regularity is as important here as regularity of meals. Defecation should take place daily and preferably *at the same hour*, so that the habit may become established. Food eaten should be such as will leave considerable bulk to be eliminated, that is, the diet should contain an abundance of vegetables and fruits, and grains which have not had all of their outer covering removed, such as oatmeal and whole wheat. Fats and oils help in some cases. Plenty of water should be taken; exercise, especially such as work the abdominal muscles and sometimes massage is helpful.

Wastes in the Blood

The organs chiefly concerned in eliminating the wastes from the *blood* are the lungs and kidneys. Carbon dioxide, and incidentally some water, is discharged by the lungs, also a small amount of carbon dioxide passes through the skin by diffusion from the blood in the skin capillaries. The nitrogen and sulphur products of proteid decomposition with water, salts, and many substances in small quantity are eliminated as urine by the kidneys.

Proteid Waste Products

The oxidation of carbohydrates and fats yields only carbon dioxide and water. The proteids, gelatinoids and extractives, in addition to carbon dioxide and water, give urea, kreatinine, uric acid, sulphur compounds and other substances in small quantities.

Kidneys and Bladder.

The Kidneys

The kidneys are two bean-shaped bodies situated on either side of the spinal column in the small of the back. A large artery and a large vein pass between them, both of which send off branches to each kidney. The blood flows from the artery through the kidneys to the vein. The kidney cells have the power of selective absorption and take out harmful and waste products from the blood. They are constantly secreting urine, which passes through the two ureters to the bladder from which it is discharged from time to time.

In general, the secretion of the kidneys—the salts and other waste products, but not necessarily the water — is determined by the blood supply. Thus it is increased by active exercise, during which all the blood is circulating more rapidly.

Cold weather increases the secretion to some extent because the constriction of the blood vessels in the skin throws a greater quantity of the blood to the interior of the body.

Elimination of Water

The amount of water in the blood is kept nearly constant by the activity of the kidneys and sweat glands. If more water is taken than is required, the excess is promptly eliminated. The kidneys must have sufficient water to dissolve the urea and other products, but especially uric acid. This is not a very soluble substance, and is the probable cause of a number of disorders, for which reason and others, it is desirable to have an excess supply of water.

During active perspiration, the skin secretes considerable water and a small amount of urea and other waste products found in the blood. If a large amount of water is secreted by the sweat glands less is eliminated by the kidneys. In certain diseases of the kidneys, the excretion of the urea in the perspiration is increased, but the more important function of the sweat glands is their work in temperature regulation, and not in their elimination.

TEST QUESTIONS

The following questions constitute the "written recitation" which the regular members of the A. S. H. E. answer in writing and send in for the correction and comment of the instructor. They are intended to emphasize and fix in the memory the most important points in the lesson.

PERSONAL HYGIENE

Part II

Read Carefully. Answer each question fully. Do not be afraid of writing too fully. Use your own words, so that the instructor may be sure that you understand every point. You are expected to ask questions freely. Leave space between your answers for comments and write on one side of the sheet only.

1. How is energy of the human machine obtained? In what ways is this energy used?
2. What are enzimes and how are they of use in the body?
3. Trace the digestion and absorption into the general circulation of (a) starch, (b) the fats, (c) the proteids.
4. What brings about the secretion (a) of the saliva, (b) the gastric juices, (c) the pancreatic juice?
5. To what extent have we voluntary control over digestion?
6. What can you say of the composition of the blood? (b) How is its proportion of sugar maintained? (c) How is the blood circulated? (d) What would be the effect of a sluggish circulation and what might bring it about?
7. How is oxygen used in the body? Does it purify the blood?
8. Explain fully how oxygen is brought to the cells and how carbon dioxide is eliminated. (b) How is the process made more effective?

9. How is water used by the body? (b) For what are the mineral matters necessary? (c) How are the salts and water eliminated?
10. Why must the body have proteid food?
11. How are the carbohydrates used by the body cells? The fats?
12. Give the various theories as to the way in which proteids are used.
13. Contrast the manner in which the body acts towards proteids and non-nitrogenous foods.
14. In what forms is the body fuel stored? What happens in starvation?
15. How is the temperature of the body kept up and how is it regulated?
16. What are the products of proteid disintegration?
17. Why should the waste matters of digestion be eliminated promptly? (b) By what natural means may a tendency to constipation be overcome?
18. What new facts have you learned in this lesson applicable to the care of your own health?
19. Have you read any other books in connection with this lesson?
20. What questions have you to ask?

Note. After completing the answers, sign your full name

PERSONAL HYGIENE

PART III

Care of the Machine

DOUBTLESS because our instincts guard us in many ways and because it is only the application of physiology, the subject of Personal Hygiene has not yet reached the stage of a science or even a well-defined art. The application is often hard to make. Medical schools teach the science of the relief of illness, but the care necessary to keep the body in health is usually considered only in brief series of lectures. There are numerous technical books on anatomy, physiology, medicine, sanitation, but at present none on Personal Hygiene. The progressive physicians are true practitioners of hygiene instead of merely prescribers of drugs. "Preventive medicine" has a great future.

Personal Hygiene Not Yet a Science

So far we have considered the human body as a living machine, and learned how it is operated. A little has been said in passing on the care of the machine, but what has gone before, while more or less interesting, is important only in relation to the care of the machine. It is, of course, necessary to understand a mechanism to know how it should be cared for.

Reasons Not Rules

Mere general rules of health are of little value. We seldom follow such unless we understand the reasons for them, or realize the sure penalty, near or remote, of their infringement. Happily the day is past when poor health was a distinction; still the majority feel that illness is a grievance and not direct retribution for our physical sins of omission and commission, as it usually is. Here, it is true, "the sins of the fathers are visited on the children unto the third and fourth generation." The adult body is rarely a perfect machine; through inheritance, accident, or lack of proper care in youth some function or organ may become impaired. We all have our physical limitations, but how few of us live up to such limitations! When will physical ills be as much of a reproach as moral ills, and when shall we regard as nearly equal the "Physical health scorning disease and mental health scorning sin."

HYGIENE OF THE NERVOUS SYSTEM

Nervous Demands of Modern Life

Modern life has undoubtedly greatly increased the demands made on the nervous system. The introduction of rapid transportation, newspapers, telephone, keener competition in social and business life, many and varied interests, all have increased nervous wear and tear. The majority live more rapidly than two generations ago. All this calls for a strong nervous system, but a strong nervous system is built up only by education and use and maintained only by use and a healthy body. The brain can accomplish an immense amount of work if it is supplied with good blood and given sufficient rest and relaxation. It is worry, poor nutrition and lack of rest that most often cause nervous breakdown—not brain *work*.

Importance of the Nervous System

As the nervous system controls every function of the human machine, its care is of the greatest importance. When damaged, repair is always a long and difficult process, for its impairment throws out all the functions of the body. All the organs are subject to fatigue, and require a period of rest. The muscles cannot contract continuously, the stomach cannot always be engaged in digestion—there is even a period of rest for the heart between beats. Because of its great complexity, rest is absolutely necessary for the nervous system, especially the higher nerve centers making up the brain. This rest the brain obtains only in sleep,—perfectly only in deep, dreamless sleep.

Change of occupation gives rest to a part of the nervous system, as for example changing from mental work to physical activity; but each muscular contraction calls for nervous impulses and so adds to general fatigue. Most often this is desirable, for general fatigue brings about sound sleep.

Sleep

We must sleep periodically probably because the wastes of the body accumulate faster than they are eliminated. During sleep nearly all the organs are less active and the wastes are eliminated faster than they are made. The muscles store up oxygen and nutriment, the glands build up substances out of which they make their peculiar secretions, the nerve centers store up energy and all the cells are repaired.

Conditions in Sleep

During sleep respiration is slowed down and deepened, the breathing is more intercostal; the heart beats somewhat more slowly; the muscles are relaxed; less blood flows through the brain and more through the skin. "It is sometimes stated that the digestive secretions are diminished during sleep, but the statement does not seem to rest on satisfactory observation, and may be doubted." * * * "On the whole, however, the physiological activities of the body go on much as in waking conditions." (Howell.) It is chiefly the *brain* which sleeps.

Amount of Sleep

Most people require eight hours of sleep, others nine, although for some seven hours seems to be sufficient. It is said that women need an hour longer sleep than men, but that probably depends upon the individual and habit.

Soundness and Effect of Sleep

The depth of unconsciousness increases to between the first and second hour of sleep, and then gradually diminishes, although towards morning it increases slightly again. Sleep is more sound in a darkened room, and when there is quiet. Sleep is not nearly so deep during restlessness. To have the greatest effect, sleep should all be taken at one time; several periods equaling eight hours do not give nearly as much recuperative effect as the same period at one time. If one is constantly disturbed during the night more sleep is required.

The question of naps depends upon the general health and conditions. Those subjected to great nervous strain, or those who are weak are much benefited by a brief nap, but people in robust health should have a nervous system sufficiently strong to make naps unnecessary. The nervous system is strengthened through use, just as the muscles are trained by exercise and the stomach by eating food (in moderation) that requires strong digestive power. If one is under special strain, a brief nap gives refreshment all out of proportion to its length. Naps cannot, however, replace the long sleep at night, and they should not interfere with it. Momentary relaxation also gives a recuperative effect out of proportion to its length. **Naps**

The necessity of good ventilation at night has already been spoken of. An increasing number of people are making a practice of sleeping out of doors under sheltered porches, especially in summer time. What is good for the upbuilding of consumptives should prove of equal value in helping minor troubles or in maintaining health.

The temperature of the sleeping room should be brought down to what it can be maintained throughout the night; then the bedding can be arranged to suit the temperature.

The Bed and Bedding

Heavy bedding is undesirable. Woolen blankets give the greatest warmth for their weight and "down puffs" are much superior to the heavy cotton quilts or "comforters." The typical white bed-spread is heavy and gives very little warmth. It is best removed or turned back at night. The spring should keep the mattress level. As about a third of life is spent in bed, it pays to get a good mattress. It should be comfortable, but not too soft. For most people, a low pillow is desirable, as high pillows keep the body from lying flat.

Insomnia Sleeplessness has many causes, but it is lack of muscular activity that is most often at the bottom of the trouble. The day laborer, the farmer, fishermen, lumbermen—all who live an active, outdoor life, are not troubled with insomnia. Anything which over-excites the brain is liable to cause sleeplessness. If there is trouble anywhere in the system, the nerves are unduly excited, and as there is intimate connection between all parts of the nervous system, the brain is affected. Indigestion is a frequent cause. The use of tea, coffee and even cocoa at night often causes sleeplessness. Those who go over in the mind the activities of the day—lie in bed and think and think, are troubled with sleeplessness. Sleep depends much on habit. Those who have acquired the habit of not going to sleep easily, find it hard to break themselves of the habit. Regularity as to the time of going to bed is a great help in establishing good habits of sleep. If one goes to bed at all hours, it is increasing the difficulty to drop off to sleep immediately. Sometimes the trouble comes from the inability to relax the muscles completely. This power needs to be cultivated.

To Induce Sleep

The only means of overcoming the vice of sleeplessness is the removal of the *cause*. The *immediate* cause of sleeplessness is most frequently an excess of blood in the circulation of the brain. Anything which will draw the blood away from the brain will prove helpful. The blood supply of the brain is most intimately connected with that of the skin. It is almost impossible to go to sleep if the surface of the skin is cold. Bed clothes should be sufficiently warm, but not *too* warm or too heavy. Any action which will cause the blood vessels of the skin to dilate will diminish the flow of blood to the brain. Thus, warm baths are apt to be helpful or a hot foot bath with a cold cloth at the back of the neck; light physical exercise will draw the blood to the muscles and skin. Taking a little easily-digested food, if the stomach is in good order, will often draw some of the blood from the brain. If indigestion is the cause of sleeplessness, effort should, of course, be directed to improving that. A light meal should be taken at night in such cases.

If study or other mental work *must* continue until bed time, light exercise for ten or fifteen minutes such as a walk of half a mile out of doors, will be conducive to a good night's sleep.

Preparation for bed should be a leisurely process, so that the mind may get into the proper condition for sleep. The cares of the day must be banished. It is well to avoid lying awake in bed, and thus establishing the habit. If sleep does not come after ten of fifteen minutes, it is better to get up again, take a few gymnastic exercises, or in some way get the mind in a condition for rest, care being taken not to become chilled. Sometimes the repetition of numbers, monotonous phrases, counting the respirations while breathing deeply, and the like, may induce sleep.

Physiology of Habit

The whole question of habit depends on the nervous system, and this plays a large part in the daily life of every one. A habit is a more or less automatic act which is repeated frequently, requiring each time less effort from the will to accomplish it easily. The process of acquiring a habit may be likened to the making of a path through a heavy fall of snow. The first person to walk through the deep snow does so slowly, and with great difficulty. The second person finds it easier to follow the tracks already made, than to make new ones. All who come after, find the path smoother and easier to travel, and would not think of going into the deep snow on either side. In the same way, the acts performed by the body develop an easiest path along certain routes of the nerve tissue and the act is performed automatically. This is true of the mental as well as the physical habits. The ease with which a habit is formed depends upon the softness and the plasticity of the nerve tissue; the younger the person, the easier are the habits formed. Nearly all personal habits are formed before the age of twenty or twenty-five. It is increasingly difficult to form new habits after the age of thirty, and it is, therefore, essential that we form right habits of eating, breathing, sitting, standing, sleep, and so on, as early as possible. Considerable strength of mind and long persistence are required to break oneself of an evil habit.

HYGIENE OF FEEDING

We have already considered the digestion and use of food. There remains to be spoken of the how, what, when, how much to eat, and the care of the organs of digestion.

Digestion may be said to commence with the gathering and refining of food stuffs, and to be continued by the art of cookery, which helps to make food soluble and appetizing, but the first necessary part of digestion in the body is mastication.

CARE OF THE TEETH

Degenerate Teeth

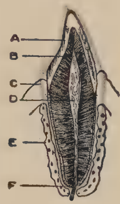
The art of preparation of foods and the art of cookery in removing hard substances and softening foods has diminished the necessity for powerful mastication, so that the teeth of civilized people are softer and more liable to decay than those of primitive people and animals. It is a law of nature that organs or functions not used tend to degenerate, hence special care of the teeth is necessary to preserve them.

Parts of a Tooth

A tooth consists of the crown, projecting in the mouth, the root in the gum and the narrow portion between, called the neck. The greater part of the tooth is made up of a hard, bony substance, called dentine. On the top and sides the dentine is covered with the very hard polished enamel, which serves for protection. The root is covered with a grayish substance called cement. In the center the cavity is filled with blood vessels and a nerve, which enter through a small opening in the end of the tooth.

Permanent Teeth

The thirty-two teeth of the adult begin to replace the first set of "milk teeth" at the sixth to eighth year. The four innermost permanent teeth — the wisdom teeth — do not appear until some time between the fifteenth and twenty-fifth year; in some cases they do not come at all. They usually are very soft, and decay easily.



A TOOTH

A, Enamel; *B*, Dentine; *C*, Gum; *D*, Cavity; *E*, Jaw Bone; *F*, Cement.

Irregularity in the teeth is usually due to lack of development of the jaw or to extra large teeth coming early. The teeth of a child should be watched, and if they tend to form an irregular line, the dentist should be consulted at once. He may find it advisable to extract one tooth and thus allow those remaining to come in evenly. Especially while the teeth of the child are developing, the diet should contain some foods, like crusty bread and hard crackers, that will tend to develop strong teeth. In a grown person, even, much may be done to strengthen naturally soft teeth by providing food which requires vigorous mastication.

Although the miller and the cook give us soft bread instead of the hard, coarse, ash-cake of primitive people, and the art of stock raising and of the butcher give us tender meat, instead of the tough flesh of the wild animals, the food must be insalivated and finely divided to make digestion in the stomach quick and thorough. The chief work of grinding comes on the molars, of which there are twelve,

Grinding Power

HALF SET OF UPPER AND LOWER TEETH

1, First Incisors; 2, Second Incisors; 3, Cuspids or Canines; 4, First Bicuspids or Stomach, 5, Second Bicuspids; 6. First Molars; 7, Second Molars; 8, Third Molars.

counting the wisdom teeth. These are very often lost early, leaving only eight. The loss of only one of these diminishes the grinding capacity *one-fourth*, for the opposing tooth is of little use. The loss of two molars may lessen the grinding power by one-half. The triumphs of American dentistry are such that the loss of a few teeth or even an entire set is not regarded as a serious matter by most people, yet poor teeth are responsible for a much greater proportion of digestive troubles than is often supposed. A good dentist can accomplish wonders, but he can-

Indigestion and Poor Teeth

not equal nature's providing, any more than a false foot is equal to the natural member.

Many theories have been advanced to explain the cause of caries or decay, but it is now well established

Causes of Decay

COMPLETE SET OF UPPER TEETH

that the main cause is in some way connected with the growth of the various micro-organisms lodged between the teeth. As long as the enamel is intact and the neck not exposed, decay does not begin readily, but if the bacteria find lodgment and food, the fermentation and decomposition caused by their growth tend to injure even the enamel. Once the enamel is broken, the decay of the dentine goes on rapidly.

Preserving the Teeth

It is safe to say that if the growth of bacteria on the teeth could be prevented entirely, even the weakest natural set could be preserved. Absolute cleanliness is the most important preventive to decay; next comes maintaining a high degree of polish so that the bacteria will find no place of lodgment. The practice of picking the teeth with pins or other metal instruments tends to crack the enamel, and thus expose the dentine to the action of bacteria. Biting of hard substances, as in cracking nuts with the teeth, or the constant biting off of threads may have the same effect. Decay is favored by the exposure of the neck of the tooth when the gums are loosened or pushed back by the injudicious use of the tooth pick or a stiff bristle brush.

Tooth Brushes

A good brush is the most effective instrument for cleaning the teeth. The bristles should be stiff, but not *too* stiff, set not too close, and the tufts on the end should be a little longer to facilitate brushing between the teeth. The brush should be discarded when the bristles become spread and so apt to irritate the gums.

Use of Tooth Powder

Precipitated chalk is one of the best powders to use, because it is sufficiently coarse to produce some scouring action and cleanse thoroughly, yet not hard enough to injure the enamel. Powdered soap, orris root, and flavoring may be added if desired. The brushing should be forward and back, and up and down between the teeth. The inside of the teeth should be brushed as carefully as the outside. The brush should be used, if possible, after every meal, and especially before going to bed at night. The night cleansing is most important, for during the hours of sleep the bacteria have a long period of uninterrupted activity. The mouth provides the most favorable condition for bacterial growths — moisture, warmth and darkness, and if there is food present, they multiply enormously. When it is known that with some kinds of bacteria a new generation may be formed every twenty minutes, it is not surprising to learn that by morning *the uncleaned mouth may contain literally millions of bacteria.* No wonder that many are reminded by the condition of the mouth to use the brush in the *morning.*

Cleaning the Teeth

At night, then, the teeth should receive their most thorough toilet. The use of the brush and powder alone will seldom remove all the food between the teeth and a fine silk thread, or better, the so-called "dental floss," should be pulled back and forth between close-set teeth, care being taken not to injure the gums. To preserve the polish of the teeth and to prevent the accumulation of sordies — tartar— an orange wood stick, cut in the shape of a chisel, should be rubbed up and down between the teeth, with a little powdered pumice stone, several times a month.

Use of an Antiseptic

After cleansing the teeth thoroughly the mouth may be rinsed with an antiseptic solution. This checks the growth of the bacteria somewhat, but is ineffective if food is left between the teeth. Any of the common mouth washes, such as listerine diluted with an equal quantity of water, may be used; Seider's antiseptic tablets are convenient. While thus cleaning the mouth, it is well to gargle the throat, as this tends to prevent throat troubles.

Visiting the Dentist

It is economy of money, time and pain, to say nothing of the appearance of the teeth, to visit the dentist frequently. He should examine and *clean* the teeth at least once every six months. If the teeth are subject to decay, it is best to go once in three or four months. The thorough cleaning which only a dentist can give is important, for small cavities easily filled, are frequently discovered which would otherwise pass unnoticed and become very much larger. Properly done, the cleaning can do no harm, and the high polish will lessen the chances of food and accompanying bacteria finding lodgment. Sometimes slight defects in the enamel can be treated with nitrate of silver or otherwise without filling.

Fillings

Of fillings gold is the most permanent, the amalgam or silver filling darkens the teeth and can be used only where it will not be seen. The ideal filling would be cement if a substance could be found which would be permanent. With other kinds of fillings, the cavity must be "under cut" to hold the filling in. Cement has sufficient adhesion so that the undercut is not so necessary, and not nearly as deep an excavation need be made. When the teeth are very soft, cement may prove the most economical filling even if it has to be renewed every year or two.

WHEN, HOW MUCH AND WHAT TO EAT

The composition, nutritive value and digestibilty of food have been treated in the lessons on *Food and Dietetics*, but it will be well to look at the subject from a different standpoint here.

Meals

By providing us with a stomach, nature evidently intended that we should take our food in meals. Some of the working people of the European nations partake of food five times daily, and those who attend the theater and late entertainments often may add an extra meal at midnight, but for most of us three meals a day seems to be the best plan. The stomach usually empties itself in about four hours, so that breakfast between 7 and 8, lunch between 12 and 1 and dinner between 6 and 7 gives it some rest between periods of activity. It needs this rest, for the stomach is not a continuous performance organ, like the heart. Moreover, stomach digestion goes on in stages. As the "psychic" or appetite juices decrease, the secretion brought about by the products of digestion continue, and the juice secreted is *adapted to the food being digested*. Eating between meals may upset the balance.

Eating Between Meals

If one is really hungry, there is no objection to taking a little simple food *once* between meals, provided it does not interfere with the appetite at the regular meal time. It is the constant eating of candy, etc., to gratify the sense of taste that is disastrous to appetite and digestion. Young children usually need a lunch between meals. When a child is willing to eat bread and butter, it is probable that he needs food. Those of weak digestive power usually manage the same amount of food in four or five meals better than in three.

Regularity as to meal time is important. If for any reason one goes much over the regular meal time, the appetite may be too keen and there is an inclination to overeat and eat too rapidly, with resulting digestive disturbance. Unless there is a regular lunch to prepare, the housekeeper is very apt to become careless and eat at any time or wait until there is a "sinking feeling" in the stomach.

Time for Eating

For the secretion of the digestive juices a liberal supply of blood is needed, so that very active exercise which calls blood to the muscles should not follow directly after the taking of a full meal. *Moderate* activity, like slow walking after a meal, is without much effect, and may be favorable. In the same way, bathing should not immediately precede or follow eating a full meal, but a short cleansing bath has less marked effect on the distribution of the blood than severe exercise and is usually attended with no unfavorable results. We should not take a full meal directly after the loss of considerable water through perspiration. At such times the proportion of water in the blood is lessened and the secretion of gastric juice is apt to be scanty. We naturally drink water at such times, from the call of thirst, and in fifteen or twenty minutes the blood has regained its normal composition. We should not partake of a full meal when we are very tired, either physically or mentally. A rest of half an hour before eating will put the system in more favorable condition. This is one argument in favor of having the principal meal at night when the active work of the day is over. Then there is time to take the meal slowly with full enjoyment.

How Much to Eat

As to how much to eat, the appetite is the best guide we have. Indeed, an intelligently directed appetite is a very good guide. Pawlow's researches show very clearly how necessary it is that food should be eaten with *appetite*. If the appetite does not call for food, little food should be eaten. As Pawlow points out, however, the appetite may be disarranged because of some disorder or mental condition when the body really needs food. After a few mouthfuls the appetite develops, or as the saying goes, "appetite comes with eating." If there is a continued impairment of the appetite, the warning should be heeded, its cause should be found and conditions changed. Meanwhile, little food need be eaten. The body usually has sufficient stored food material to supply deficiencies for a day or longer if necessary.

Food and Exercise

From the physical standpoint alone, the question of the total amount of food required is determined solely by the heat and energy output of the body. This the United States Department of Agriculture has found very accurately in the respiration calorimeter under different conditions. The outgo beyond a certain minimum depends upon the muscular exercise taken. See table, page 49.

The amount of heat lost is dependent chiefly on the skin surface, for most of the heat of the body escapes through the skin. The weight or contents of bodies increases faster proportionately than the surface area. That is, a small orange has more peel in proportion to its contents than a large orange. The body of a child has a larger surface area than that of an adult in proportion to the weight. A tall thin person has a greater skin surface in proportion to weight than a short, fat person.

Standard Diets

Taking into consideration all these factors, it would be easy from the table on page 49 to calculate to a nicety the number of calories of food required to keep the body in condition, as the fuel and energy value of all foods has been determined. Such calculations, however, would be only of general value, for although rules may be laid down for averages, individuals differ so greatly in the amount of food required that standard dietaries and the like are of little value except for comparison. It is a matter of every-day experience that two persons of about the

Personal Peculiarities

same weight and height and taking about the same amount of muscular exercise need very different quantities of food to keep them in the condition of health. One person may put on fat on a diet which would be insufficient to keep up the body weight of another. Inheritance is a large factor. One person may be able to digest and assimilate a much larger proportion of food eaten than another. It is the amount of food digested and assimilated which is of use to the body.

Nutritive Value of Food

However, people are much more alike than they are different and it is important to know the composition and the nutritive value of foods. The following table gives the food value (fuel and energy value) of a number of common foods *as eaten*: that is cooked, if they are cooked, and without refuse or the inedible part. The figures only represent averages for the composition varies greatly, a large proportion of water decreasing the food value and fat greatly increasing it. The value is given in calories per ounce. The volume of a pint equals about 16 ounces and a measuring cup 8 ounces and two level tablespoonfuls about an ounce of many foods. A cubic inch of butter or meat and a slice of bread half an inch thick weighs about one ounce.

FUEL AND ENERGY VALUE OF FOODS AS EATEN

Food	Calories Per Ounce	Food	Calories Per Ounce
Lard, salad oil, etc	250	Indian Pudding	52
Butter	225	Eggs (boiled)	48
Nuts (almonds, peanuts, pecans, walnuts).avg.	185	Fish (baked blue)	42
Chocolate (bitter)	179	Baked Beans	35
Chocolate nut candy (about)	140	Bananas	29
Cheese (cream)	123	Grapes	28
Crackers and cookies	119	Potatoes (boiled)	28
Sugar	116	Macaroni (cooked)	26
Plain candy	112	Hash	24
Cake	105	Milk (whole)	20
Lamb (broiled chops)	104	Apples	19
Dates and raisins	101	Oat Meal Mush	19
Beef (roast)	101	Chicken Soup(home made)	18
Mutton (roast leg)	89	Peas (green canned)	16
Olives (green pickled)	87	Spinach (cooked)	16
Mince Pie	85	Oysters	15
Ham (boiled)	83	Oranges	15
Broiled Tenderloin of Beef	81	Soup Stock	12
Apple Pie	79	String Beans, Onions Beets, Squash	12
Bread (white)	76	Musk melon	12
Bread (whole wheat)	72	Strawberries	11
Sweet Potatoes	58	Milk (skimmed)	10
Cream	57	Tomatoes and Lettuce	6
Pudding, rice, tapioca	52	Celery and Cucumber	5
		Cereal Coffee (infusion)	2

Note. From the above table, in connection with that on page 49, it will be easy to get a general idea of the quantity of food required. For example, with eight hours of sleep, six hours of rest, and ten hours of light exercise, a man of a body weight of 154 pounds would require about 2,800 calories. (See page 49.) A woman weighing a little over 100 pounds would need 1,900 calories. This would be supplied by 14 ounces of chocolate candy, or about a pound loaf of bread and three ounces of butter, and so on.

Over Eating

There are many people "blessed with a good appetite;" such are apt to eat too much. Indeed, with abundant food supply, which the art of the cook has made most tempting, and because of rapid eating, very *many people eat too much*, especially those of sedentary habits. We must eat only to satisfy the *demands* of the appetite, not to gratify the sense of taste. It is only one who has much manual labor to perform that needs "three square meals a day." A light breakfast, a light lunch, and a moderate dinner will keep others in a better condition.

If overeating does not ruin the digestion, the person is apt to grow fat, especially after middle life. Although heredity makes a great difference, accumulation of much fat is always a proof that too much food has been eaten or that there has been to little physical activity — usually both.

Reducing Fat

Fat is so much stored food material — lifeless matter. The only way it can be reduced is by oxidizing it in the body — burning it up. This can be done only by lessening the food supply and by taking very active physical exercise. Exercise which produces active perspiration is most effective. Putting on of fat gives a disinclination for active exertion and so the tendency is for the fat to accumulate. Although there is no evidence that fat may be made from the proteid of food eaten, and if the food could be made up entirely of proteids (which is impossible), the amount of fat would not *increase*, but it cannot be diminished unless the physical activity calls for more fuel and energy than is contained in the food eaten. The diet in obesity, then, would consist of such foods as have low fuel and energy value. A concentrated food means a food that contains little water. Fats have nearly 2½ times as much fuel and energy value as proteids and carbohydrates. Foods that contain a large amount of water are vegetables and fruits, except dried fruits. A certain bulk has to be taken to satisfy the calls of the stomach and to prevent constipation. It is usually recommended that the diet consist largely of proteid foods, especially lean meat. As we have seen, the proteids are quickly burned up. However, if the diet, even made up chiefly of proteids, is *liberal*, sufficient energy will be furnished to the body and none of the body fat will be consumed; consequently the total fuel value of the food is the chief consideration, so far as diet is concerned, if fat is to be *decreased*.

Less clothing should be worn, as low external temperature increases the heat output of the body, and so body fat is consumed if the diet is light. Less sleep should be taken, for during sleep the body uses less than a fourth the energy used in active exercise.

Increasing Fat

The conditions for increasing fat are just the reverse. The diet should be liberal and consist of easily-digested food, with abundance of fats and carbohydrates. Long hours of sleep and rest should be taken; there should be freedom from worry and nervous wear and tear; clothing and surroundings should be warm; sufficient out-of-door exercise should be taken, to give a *keen appetite*. It is often more difficult to put on fat than to lessen the amount, as heredity has such great influence. A complete change of life may be required to make any difference in body weight.

Winter Diet

Somewhat more food is required in winter than in summer, because of the greater heat output of the body, but if thicker clothing is worn and one is not exposed to any great extent to out-of-door temperature, no more food is needed than in spring or fall.

Hot Weather Diet

During very hot weather the quantity of food should be considerably diminished, especially proteids, and more liquids should be taken so that perspiration may be active and not diminish the proportion of water in the blood.

Heat Stroke

It has been found, strangely enough, that when the external temperature is very high, the body furnishes *more heat than at ordinary temperature*. In other words, oxidation is more active, the bodily fires burn more fiercely. This increase is brought on by the proteids, carbohydrates and fats in the ratio of 20 to 10 to 7. The increased heat production may raise the temperature of the body to such an extent as to cause a "heat stroke" if it is not lost sufficiently rapidly. During hot weather the appetite calls for less food, for much water and succulent vegetables, as salad plants and fruits. It is recommended that the total amount of food eaten should be less in fuel value than the heat output of the body. Under these conditions, some of the body fat is used, which accounts for the fact that most people lose weight during a long period of hot weather. Here is the probable reason that exercise inducing perspiration is found to be most effective in the reduction of weight in obesity.

What to Eat As to what to eat, again the educated appetite is a trustworthy guide. We should eat the things which we find palatable, for these will have a better chance for thorough digestion. This is not saying, however, that all food eaten with enjoyment will be perfectly digested. When the digestive organs are in good condition, a reasonable amount of all foods that have been found by experience to be wholesome should be disposed of without trouble *provided only*, that the food be properly cooked and properly eaten. No human stomach can be expected to digest pies and doughnuts as they are sometimes made, but they may be so cooked that any one in health should be able to eat *small quantities* without discomfort. The stomach needs some exercise, like all the other organs of the body. The constant eating of easily digested and predigested foods will weaken the digestive organs, just as lack of exercise will weaken the muscles. While the digestive organs should be capable of taking care of small quantities of difficultly digested food, the whole diet should not consist of foods known to be digested with difficulty. A little fried food occasionally, skillfully cooked, should cause no trouble, but a constant diet of the product of the frying pan may be expected to ruin any digestion.

Digestive Peculiarities

Many people find that certain foods disagree with them at times, such as lobster, sausages, strawberries apples, cucumbers. Such personal peculiarities must, of course, be heeded, but the list of forbidden foods ought to be a small one. Those who will take little or no exercise find their list of indigestible food constantly increasing. It is far better to take sufficient exercise to keep the digestive powers up to a reasonable level.

Omnivorous Tastes

What we like depends upon our education; we usually prefer throughout life the foods which we learned to like in youth. It is desirable that we develop omnivorous tastes while young, for the appetite calls for variety. Children are very apt to acquire unreasonable tastes in food, and while they should not be forced to eat food that is distasteful, still with a little tact, good food habits can be formed. A child will usually consent to eat a *little* of a new food without undue family disturbance if favorite foods are withheld until the mouthful or two is disposed of. After a few times, he will often call for more than a little of formerly despised foods.

Proportion of Nutrients

As we have seen, it makes little difference whether the energy of the body is supplied by fats or by carbohydrates or by proteids. If the composition of foods is known, we can safely leave the appetite and experience to the subconscious selection of the proportion needed for the body in *health*.

Amount of Proteid

Recent experiments have shown that in any diet which we would select, if free to choose, we would obtain sufficient proteid to furnish that required for cellular repair, so we need have little fear that the diet will be *deficient* in proteid. We may, however, easily take too much. Although eggs, milk, cheese, beans, and peas contain a considerable proportion of proteid, there is not much likelihood that we shall eat in excess of any of them. The proportion of proteid in *meat* is much greater, and very many people, especially those of sedentary habits, undoubtedly eat too much meat. This comes about because most people like meat, and because it is somewhat difficult to make a good roast or steak unpalatable by poor cooking.

Meat Eating

As we have seen, the proteid foods have a decidedly stimulating effect on the organism. In case of general debility, anæmia, and in wasting diseases such as consumption, this stimulus is just what the body requires, but for those leading inactive lives, there may be too much stimulation. It is only *oxidation* that is stimulated; elimination may not keep pace, and the accumulation of wastes brings about unfavorable conditions. Headaches and other nerve troubles are favored by too much meat eating more often than commonly known.

The diet of the growing child and youth needs to be high in proteid.

Vegetarianism

Vegetarianism has been advocated as a cure-all, and for those who eat too much or whose diet consists too largely of proteids, it is undeniably helpful, but there seems to be no reason (except the ethical argument that man should not take animal life for his maintainance) that all use of meat should be abandoned.

Common Sense in Diet

To quote from Professor Chittenden, whose work gives a strong argument for less meat eating: "I am inclined to emphasize the desirability of using common sense in the application of dietetic rules, remembering that man is an omnivorous animal, and that Nature evidently never intended him to subsist solely on a 'cereal diet,' or on any specific form of food to the exclusion of all others. On matters of diet every man should be a law unto himself, using judgment and knowledge to the best of his ability, reinforced by his own personal experiences. Vegetarianism may have its virtues, as too great an indulgence in flesh foods may have its serious side, but there would seem to be no sound physiological reason for the complete exclusion of one class of food-stuffs, under ordinary conditions of life."

DRINK

Water as Drink

As to drink, pure water is the best drink we have, but impure water is very dangerous as it may pass through the stomach without becoming mingled with the hydrochloric acid, which destroys nearly all disease germs. The living tissue contains nearly nine-tenths water, *i. e.*, the muscles 87 per cent, the glands, like the liver, 86 per cent, the blood 90 per cent. Many people, especially women, do not drink sufficient water. There is a feeling that water taken at meal times will dilute the gastric juices, and so interfere with digestion. Pawlow found that water is one of the few substances that stimulates the secretion of the gastric juices, and it has been proved that any quantity less than three pints (an impossible amount) helps rather than hinders digestion. It is well to take a glass or two of water in the morning before breakfast, one or two glasses with each meal and between meals, if desired. The water passes rather quickly out of the stomach and is absorbed into the blood in the intestines, and soon after is secreted by the kidneys. Experiments have shown that an imperceptible amount of energy is required for the absorption and elimination of water, and it has been found that increasing the quantity of water increases the amount of urea and other waste products eliminated.

Drinking water with meals is favorable to digestion, but this is by no means the same thing as taking water *with food*. As we have seen (page 53), dry foods should be chewed until the saliva has moistened them sufficiently to make swallowing easy, for in addition to the digestive action of the saliva, the taste of foods increases the flow of the "psychic juices." If the food is *washed down* with water or other liquids, it will not have nearly as good a chance of being easily digested.

The temperature of the water does not seem to make very much difference. Ice water is not harmful, provided it is sipped slowly, and so becomes warm before entering the stomach. Hot water is sometimes recommended in cases of indigestion, but in reality the heat has very little effect. It does not cause an increased flow of gastric juice but may increase the movements of the stomach somewhat.

Tea Coffee Cocoa

Of the beverages, tea, coffee, and cocoa, tea and coffee contain the alkaloid caffein and the cocoa a substance very similar, called theobromin. These are substances something like uric acid in chemical composition, and so undesirable in certain disease conditions. For most people a cup of coffee with the breakfast adds to the enjoyment of the meal and for that reason may help digestion. While one cup of coffee may be favorable, two cups may be decidedly harmful. Here, as in all else, temperance should be the rule. Tea, coffee, and to some extent cocoa have a stimulating effect on the nerves. Some people can take coffee and not tea, others the reverse. We usually know whether tea or coffee is harmful or not, and we certainly should have the strength of mind to refrain from one or the other if we cannot take it with impunity. Few people leading sedentary lives can take either tea or coffee three times a day without harmful results.

Alcohol Alcohol is commonly regarded as a stimulant. At first it increases the flow of blood to the skin and brain and gives a feeling of warmth and of general well-being. According to the latest experiments, alcohol brings about the increase of the flow of blood to the skin and brain by *inhibiting*, paralyzing, the action of the vasco-constrictor nerves. In the brain it loosens up or gives freedom from restraint. In small quantities alcohol can without doubt be taken without harm, but it is a powerful drug, and as the system adapts itself to abnormal conditions, larger amounts are required to produce its effect and the appetite demands more and more. Large quantities are disastrous to every function of the body. The evils of alcoholic intemperance do not have to be enlarged upon; without doubt the world would be far better off if there were not such a substance as alcohol, even though physicians may sometimes use it to advantage.

HYGIENE OF THE SKIN AND ITS MODIFICATIONS

The skin is the protecting covering of the body, and the hair and nails come from modifications of its structure. The mucous membrane is similar to the skin in structure, but without its outer horny layer. (See page 42.) Although the outer skin contains many "pores," sweat glands and sebaceous glands — it is not *porous*. On the contrary, the skin is practically water tight from the outside inwards. Aside from certain mercury preparations, the skin cannot be made to absorb a material amount of any substance, although the outer covering takes up oils and other matters to some extent. The mucous membrane, however, in some parts is "porous."

The Skin Water Tight

The outer skin is constantly shedding its outer layer of horny cells; the salts dissolved in the perspiration are deposited on the surface and in the mouths of the sweat glands, the oily material secreted by the sebaceous glands accumulates, and may stop up the opening, causing pimples; and the secretions contain odorous substances; so for health and decency bathing is required.

BATHS

Cleansing Bath

The chief use of the bath is for cleanliness, but it may also have other hygienic effects. The frequency of bathing from the standpoint of cleanliness depends on the occupation and environment. Some people require a daily cleansing bath, while with others one or two a week is sufficient. Too frequent bathing with soap and warm water may have unfavorable effects, as it is not well to carry away all the oil of the skin which is needed to keep it soft and pliable.

Effect of Different Kinds of Baths

The stimulating effects of bathing depend on (1) the temperature of the water used, (2) kind of bath, (3) the time of day, and (4) the duration of the bath.

(1) Very cold water produces a shock and either depresses or overstimulates, according to the strength of the individual. Hot water always produces a sedative and depressing effect. Cool water produces a tonic effect, and from a hygienic standpoint, is the only temperature that should be used for bathing. The degree of coolness which will produce the greatest benefit varies with different individuals and in different seasons.

(2) The kind of bath used depends on the volume and the force of the water, which comes in contact with the body. Great force and large volume produce a shock, and thus tend to overstimulate. The douche, large shower with high pressure, and the plunge, represent baths with great force and large volume of water. Applying water to a small surface at a time, as in a sponge or hand bath, produces only local effects, because the volume and the force are not sufficient to stimulate the whole body. A needle spray, mild shower, or a sponge bath with a very large sponge tend to produce general tonic effect.

(3) A bath taken just after rising, when the func-

tions of the body are greatly reduced in activity, will produce far greater effects than later in the day after some vigorous muscular exercise.

(4) A cold shower bath of two minutes' duration would ordinarily have a tonic effect on a healthy individual after exercise, but the same bath continued for eight or ten minutes would have a decidedly depressing effect. A warm bath of five minutes' duration would have a soothing effect, but if continued for ten or fifteen minutes it would prove depressing.

Stimulating Baths

We have, then, four important principles governing the question of bathing. These principles are closely related and overlap each other. For example, a plunge in luke-warm water in the early morning would not stimulate any more than a cold sponge bath at the same hour, and a cool sponge bath in the early morning would produce as much effect as a cold shower or plunge bath in the late afternoon. Knowing the general effects of temperature, pressure, and volume of water, time of day, and duration of bath, we can arrange the conditions with a view to securing a tonic effect. It is impossible to lay down rules for everybody, but, fortunately, every one can find out for himself what is the temperature, kind of bath, and duration of bath which will be most beneficial for him. This is shown by the after-effects of the bath. If the bath has produced a tonic effect, the individual will feel warm, wide awake, comfortable, and ready for work, and there will not be a reaction of depression one or two hours later. On general principles, the most favorable conditions for a daily hygienic bath would be a cool or cold shower bath, following some vigorous muscular exercise about five o'clock in the afternoon. If the bath is taken immediately after rising, the temperature, volume, and force of water should be moderate.

The Morning Bath

Most people are benefited by a cool bath every morning. While it takes considerable courage to indulge in a tub bath of very cold water, it is not necessary that the water be of the same temperature as it comes from the tap. Although a tub or shower bath is not available for every one, all having a bowl of water may indulge in a sponge or hand bath, and the brisk rub afterwards. The stimulus of the reaction sends the blood coursing through the system, the respiration is deepened, and the active exercise of rubbing gives one a good start for the work of the day.

Salt Water Bathing

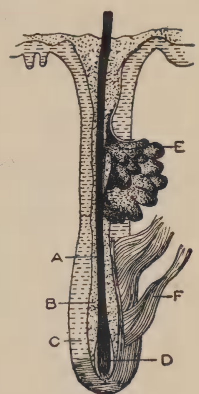
Salt water bathing is supposed by most people to be more beneficial than fresh water bathing, because of the presence of salt in the water. It is true that sea bathing is more exhilarating than lake or river bathing, but the exhilaration comes from the sea breeze, the greater coolness of the water, and the movement of the waves; the presence of salt in the water has no effect. The use of rock salt in the bath tub at home is a waste of time and money.

Sun Baths

Another most valuable tonic for the skin is the sun bath. The effect of the sun's rays on the skin is appreciated only by those who have tried it. The skin should be exposed for a short time at first, in order to avoid burning. Gradually the time may be increased, until the skin is of a rich brown color. The good effect of sun baths is not limited to the skin, but the whole body, and the nervous system in particular, is greatly benefited.

CARE OF THE HAIR

The hair and hair sheath are both modifications of the outer skin. Each hair root has a small network of blood vessels supplying it with nourishment. The skin forming the scalp is very thick, owing to its large number of hair roots and blood vessels. The amount and quality of the hair, like nearly all the physical characteristics, is largely a matter of inheritance. Its condition depends indirectly on the general health and directly on the circulation in the scalp. When the scalp is thin and tightly drawn, the circulation of the scalp is apt to be poor, the nourishment of the hair roots inadequate, and the hair suffers. Sometimes the amount of the hair diminishes rapidly in a few weeks because of acute illness or a general low condition.



A, Hair; *B*, Sheath; *C*, Folical; *D*, Hair Root; *E*, Sebaceous Gland; *F*, Muscle.

With the return of general bodily health, the hair roots secure sufficient nourishment, and the hair resumes its normal growth.

Dandruff The presence of dandruff is perhaps the most common accompanying condition in the falling of the hair. Cleanliness is absolutely essential to the health of the scalp, and dandruff is an indication of poor condition. The best way to keep the head free from dandruff is by the use of a stiff brush night and morning, and by washing the scalp with soap and water two or three times a month, or as often as necessary. A stiff brush should be used for brushing the hair, with the bristles far enough apart to allow of the brush being easily cleaned. Three to five minutes, vigorous brushing night and morning will prevent dandruff from accumulating, and will stimulate the circulation of the blood in the scalp. If the scalp is very tender, a softer brush should be used. The comb should have long, blunt teeth, set not too close together; sharp, rough teeth tend to scratch the scalp and injure the hair.

Brushing the Hair Some people hesitate to comb or brush the hair, any more than is absolutely necessary to dress it, because by so doing some of the hair comes out. If the right kind of a brush is used with gentleness, the hair which falls in brushing and combing is practically all dead hair which ought to be removed.

Shampooing The frequency of shampooing depends on the individual. With some, once a month is often enough, and others require a thorough washing once a week. Any good toilet soap will serve the purpose. The scalp should be rubbed thoroughly with the ends of the fingers, care being taken not to scratch with the nails, or a stiff brush like a nail brush may be used. The soap should be washed out completely with warm water, and the head rinsed with cold water, to avoid taking cold. The hair must be dried thoroughly with towels and finally held near a register, or preferably in the sun.

A certain amount of oil is necessary to keep the hair soft and in good condition. The oil glands in the scalp usually secrete a sufficient amount for this purpose. It is sometimes thought that frequent washing of the scalp will remove all the oil and make the hair too dry. This is not usually the case, because the rubbing and cleansing stimulate the oil glands to greater activity. The application of oil or vaseline is advisable only when the hair is very dry.

Massage of the Scalp

Aside from cleanliness, massage is about the only effective method of stimulating the growth of the hair. For the best results, massage should be applied for about five minutes every day. A long application at infrequent intervals has very little effect. The ends of the fingers of both hands should be applied to the scalp as closely as possible and rubbed gently backward and forward, alternating with a circular movement, care being taken not to pull too hard on the hair. At times the scalp itself should be moved over the bones beneath.

Electricity has been recommended as a stimulant to the scalp. If used judiciously it may increase the circulation to some extent, but the results obtained are no better than massage, and hardly warrant the inconvenience and expense. The same may be said of vacuum caps.

Hair Tonics

Innumerable hair tonics are advertised in superlative terms, but the only benefit to be derived from them is the little massage involved in the application of the so-called tonic. No drug can be absorbed by the skin in sufficient quantity to produce much effect.

Cutting and Singeing

Cutting and singeing have been recommended to increase the growth of the hair, but there is no evidence that this has the slightest effect. Split ends of long hair should, however, be trimmed off.

Curling the hair may injure its quality and appearance by pulling too hard on the roots, or in using the curling iron too hot. If the hair is not pulled or burnt, curling does not seem to injure it.

Superfluous hair on the face can only be removed permanently by means of electricity. If done properly, this method is painless, the root is destroyed, and the hair never grows again.

Gray Hair

The time when the hair grows gray depends largely on inherited tendency, but this change is hastened by mental strain, worry, overwork and unhygienic living. Occasionally some great sorrow or nervous shock will cause the hair to turn gray in a short time. In rare cases its color may return with improvement of the general health. There is no drug or remedy applied externally or taken internally which has the slightest effect in preventing the hair from turning gray.

CARE OF THE COMPLEXION

Complexion and Health

A clear, healthy complexion is an indication of good digestion, good circulation and good elimination, and is to be obtained and kept only through attention to the general health. The skin of the face is both delicate and much exposed, so its care calls for special attention. Here as elsewhere cleanliness is essential to the health of the skin. As to how often to use soap and water depends upon conditions. In a soft coal city and in dusty places soap must be used. There is some danger of removing too much of the oil of the skin if the face is washed too frequently with soap and warm water. Soap may be used on an oily skin with advantage more often than on one which has a tendency to be dry.

Washing the Face

It is probable that moderately cold water is best for general use. The cold stimulates the muscles of the face and the blood vessels of the skin, and keeps them in good tone. Only clean, soft water should be used, and the wash cloth must be absolutely sweet and clean. Whenever soap is applied it should be thoroughly rinsed off with cold water. If the skin is apt to be dry, an application of an oil substance, such as cold cream, will prove helpful.

The best time for thorough cleansing with soap and warm water is probably at night before going to bed. Then the skin will not be exposed to cold, and by morning the protecting oil secretion will have been restored. Any good toilet soap may be used; medicated soaps are of little value. The price is a fairly good indication of the care with which the soap has been made. Transparent soaps usually contain glycerine.

Steaming the Face

For a thorough cleansing, a thick cloth like a Turkish towel may be wet in hot water and laid over the face. This, in addition to softening the tissues, induces perspiration, which tends to clear out the sweat glands. This may be followed by an application of cold cream, well rubbed in. On wiping off the cold cream with a soft cloth the amount of dirt removed will often be surprising. This treatment should be followed by an application of cold water to contract the blood vessels of the skin.

Massage of the Face

In addition to the stimulating effect on the muscles of the face of cold water, massage with cold cream is very helpful in improving the circulation. The tips of the fingers should be used with a rotary, upward and outward movement, the lines and wrinkles being always rubbed across. The touch should be firm, but gentle. To have much of any effect, massage must be practiced for a few minutes every day.

Cold Cream

Cold cream is a mixture of white wax or spermaceti and some oil, as almond oil or castor oil, to which some fragrant substance is usually added. Lotions and creams usually contain glycerine and a great variety of substances, some of which are harmful.

Face Powders

Face powders are made of talc, starch, bismuth, zinc oxide, chalk and magnesia, and as a rule are harmless if applied in moderate quantity for a short time and thoroughly washed off. Powder is white dirt instead of black dirt; it has the same effect as the application of so much graphite — the principal ingredient of stove blacking — which has about the same physical properties as talc.

Pimples and the Blood

Pimples are most often caused by some microorganisms, usually bacteria, finding access to the skin in dirt through some small break or through some gland. The pus which they contain is made up, among other things, of the dead bodies of white corpuscles which have perished in their endeavor to rid the skin of the intruders. A boil is an enlarged pimple. Their discharges are somewhat infectious. In general, pimples and boils do not represent the efforts of the blood to free itself from the impurities, but if the blood is in poor condition, by reason of faulty elimination or indigestion, its protecting power is lessened and skin troubles are more apt to manifest themselves. Skin diseases are many and complex, and they should be treated by specialists.

Blackheads are the hardened secretions of sebaceous glands. They may be softened by the application of cloths wet in hot water and removed by pressing the skin gently between the balls of the thumbs.

Care of the Hands

Some care is required to keep the hands in good condition, especially if much housework is done. Stains and dirt should be removed as soon as possible, so that they may not become deeply imbedded and require rough treatment for their removal. Crude soaps contain free alkali, and when used in hot water remove all the protecting oil, making the skin hard, dry, and apt to crack open or chap. Only a good grade of white soap should be used in dish-washing and the like, if the appearance of the hands is to be considered. The hands must be kept out of hot water and soap and soda when possible, and should be dried thoroughly at once after being wet. When it is necessary to use strong soaps and alkali, rubbing vaseline or oil into the hands previously will help. Thin rubber gloves may be used, but they are very uncomfortable and clumsy.

The nails should be kept clean not only for appearance sake, but because the dirt may harbor dangerous infection. The nail brush, orange-wood stick and nail file are better to use than sharp instruments. If the nails are brittle and so-called hang-nails form, nightly treatment with cold cream for a few weeks should bring about improvement.

CARE OF THE MUCOUS MEMBRANE—COLDS

Cause of Colds

Inflammation of the lining of the upper portion of the respiratory tract, given loosely the general name of a cold is, perhaps, the most common ailment with which people, healthy otherwise, have to deal. It is well established that the real cause of colds is bacterial activity. Explorers, while in the arctic regions, where there is no bacterial life, are not afflicted with colds, although they are exposed to greatest extremes of temperature. On their return to civilization, an epidemic of colds usually comes on. A mother with a family of small children does not need to be told that colds are infectious, for if one child catches cold the rest usually have it, although some members of the family, by reason of better resistance, may escape.

Bringing on a Cold

The means by which a cold is usually brought on is through some disturbance of the circulation, most frequently by chilling of the surface of the body. Chilling continued for some time throws a greater volume of blood to the internal organs, and the vessels of the mucous membrane become overcharged. This condition in some way enables the bacteria to gain a foothold and multiply. This, in turn, leads to a further accumulation of blood, especially of the white corpuscles, to repel the invaders. The continued excess of blood results in the inflammation. In this condition some of the capillaries may become stopped up from white corpuscles adhering to the minute veins, and this makes a congestion. As the bacteria are driven out, the inflammation subsides and the blood vessels are gradually cleared.

Prevention of Colds

The prevention of colds, then, involves keeping the mucous membrane as clear as possible from foreign matters, in accustoming the system to change in external temperature, and in reasonable care that the surface of the body does not become unduly chilled. The first involves the care of the nasal passages and the throat. The most convenient and effective means of doing this is the oil atomizer. A light mineral oil called alboline is generally used. This may be used plain or some medication may be added, such as eucalyptus, menthol, with a very little carbolic acid. A physician will give the proper prescription which should be adapted to the condition of the individual. This oil spray used night and morning, together with gargling the throat with an antiseptic solution, will help to keep the mucous membrane in good condition and to remove the source of infection.

Hardening the System

More important, perhaps, is the training of the heat-regulating mechanism to become less sensitive to change in external temperature — in hardening the system. Cold baths are most effective here. The clothing should not be too warm and the rooms not kept at too high a temperature, for this keeps the skin in continual tropical surroundings, so that any slight change of external temperature has marked effect. Reasonable care should be exercised towards chilling the body. The greatest danger comes in sitting still in a room below 65° or remaining inactive for a considerable time in a strong draught or wind. While one is taking active exercise, there is little danger of taking cold. Wet clothing conducts the heat away from the body much more rapidly than when it is dry, so that it is dangerous to remain quiet if the clothing is damp. This is especially true in regard to the shoes and stockings.

Catching Cold

The body is much more susceptible to colds at one time than at another. Naturally, susceptibility is greater when the other functions of the body are not in good condition. Indigestion may make one especially liable to take cold, and we are always more susceptible when we are tired. If the bedding is too warm, the body may get into a perspiration, and if it is then thrown off unconsciously, a chill is liable to follow before one is awakened.

Susceptibility to Colds

"No cold is trivial." Although a slight cold may not occasion serious inconvenience, it should be cared for. Even a slight disturbance of the system by a cold, with the attending inflammation, makes the body less resistant to communicable diseases, and a slight cold may become a serious matter if added to. Frequent colds tend to produce chronic inflammation of the mucous membrane or catarrh which is a condition difficult to cure.

Care of Colds

Much may be done when a cold is felt coming on to lessen its effect. Any means which will draw the blood away from the congested area is helpful. Hot baths, or mustard foot baths are recognized as a means of bringing about the desired results; the taking of hot drinks, as hot lemonade, throws the blood to the skin and away from the mucous membrane.

After the cold has once gained foothold in the body, not very much can be done except to protect the body from further chilling. Cold baths, if taken, should be discontinued; in going out of doors in cold weather the clothing should be warm and come up well around the neck and throat. Very active exercise which produces rapid circulation is not favorable at the height of a cold, but may help to clean out the stopped-up blood vessels at the end of a cold. The taking of drugs, unless the whole system is involved, is worse than useless. Many of the so-called cold cures throw out the digestive system, which needs to be kept in good condition at this time. Local applications, however, may help somewhat. Medicated oil spray will give some relief and "adrenolin" ointment is recommended for a cold in the head. This contains a very small amount of the extract of the adrenal gland of some animal, and has the property of constricting the capillaries locally. If there is a hard cough, which tends to irritate the inflamed area simple cough drops or mixtures, which will prevent the coughing, are useful.

Drugs for Colds

HYGIENE OF CLOTHING

Clothing is worn to help the body maintain an even temperature, also for personal adornment and modesty. Heat is transmitted from the skin by conduction and convection, and leaves the clothing in both these ways, and by radiation.

Conductivity of Cloth

There is only a very slight difference in the conducting power of the substances of which textile fibers themselves are made. The chief difference in the heat-conducting power of fabrics comes from the structural nature of the fiber and the weave. As dry air has less than 1-100 of the conductivity of the fiber substance, clothing is a poor conductor of heat in proportion as it contains air between the meshes and fibers. A number of layers of cloth give more warmth than one of the same weight.

Character of the Textile Fibers

The fibers of wool are very much curled and twisted, and have considerable elasticity or spring, so that they are not easily spun into compact thread or matted. Cotton fiber is flat and twisted, without much elasticity; linen and silk are nearly straight and cylindrical, the fiber of silk being very fine and that of linen much coarser than any of the other textile fibers. Wool fabrics, because of the character of the fiber and the way in which it is woven, enclose the greatest amount of air between the fibers, and so make the warmest clothing. Cotton may be so woven as to be almost equal to wool in this respect, but it mats much more readily. If meshes are *too* large, the heat is carried away rapidly by convection — especially by moving air.

Relation of Clothing to Perspiration

Although clothing should prevent undue loss of heat, it should not prevent the escape of perspiration. It is only by evaporating that the perspiration carries away heat. If the vapor cannot escape, the skin is apt to become too warm, more perspiration is given off, and the underclothing becomes saturated; water replaces the air and the underclothing then becomes a very good conductor of heat. If there is any movement of the air, the heat is taken away rapidly, both by convection and increased evaporation, so the body may become chilled. A leather jacket or newspaper worn under the coat may be desirable out of doors to keep cold winds from penetrating the clothing, but any covering which prevents the evaporation of the perspiration as fast as it is formed, is very undesirable. Rubber waterproof garments are for this reason very uncomfortable during warm weather. Fabric called "cravenette," which is treated so as to be waterproof, yet still retain its porous character, is more desirable.

Warm Weather Clothing

Clothing for the hot days in summer should impede the escape of superfluous heat and the perspiration as little as possible. For underclothing the open mesh or net knit goods seems most suitable. While this permits the free circulation of air, and so ready cooling, it makes an extra layer of air between the skin and outer clothing when additional wraps are added, and so gives considerable warmth.

Winter Clothing

The amount of clothing to be worn in winter depends upon conditions. People living in a city in houses more apt to be overheated than underheated, and riding in heated street cars, require clothing but little heavier in winter than in spring or fall. Increased warmth when going out of doors is better obtained by putting on extra warm outside wraps, which are removed when in the house. For robust people, only medium weight clothing, especially underclothing, ought to be worn, for when the temperature of the rooms is kept at 68 degrees F., with heavy underclothing perspiration becomes active, and the skin is made very sensitive to the changes in temperature and the liability of taking cold increased. Old people leading inactive lives and those who are not strong may require thicker underclothing.

Those who live in the country where houses may not be well or uniformly heated, or people who are much out of doors and *inactive*, as when riding in carriages, may well protect themselves by thicker underclothing, as well as with warm outside garments.

Effect of Color of Clothing

Color has some effect on the *radiation* and *reflection* of heat by clothing. White reflects heat, as it does light, much more completely than black or dark colors which absorb it, so we wear white in the hot sunshine of the summer. Dark colors which absorb heat *radiate* it better than white or light colors. For this reason, white is warmer in winter, except in the sunshine, as well as cooler in summer. It is stated that a white rabbit loses only three-fourths as much heat as one whose coat is gray or black. White or light colored underclothing and bedding, then, is somewhat warmer than that of dark color.

Uniform Warmth

Clothing should be of uniform thickness all over the body, as there seems to be no logical reason why one part of the body needs greater protection than another in health — although it may be desirable to protect certain parts in special cases. Clothing should allow unrestricted movement of all parts of the body.

Freedom from Restriction

Constriction at any place disturbs the circulation of the blood and interferes with proper nutrition. Circular garters for holding up the stockings have no excuse for being. Nothing will so quickly ruin the graceful curves of the neck as a tight collar.

The Corset

It would be impossible to write of the hygiene of clothing without adding a word to the already sufficiently great protest against the corset. *If* the corset is not worn until full growth is attained, and *if* it is the proper shape and not too stiff, and *if* it is not worn too tight (but no woman will admit that she wears her corset *tight*), then they do little or no harm. It is hardly less than criminal to put a young growing girl into a tight waist or corset. The abdominal organs need the support of the abdominal muscles to keep them in a proper position and the muscles can only be developed by use. Natural breathing is prevented, the natural figure is distorted by the constriction, grace of movement is interfered with because of the cramping and under-development of the muscles of the waist.

Boys might be put into corsets and men wear them with comparatively little harm. The corset and the high heeled shoe are, according to all physicians, responsible for the greater part of the ills peculiar to women. Undoubtedly to the corset may be attributed more suffering in America yearly than was ever caused by the Spanish Inquisition.

Deformed Waists

A waist too small is as much of a deformity as too small a neck. Compare a fashion plate to a Greek statue! In time education may lead to reform, but there seems to be no hope at present that the corset will be banished, at least for dress-up occasions.

Working Dresses

However, there seems to be no good reason why a woman's clothing, while working about the house, should not be so constructed as to make a corset unnecessary. As made at present, skirts which fasten with a draw-string or narrow band at the waist are uncomfortable without a corset, but they may be made with a wide fitted band so as to be supported by the hips and waist, or made on a waist and supported by the shoulders. Union suits and combination garments are a step in the right direction. Equestrain tights are warmer and not so heavy as thick underskirts.

SHOES

Foot Troubles

Because the feet have such heavy duty to perform and are so important in connection with physical exercise, shoes deserve considerable attention from the hygienic standpoint. American shoes are now constructed more in accordance with the natural shape of the foot than formerly, but it is rather rare that the adult foot is not mis-shapen by wearing improper shoes, and corns, bunions, ingrowing nails are still very common.

Preserving the Arch of the Instep

The foot is made up of twenty-six small bones, which are held in place by ligaments, cords and muscles. To preserve the arch of the instep, all of these must be strong and well developed. The important cords running under the instep to the toes form the bow-string action necessary to maintain the truss which the arch of the instep really is. They may be easily felt by placing a hand under the instep. To make these tendons strong, the toes must have full play, and this they cannot have in the typical pointed shoe. In order to act as a perfect lever, the great toe should be nearly straight in the line of the foot and hence the inside line of the shoes should be nearly straight. The toes should be sufficiently wide; the soles should be flexible, so that the toes may be able to push in walking. A large stiff box prevents this. Now-a-days it is possible to obtain ready-made shoes that fulfill these requirements which are still not clumsy in appearance. The shoe should fit snugly around the instep and heel, but allow sufficient room at the ball of the foot and toes.

Flat Foot

People who have worn shoes that have deformed the feet and have prevented the development of strong cords and tendons, are apt to have the arch give way some time during middle life. The bones of the instep sag, giving the condition called "flat foot." This, in addition to being very painful, prevents enjoyment of the very good and most available form of physical exercise — walking.

Those afflicted with flat foot find some relief in using a metal innersole made for the condition, or in especially constructed shoes, which support the instep.

Corns and Bunions

Corns are a malignant growth of a papilla caused by irritation of an ill-fitting shoe, usually by shoes that are too small — sometimes by too large a shoe. They may be cured by the attention of a chiropodist, the wearing of shoes which prevent the irritation, and thorough cleanliness. A bunion is a much more serious affair, being a disease of the joint of the great toe, and caused from a turning out of the toe by pointed shoes, and by pressure. Since the improvement of the art of shoe-making, they are much less common than formerly.

Perspiring Feet

While leather is somewhat porous, it is not sufficiently so in many cases to permit the perspiration to escape as fast as it is formed. This leads to an accumulation of perspiration, the stockings become damp and then the feet grow cold easily. If the sweat glands of the feet are especially active, shoes of thin leather should be worn and thin stockings. If the feet are especially tender, a nightly bathing in warm water and then in cold, with the application of a little oil, will prove beneficial.

Low Shoes Low shoes, because they give good ventilation, are a hygienic form of footwear, especially for the summer months. If gaiters are put on when out of doors they may be worn the year round. Tan shoes reflect heat, and so are cooler for summer wear. Patent leather shoes are practically non-porous because of the coating of varnish, and are not suitable for constant wear.

Rubbers Rubbers seem to be a necessary evil, and undoubtedly prevent many colds. The sandal variety which protects the soles sufficiently do not cause the feet to perspire so much as those that cover the entire foot. A liberal application of oil to the soles of shoes makes them much more water-proof. It is said that the vegetable and animal oils, such as salad oil and lard oil, are better for the leather than mineral oils.

PHYSICAL EXERCISE

The hygiene of physical exercise has been left until now because it is so inclusive. We all know of people who take little muscular exercise, yet seem to maintain a fair degree of health. Is muscular exercise absolutely necessary for health, and if so, why? We must remember that those who seem to get along comfortably with hardly any physical activity, are the exceptions. Many, very many more leading inactive lives are continually in a half-well condition. The mere act of sitting, standing and walking involves some muscular activity, and undoubtedly is the physical salvation of many who lead sedentary lives.

Necessity of Muscular Activity

As to why muscular activity is so essential to health, it is only necessary to point out that about half the weight of the adult body is made up of the skeletal muscles (those attached to bones). Further, the fat of the body is so much lifeless food material, the bones, except the outer layer, are practically lifeless, the connecting tissues, cords and tendons have comparatively few living cells, and the blood, aside from the corpuscles, consists of nutrients, wastes and water. There remain the glands, nerve tissue, and muscles, which constitute the active, *living* cells of the body. Of these the muscles comprise over three-fourths by weight. The really living part of the body, then, is made up largely of the muscles. They are the dominant tissues; for them the organs of digestion, respiration, circulation, and elimination do most of their work.

Developed Through Muscular Activity

In the child, muscular activity trains and develops the nervous system, the heat regulating mechanism, the heart, the lungs, the digestive organs, and the muscles themselves. The development of the bones, even, is largely dependent on muscular exercise. It is easy to see, then, why nature has made the life of the young one of constant muscular activity.

As no organ except, perhaps, a part of the brain, can be properly developed without muscular activity, so the full strength and activity of no organ or function can be *maintained* except through muscular exercise.

Reserve Power

An automobile with a half-horse power engine is able to run along without trouble so long as the road is smooth and level. Rough going, or a hill, however, would cause something to break or bring the engine to a dead stop. Reserve power is needed. In the same way we all need reserve power to weather the storms and overcome the rough places in life. We need to be able to "speed up" for a time, if necessary.

Effects of Physical Culture

The good effects given by physical activity are (1) the *training of the heart* — muscular exercise is the only natural way of increasing the number and power of the heart-beats, and so in maintaining a strong heart. (2) *Respiration* is increased and deepened during muscular activity, the capacity of the chest increased by movement of the ribs, the lungs ventilated, and all of the remote air sacs distended. (3) The *circulation* is made more rapid by exercise and rhythmic contraction and relaxing of the muscles, combined with deep breathing, are powerful aids to a good circulation, preventing stagnation in the blood vessels, and especially in the lymph vessels. This leads to better *elimination*. (4) The *heat regulating mechanism* is trained, for muscular exercise sets free much heat. (5) Moderate exercise has a favorable effect on *digestion*, and the movements of the abdominal muscles help *peristalsis;* exercise gives a keen *appetite*, and so helps digestion. (6) General exercise gives the body general fatigue and thus makes *sleep* natural and profound.

Human Machine Built for Work

The life of our ancestors involved considerable muscular activity, and the human machine is adapted to do a large amount of muscular work. Conditions of living have changed faster than the physical body could possibly change. We have essentially the same sort of a body as that of our prehistoric ancestors. It is a question whether the race will ever develop into one with weak muscles, small bones, and degenerate organs. Certainly the type of man would not be so high.

Two generations or so ago few people were troubled because of lack of physical activity. Nearly all received a sufficient amount in the course of their daily living. It is estimated that the amount of muscular work performed by the people of the United States has decreased about 75 per cent during the last twenty-five years. This great change is due to the introduction of all sorts of labor-saving machines. A generation ago wage earners did a great deal of laborious muscular work; now they accomplish more by sitting down and tending a machine which does the mechanical part and simply requires close watching. A corresponding change, although to a less extent, has taken place in housework. Running water, coal and gas stoves, sewerage have lessened greatly the amount of laborious work necessary.

Increase of Nervous Activity

There are certainly many advantages in this decreased amount of muscular work needed at present, but there are also disadvantages. With the decrease in manual labor, there has been an accompanying great increase in the nervous energy required in the life of to-day. Investigations have revealed the fact that city families on an average do not last more than three generations, and rarely more than two, without the addition of country stock. It is undeniably true that average conditions of life in a city are not so favorable to health as the conditions which exist in the country. This comes about through less muscular activity, less out-door life and more mental work, excitement and nervous stimulation. There is no principle in hygiene better established than that considerable muscular activity is necessary to counteract the evil effects of sedentary life.

Economy of Time

The objection is often made that "there is no time," but time *must be found*. The necessary physical activity takes no more time than that lost through illness. The diminished efficiency in work counts for more than time actually spent in muscular activity needed for health, to say nothing of the increased pleasure of living and joy that comes with abundant vitality. The amount of neglect and abuse that the human machine will stand is surprising, but physical sins have their punishment soon or late.

Physical self-sacrifice which may perhaps lead to invalidism or death is never justifiable. It is better for the children to receive less of the mother's time and still have a mother; better for the family to have less money than no provider.

Principles of Hyiegnic Exercises

There are certain essential principles governing the value of various forms of muscular activity. Exercise taken for its hygienic effect should involve a maximum amount of muscular work and a mininum of nervous energy. This is accomplished by exercising the large group muscles of the legs and trunk rather than the small muscles of the arm. A considerable amount of muscular work is done in playing the piano, but the amount of nervous energy expended is so great that the activity does not serve the purpose of hygienic exercise. Brisk walking, swimming, bicycle riding, golf, and the like, call for a considerable amount of work by the larger muscles, and for this reason are valuable hygienic exercises. The exercise should be sufficiently vigorous to increase the activity of the *heart* and *lungs*. It should be rhythmic rather than sustained, because such exercises are more pleasurable and less apt to cause strain. It should be enjoyable, if possible, and so rest the mind.

Undoubtedly the best kind of physical exercise is that involved unconsciously in one's daily occupation. A long walk taken to one's place of business or to do marketing is better than the same amount of walking done simply for the exercise. A situation "only a two minutes walk" from the markets, station, or street car is not always desirable for one's homes.

A mother with three or four small children, doing most of the housework, gets sufficient physical activity, perhaps more than enough. What she needs is a lessening of nervous strain through social relaxation and moderate out-door activity.

Housework as Exercise

If the clothing be loose, the shoulders kept back, the chin in, housework is a very good form of physical exercise (except that it is indoors), but if the work is not well organized, or if there is a wrong attitude of mind towards the work, the nervous strain and mental disquietude counteract the good physical effects. But there are many women able to keep two or three servants, whose physical (and mental) health would be far better if they were not so fortunate (?) and found it necessary to do more of the housework.

For those leading a sedentary life, then, some muscular activity outside the daily routine is necessary for health. No argument is necessary to prove that when possible exercise should be taken in the open air. The simplest, most universally available and a very desirable out-of-door exercise, is walking. It is estimated that a brisk walk of two or three miles a day, or its equivalent, is needed on the average to keep a man or woman in good physical condition. The walk must be rapid — between three and four miles an hour. The saunter of the typical "constitutional" requires little more muscular activity than standing. Walking on level city pavements produces weariness long before an adequate amount of muscular exercise has been done. The feeling of monotony and weariness does not come so soon if the walk is taken in good company. A cross-country walk up and down hill is usually delightful and most beneficial exercise. **Walking**

It is always better to walk with some object in view. Any physical exercise, taken simply for the exercise, although it may have some favorable effect, cannot begin to compare with that through which pleasure is obtained. Out-of-door *fads* involving considerable walking contribute greatly to physical well-being. Among such are botanizing, the study of birds, of butterflies, and all of the many forms of nature study, microscopy, geology, amateur photography, and the like. For the summer vacation there is mountain climbing. There is no way equal to walking of coming close to nature and getting at her wonderful secrets. Often exploration of one's own **Out-of-Door Recreation** city or town will yield much of interest in history and sociology. We are apt to neglect the things within walking distance.

Bicycling Bicycling has some advantages over walking, as it involves a greater distribution of muscular effort and so a greater total amount of work may be done without fatigue. It gives one a much larger radius and a wider range of interests. It is a pity that bicycling has now lost the vogue it formerly held, but it is just as enjoyable as ever, and machines are much less expensive. Automobiling and carriage riding give very little exercise. Taking the air is desirable, but not a substitute for physical activity. The rapid motion and fresh air may whet the appetite, and so tempt one to over-eat.

Horseback Riding Horseback riding is an excellent form of exercise, although not suitable for delicate women. It is expensive in the city, but not so in the country.

Rowing Rowing and paddling are exceedingly valuable. They are easily learned, pleasurable, and are usually associated with beautiful scenery and delightful surroundings. The movements involved in handling the oars and paddles are particularly adapted to the exercise and strengthening of the arms, back, chest and waist.

Swimming Swimming is a most fascinating and exhilarating exercise, especially when practiced in the ocean. It involves the activity of nearly all the muscles in the body, and tends to give a symmetrical figure and erect carriage. Because swimming is so enjoyable there is danger of remaining too long in the water, if the water is cold. If the body becomes chilled and the lips blue, much more harm than good comes from sea bathing. Swimming has the disadvantage of being difficult to learn after youth.

Of the out-of-door sports, golf seems to be the most generally valuable. It is not difficult for adults to acquire some proficiency, it is suitable for all ages; nearly all get the "enthusiasm;" it can be played nearly all the year round. In addition to the muscles involved in walking, there is moderate exercise for the arms, shoulders, back, waist and abdominal muscles. It occupies the mind completely, and most people find they can cover a distance in following the ball that would be impossible in a straight-away walk. Much or little exercise can be taken, as desired. **Golf**

Lawn tennis, also, has many advantages. It is interesting, adapts itself to mild, moderate, or vigorous exercise, and the movement involved in lifting the arms overhead, the frequent bendings and twistings of the waist, the running and jumping, make it a splendid all-around exercise. The disadvantages are that the game is difficult to learn after youth, and like golf it is not available for every one. **Tennis**

Croquet, archery, and the like, are mild forms of exercise, and although better than nothing, do not give robust people sufficient muscular activity for the time taken.

Winter Sports

It is more difficult to get sufficient out-of-door exercise in winter. Skating, snowshoeing, tobogganing are excellent, but they are usually possible only at irregular intervals and cannot be depended upon for regular exercise. Walking is always available, but somewhat less interesting. In winter we must resort to indoor games which afford valuable exercise, combined with recreation. Bowling is easily learned, and combines activity, with considerable enjoyment. Even though only one hand is used, there is little danger of one-sided development in bowling two or three times a week.

Gymnasium Games

Fencing has many advantages as an indoor exercise. It gives grace of movement, an erect carriage, agility and precision. The combative element makes fencing fascinating, and develops judgment, coolness and self-control. Basket ball is an excellent indoor game, but it is apt to become somewhat violent. Hand ball is a very good gymnasium game.

Dancing

Were it not for poor ventilation and late hours, dancing would be an admirable form of exercise, but in a close, dusty hall it is of doubtlul value. How ever, it is possible to have good ventilation and to stop at a reasonable hour.

Gymnastics

In addition to the indoor games there is an endless variety of systematic gymnastic movements which, if practiced regularly and judiciously under a trained instructor, bring about the very best results in the correction of faulty carriage and in de-

FUNDAMENTAL POSITION

veloping the muscles, as well as in the maintaining of good physical condition. We are not concerned here with the large subject of physical education, but are more interested in gymnastics from the hygienic standpoint. While the best results are obtained in gymnasium classes under a trained instructor, it is possible to receive much good by practicing free movements, without apparatus, at home. For this purpose a few selected typical movements are described and illustrated here for the benefit of those who are willing to give ten or fifteen minutes every day to maintaining and improving their physical condition.*

Home Exercise

There are two series of exercises. Those in the first series are simple and not very vigorous; those in the second series—in brackets—are more vigorous, and should not be tried until those in the first series have been practiced for several weeks. All the exercises in the two series may be taken by vigorous women after a few weeks' practice.

The figures indicate the counts that correspond to the movements in each exercise. It is well to count while doing the movements.

Try to imitate the positions in the illustrations as accurately as possible. Practice each exercise about 8 counts at first and increase gradually to 32

*Exercises designed and photographs furnished by Professor G L. Meylan, Director Gymnasium Department, Columbia University.

EXERCISE 1.

One.—Bend head backward.
Two.—Return to position.

EXERCISE 2.

One.— Bend arms. Raise heels.
Two.—Return to position.

counts in five or six weeks. The rhythm should be rather slow at first, and increased gradually up to moderate rapidity. The total amount of work is increased by doing the exercises rapidly.

Avoid doing the exercises in a jerky manner. It is well to stand before a mirror while learning them, to make sure that all the positions are taken accurately.

Dress and Ventilation

Have the windows wide open, dress loosely, take three or four deep breaths and begin the exercises, being careful to take them in the order given. The breathing should be deep and regular while doing the movements. Follow the exercise by a cool sponge bath and a vigorous rub with a coarse towel.

EXERCISE 1

One—Bend head backward, with chin in, hands on hips, and shoulders low (inhale as head goes back).
Two—Return to position.

EXERCISE 2

One—Arm bending and heel raising.
Two—Return to position.
One—Raise heels.
Two—Lower heels and raise toes (rest hands on back of chair if necessary to maintain balance).

EXERCISE 3.

One.— Raise arm's sideways and bend the knees.

EXERCISE 3

One—Raise arms sideways and bend knees.

Two—Return to position.

One—Raise arms sideways (and bend knees as far down as possible).

Two—Return to position.

EXERCISE 4

One—With hands on hips and feet apart, bend sideways to right.

Two—Straighten up.

Three—Bend sideways to left.

Four—Straighten up.

(Same as preceding exercise, only with hands back of neck.)

EXERCISE 5

One—With arms bent and feet apart, bend forward with back straight.

Two—Stretch arms overhead.

Three—Bend the arms.

Fourth—Straighten up.

EXERCISE 6

One—Lift right knee high.

Two—Replace right leg on floor and lift left knee immediately (stationary walking in moderately quick rhythm).

One—(Same as previous exercise, only with knees straight, supporting the hands on back of chair if necessary.)

EXERCISE 4.

One.— Bend sideways, hands on the hips.

EXERCISE 5.

Two.—Stretch arms over head after bending.

EXERCISE 6.

One.— Lift knee high.

EXERCISE 7

One—Bend arms.
Two—Stretch arms overhead as high as possible.
Three—Bend the arms.
Four—Stretch the arms horizontally sideways.
Five—Bend the arms.
Six—Stretch the arms down to sides.

EXERCISE 8

One—With hands on neck, twist to right (try not to move below the waist).
Two—Return to position.
Three—Twist to left.
Four—Return to position.

EXERCISE 9

(*a*). *One*—With arms bent and feet apart, bend down and try to touch the floor (knees straight).
Two—Straighten up.
Three—Stretch arms overhead.
Four—Bend the arms.
(*b*). *One*—From fundamental position, bend the arms.
Two—Jump to position feet apart, and at the same time bend down and try to touch the floor.
Three—Straighten up, with arms overhead.
Four—Jump to position.

EXERCISE 7.
Two.— Stretch arms over head.

EXERCISE 8.
One.— Twist to the right.

EXERCISE 10

(*a*) Place hands on a chair.

One—Reach back with right foot as far as possible.

Two—Place left foot beside right foot and maintain body straight.

Three—Return right foot.

Four—Return left foot.

(Same as preceding exercise only move both feet back at the same time.)

(*b*) Lie on the floor with hands back of neck.

One—Raise right leg as high as possible with knee straight.

Two—Lower right leg to floor.

Three—Raise left leg.

Four—Lower left leg.

EXERCISE 11

With hands on hips and heels raised, jump up and down with feet together.

(Same as preceding exercise, only jump with feet apart and together alternately.)

EXERCISE 12

Run in place, lifting the heels high up behind.

(Same as preceding exercise, only lift knees high in front at each step.)

EXERCISE 10.

Two.— Place left foot beside the right, keeping the body straight.

EXERCISE 14.

One.— Raise arms sideways, palms down.

EXERCISE 14.

One continued.—Turn hands over, bend head back, take deep breath.

EXERCISE 13

One—Raise the arms forward—upward as high as possible while taking a deep breath.

Two—Bring arms down sideways while breathing, breathe out.

EXERCISE 14

One—Raise arms sideways to horizontal, palms down, turn hands over with backward bending of head and taking a deep breath.

Two—lower the arms, return head to position and out.

Exercise Not All

Although the practice of the foregoing or other home gymnastics will bring about a great improvement in health, attention must, of course, be given to correct carriage of the body, standing or sitting, proper method of breathing, wholesome food, and so on. *Fifteen minutes gymnastic work will not counteract the effect of the infringement of all other rules of hygiene through the rest of the twenty-four hours.*

Monotony

The great drawback to home gymnastics is that the work grows monotonous after a week or two, and some strength of mind is required to keep up the daily practice. However, the exercises may be varied, often by out-of-doors exercise, or light apparatus may be used. From the hygienic standpoint it does not matter much how the physical activity is obtained so long as it *is* obtained daily. Even if it does become monotonous at times, the results justify the effort. Care of the body in general is not particularly interesting, but habit makes it a matter of course. Practicing scales on the piano is irksome, but it is the only means to a desired end; so *physical activity is the only means of acquiring and maintaining a high degree of personal health.*

PERSONAL HYGIENE

Part III

Read Carefully. A number of personal questions are asked in connection with this lesson, not for the information of the instructor, but to bring the matter home to you, and to enable you to clarify your thoughts by writing them out. Answer fully and leave space between answers.

1. Give a brief account of your own health history with the probable reason for any periods of lack of health.
2. (a) Why is the care of the nervous system so important? (b) How are strong nerves developed, and how maintained? (c) Why is sleep necessary? How much do you find that you need?
3. Why is it important that good personal habits and habits of work be formed early? (b) What is laziness?
4. What are the important points in the care of the teeth? How should your own teeth be cared for?
5. (a) What determines the amount of food required? (b) Which do you consider the most important (1) the chemical composition of food, (2) the manner of eating, or (3) the way the food is cooked and why? (c) What are your own food problems?

6. Why is it desirable to drink a considerable amount of water? About what quantity of water or other liquids do you take daily?
7. What factors determine the effects of baths? Do you find a daily cool bath of any kind beneficial?
8. Give the principles governing (a) health of the hair, (b) health of the complexion.
9. What are "colds?" How are they brought on, and how prevented? How should a cold be cared for?
10. What can you say of the hygiene of clothing? (b) To what extent does the question of health govern the selection of your own clothing?
11. Why is the care of the feet and the selection of shoes of importance?
12. What reasons are there for believing that a certain amount of physical activity is necessary for health? Answer fully.
13. Give the principles governing the good hygienic effects of exercise.
14. What forms of physical activity are available for you at the present time?
15. In the care of your own health what tendency or weakness calls for special attention? What can you do to overcome such fault?

16. Make out an hourly schedule for yourself, giving hours for work, recreation, eating, and sleep, and allowing some time for the care of health — a schedule which you could easily follow, say for 350 days in the year.
17. Give your opinion of the duty of health.
18. What is your feeling in regard to the taking of medicine (meaning drugs) for minor ailments and without a physician's orders?
19. Which would you say was greater, the influence of health of mind on health of the body, or the influence of the health of body on health of mind?
20. Draw up a set of good resolutions relating to your personal health. (A certain place is said to be paved with good intentions, but "heaven is vaulted with them.")
21. Have you read any of the books recommended or others in connection with this lesson?
22. What questions have you?

Note.—After completing the answers, sign your full name.

ETHICS OF HEALTH; OR HEALTH A DUTY

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UNITY OF THE BODY, MIND, AND SOUL

The attempt to classify man under the headings of the physical, mental, and moral is misleading. No clear distinction exists or can be made between these three conditions or attributes. The complete unity of man is one of the most striking and significant facts in nature. The interdependence between different organs, functions, and faculties is so close and vital that what affects a part of the organism affects all of it, and the indirect influences frequently are so subtle and far-reaching as to confuse the best of physicians, physiologists, and psychologists.

The nervous system is as genuinely physical as bones and muscle. The brain is a physical structure — a part of the nervous system — and mind is a function of the brain; so that mental activity is essentially as physical a process as digestion, muscular action, or the circulation of the blood. Mental activity is hidden away within the brain in the skull, but the only way in which *mental action* can be expressed to others is through *muscular action* in speech, or writing, or the expression of the face, or the rest of the body.

Moral qualities have to be expressed in a similar way. In fact, "moral" refers to the attitude of the person in relation to others in purpose and conduct. Moreover, the moral tone and quality of the individual depends vitally upon physical structure, functional health, and bodily vigor.

The person who has dyspepsia or other physiologic disorders is apt to be depressed mentally; lacking in energy to do things, and frequently morbid in conscience. The vicious, criminally minded, and immoral have often been found to be deformed or diseased, and incapable, therefore, of meeting human responsibilities. "Weakness is often akin to wickedness."

In many cases no clear distinction can be made between weakness of body, mind, or soul. Some real and other apparent exceptions to this statement do not disprove the fact, or lessen the importance of the general principle. The importance of the so-called physical, then, is to be estimated in its relation to the highest and best faculties of the human being which depend upon and express themselves through the human organism.

INHERITED CHARACTERISTICS

More extraordinary than the unity of the individual human being is the continuity of human life. Heredity is a vague and comprehensive term referring to all the influences affecting the child up to the time he is born, coming from parents, grandparents, and all the ancestors back to the beginning of living things, from which the child is descended. The number of bones and organs; the shape of the body; the relation of its parts; similarity in color of hair; expression of face; even in gesture and gait, are all inherited in various degrees by child from parent.

More subtle characteristics in temperament, mental and moral qualities seem to be handed down in families. Individual deformities due to accident or injury are not inherited, and many of the popular beliefs regarding prenatal influences are without foundation in fact.

TENDENCY IN HEREDITY

Different from the inherited characteristics already briefly alluded to are the organic influences transmitted directly from parent to child, and of much hygienic importance. Children are rarely stronger and healthier than their parents, unless special attention is given to physical education. Much more frequently where there is a real difference, the children are less robust and more inclined to disease. Tendencies to degeneration and disease are much more apt to be transmitted than the tendency to improvement of any kind.

The diseases due to immorality and vicious living are most apt to be transmitted to children. Tendencies to gout, rheumatism, some diseases of the heart and other vital organs, and the various nervous disorders are not infrequently transmitted from parent to child. Tuberculosis — either of the lungs or of other parts of the body — is almost never transmitted directly, but the tendency or susceptibility to tuberculosis — transmitted to the child by the tuberculous parent — is one of the most definite and serious facts in human life.

The fundamental and inalienable birthright of the child is that he shall be born of parents and earlier ancestors who have lived their lives with an intelligent and conscientious sense of their responsibility to their possible descendants.

RIGHT LIVING

The science of healthy living is to-day well understood by a few (physicians and others), but in general and in relation to its intrinsic importance, hygiene rceives less attention than any other subject.

More serious yet is the fact that in the care of health, conduct falls so far short of the knowledge which people have upon this subject. Nowhere in the realm of human affairs is there a greater gap between theory and practice, between knowledge and action, than in the matter of hygiene. It is claimed, and probably is true, that human life is on the average longer to-day than it was a few generations ago. Nevertheless, the human animal is the least sound organically of all the species of living things — i. e., less free from disease, and further from the best health and power possible if adequate attention and care were given to health.

INSTINCT VERSUS INTELLIGENCE

In nature, under the guidance of instinct, the wild animals live healthy lives and transmit to their young the capacity for the highest degree of strength and health. They strive for the best conditions of life possible to them, and in so doing work unconsciously for the best health of their offspring and the race to which they belong. Thus does nature insure a fine quality of life among her creatures. The first effort of the animal is for self-preservation, although at times life is sacrificed for the sake of the young. The weak and injured are left to perish, and there are lacking in the animal world many of the finer and nobler human attributes, but a high standard of health in the species is maintained.

Human beings are not guided so surely by instinct as are the animals, nor are they usually as healthy and strong as the creatures in nature. This is due to the fact that intelligence, reason, and conscience do not impel civilized men and women to lead as healthy, wholesome lives as the animals live under the guidance of instinct in nature. Human beings are not yet wise enough to realize in practice the true value of the highest physical efficiency and their responsibility for it

DUTY TO POSTERITY

Each human being has received from his ancestors life and a certain capacity for health and strength. The people of this generation must be the parents of the next, and thus each generation is the connecting link between all the life of the past and all the life of the future. This responsibility imposed by nature of receiving life from the past and handing it on to the future is a racial obligation; is fundamental and must receive much more intelligent and rational human care than has yet been given to it.

The duty to be well and strong, to maintain the best possible standard of organic soundness, to improve one's human power and efficiency to the highest possible pitch, is owed to one's self, to one's ancestors, to one's contemporaries, and vastly more to one's children, and to the children's children in coming generations. Human life and health are not simply individual possessions to be controlled solely or primarily for immediate ends; to be sacrificed for personal caprice or even ambition. They may not contribute *alone* to individual achievements, however worthy such may be or seem. They may in justice be used for the present only so far as such immediate use does not detract from but rather enhances their value for the future offspring whose chance for life and health depends upon their present treatment and care. A clear understanding of this great continuity of life and its implications will modify human thought and conduct in manifold ways.

CIVILIZATION AND HEALTH

Human demands and interests to-day are much more numerous and confused than those of the animals, or even those of primitive man. Civilization rapidly increases the complexity of the human environment and multiplies to confusion the demands upon time and strength. Many of these lead away from, and not a few are in direct opposition, to the laws of rational and wholesome living.

Instinct guides the animal wisely in a multitude of ways, while man too often ignorantly or heedlessly stumbles through life, using haphazard, and perhaps destructively, the precious heritage of the ages.

SELFISHNESS

Human selfishness causes much of the irrational and unhygienic living and often prevents obedience to the laws of health which are well known. The objects for which people struggle are often superficial in value, and if attained are frequently purchased at the expense of health and perhaps of other values even more important than health in our human world. Money beyond what is needed; fashionable houses; furniture and clothing beyond that which is required for the highest living; fame in the commerical, political, social, or scholastic world beyond what is rational;

all these and other motives impel many beyond what is their reasonable best at the expense of other and more important values. But worse than the penalties involved for the adult person through unwise action are the injuries done to the health and the future of children through the folly and ignorance of parents.

It seems of slight moment comparatively to sacrifice some sleep, some rest, some healthful exercises when human affairs crowd; or to eat more than is needed, or a dish less wholesome, that the taste may be gratified. These errors are usually less serious for the grown person than for the child, but they are all wrong in principle, and they are often due to some degree of selfishness.

PROTECTION OF HEALTH PARAMOUNT

Health is not the highest or finest value in human life, nor is it the chief end of living, but health is absolutely essential to the best success in the life and work of the individual, and it is even more important for the welfare of human society and of the race. The child's health should be sacrificed to nothing else by the parent, the teacher, or the community; and in adult life health should be given for other things only very rarely. This protection of health should not be given in any selfish way, nor should it conflict in child or adult with the expression of human courage, self-sacrifice, and devotion to the needs of others.

The risking of health or life even, in the effort to help or save a fellow being in emergency, must always be considered higher and finer conduct than mere self-preservation or care. However, this unselfish devotion of life and strength to others is not a real exception to the rule of health preservation, but emphasizes the importance of considering health care a *duty*, in order that one may be most efficiently prepared for life emergencies.

In relative value the life and health of the child is more important than that of the parent because he has more of his life ahead with its undeveloped possibilities, and the child of to-day will be the parent of the children of the next generation.

This great racial obligation, if recognized, must give each individual a stronger reason and an inspiring motive for the best care of health which human science may show to him.

"NO MAN LIVETH TO HIMSELF ALONE"

The short-sighted and spasmodic attention given to health, ordinarily, leads people to guard their physical welfare as if it belonged solely to them; as if no one else, at least beyond their immediate family and children, had any claim upon it. Parents usually foster their children's health as if the world were to end with the child. This well intended but often misdirected attention frequently makes the child selfish and too self-conscious. This protection of health for one's self and for the children under one's care — whether as parent or teacher — should constantly aim to make the individual more capable and effective in doing for others. In this way, the care of health, instead of being a self-centred process, may become an impelling factor in higher and better living.

IDEALS IN LIVING

To maintain the highest standard of health possible to each individual involves an unselfish, intelligent devotion to high ideals of living and a sacrifice of present indulgences to future well-being. Instinct, feeling, and appetite are useful indications, but they must be controlled and guided by reason and judgment. The individual who eats at regular intervals, in suitable amounts, the portions of food intelligently adapted to his needs will in the long run, and frequently from the beginning, have better health and get more pleasure from eating than the person who consumes without judgment what he happens to crave. The person who takes muscular exercise rationally will enjoy movement, while the individual who neglects wholesome activity soon loses the pleasure of exercise. Thus does nature reward those who obey, and punish those who violate, the laws of life and health

Human appetites and desires bring genuine satisfaction only to those who control instinct and passion for the welfare of the family, of society, and the race.

Happiness here, as in other phases of life, cannot be attained simply by pursuing it for its own sake. True happiness is simply the pleasure and satisfaction accompanying wise conduct.

Consistent living will bridge the gap between the knowledge and practice of hygiene, but it is important to remember that people will not live consistently simply through the knowledge of the laws of health. Too many other goals in life appeal to the mind and ambition of the individual.

A rational consistent care of health is a fundamental and most important duty for each one, and the human conscience must be aroused to the importance of this duty. *The duty to health must become a part of one's religion.* The conscience must be touched, the heart thrilled, and the imagination fired with a compelling devotion to this ideal of living which will hold the individual to a care of health, which will be in accord with the more immediate and the large relations and responsibilities.

THE USE AND ABUSE OF DRUGS

By H. M. Lufkin, M. D.

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The teaching of medicine in the earliest periods of recorded history was associated with the offices of religious worship. The little known of medicine, confined to the priestcraft, was jealously guarded and its administration surrounded by the mystic rights and superstitious practices common to an age when the operation of natural laws was ascribed to the occult. The dawn of the Christian era witnessed a gradual decline of the priestly influence in medicine and independent philosophers and scholars, or "savants," made their names famous by their medical teaching. Through the intervening centuries progress in medicine has kept pace with the other sciences. Schools and dogmas have risen, attained more or less fame; have contributed perhaps something or nothing to the sum total of accepted fact, and sinking again into oblivion, have been followed by other schools and dogmas.

Until the advance of the related sciences made research productive, medicine remained more an art than a science. Chemistry, physics, botany, experimental physiology, and biology are the handmaidens of a broad and enlightened profession. Growing out of the general advance, and as a result of the accumulated knowledge, one great and illuminating fact stands out at the present time, and that is, that the *prevention* of disease is easier to effect than its cure.

"Health is that condition of the system in which all the organs of the body and mind act in harmony and without sensible disturbance." It is a truism that, "In the health of the people lies the strength of the nation."

The public health is the sum total of that of all its individuals. Hence, the individual has the responsibility of considering himself as an independent unit and as a part of the body politic. Aside from the personal discomfort of ill health he must consider his influence upon the community at large. Hence, enlightened governments provide and administer laws safeguarding the public health.

CLASSIFICATION OF DISEASES

Diseases may be broadly classified as *functional* and *organic*. Functional diseases are characterized by the arrest of a function of a part or all of the cells of an organ engaged in some essential duty involving the integrity of nutrition and elimination. So long as the disorder is purely functional, such cells or groups of cells do not undergo permanent structural change. When a structural change takes place in the cell or group of cells constituting an organ, just so far has functional disease given way to organic disease.

A healthy functionating organ is capable of resisting, by its natural powers, surprisingly long-continued and often serious attacks upon its integrity. Such attacks commonly stand for the violation of well-recognized laws of health and may be referred to ignorance, inadvertence, weak will power, or unwholesome environment or occupation.

If the disturbance has not been too acute and is recent, the proper application of the rules of hygiene which shall correct the particular fault — get at the *cause* — is all that is necessary to a cure. It must be remembered that the impairment of one function sets up a "vicious circle" which operates on other functions, this in turn vitiating the natural physiological resistance of the fluids of the body to the invasion of infection. In this way, always insidious and at first scarcely noticeable to the victim, do the cells of the body fall prey to the degenerative changes which constitute acute and chronic organic disease.

The dividing line between functional and organic disease is not always to be recognized.

An organ may be partially destroyed and yet carry on its function in a fairly satisfactory fashion. A part of the lung may be destroyed, and yet nearly perfect health is maintained through the capacity of the rest of the organ to perform the function of that destroyed. One kidney will often do the work of both when either has been removed. Sometimes an organ may be completely removed, and yet analogous structures carry on its work, as has been proved by the total extirpation of the stomach.

SYMPTOMS

A disordered function or disease is made manifest through abnormal sensations or feelings, called symptoms. Symptoms are called *subjective* when they are felt by the patient; *objective* when they are only to be known by the observation of the patient by another person.

Headache, pain, fever, are subjective symptoms and warn the patient of a disordered system. Albumen in the urine, the character of the pulse, are objective symptoms. It is the sum total of these which enables the physician to diagnose the abnormal condition.

DRUGS AS CURATIVE AGENTS

From the days of mysticism in medicine, to the present time, it has been sought to relieve symptoms and so cure disease by the administration of drugs. To find the "Elixir of Life" was one of the great goals of the alchemists.

The first use of drugs was purely empirical. That is, if the patient recovered by the use of a drug, it was assumed that the drug caused the cure, and was administered in similar cases.

Much valuable information has thus been obtained and incorporated in our materia medica. The mode of cure, the effect upon the tissues or functions as such, were not known. A notable example of the large empirical use of a drug was that of quinine upon its introduction. The curative uses of quinine are now known to be very limited.

Certain other drugs, like mercury and salicylates attained to the dignity of so-called specifics, *i. e.*, in certain affections their curative virtues were considered universal. This class of drugs is very limited.

HOW DRUGS ACT

A second class are the drugs whose action has been studied upon animals and their power over the various functions of the body noted, and this action applied to the modification of function to meet the requirements of disease. This class is very large, and its use constitutes the bulk of prescribing to-day. As knowledge of drug action has become more exact, empiricism has steadily given way to the modern prescription — a single drug, directed to a definite purpose. The so-called "shot-gun" prescription involved the combination of many drugs in the hope that Nature's selective power would supply the deficiency of the prescriber. It is now happily seldom seen outside of patent medicines. The use of drugs in the physiological sense, is the most exacting method of prescribing for the sick. It presupposes a clear knowledge of the effect of the drug upon a given function and system at large

HOW DRUGS ACT. (PHYSIOLOGICAL ACTION)

The most commonly used drugs are anodynes — pain-relieving drugs. Opium and cocaine, antipyrine and acetanilid are examples. Opium acts through its influence upon the circulation of the brain, producing first an afflux of the blood to that organ and then a decrease of the same, through the nerve centers controlling the caliber of the blood vessels (vaso-motor nerves). In the absence of undue excitability of the nerves, there is produced a condition resembling normal sleep. In large doses its action is profound, producing the following effects: Profound stupor, complete anasthesia, paralysis of the respiratory centers, paralysis of kidneys, and finally from habitual use, profound changes in nutrition and in the psychic centers, resulting in emaciation, moral perversions and imbecility. Such drugs have a far-reaching effect, and are common ingredients of patent medicines.

Stimulants are such drugs as have for their primary action the stimulation of all the functions of the body, or exert their chief influence on some special function.

Alcohol is used as a general stimulant, while strychnine, belladonna, cannabis indica, digitalis, are examples of special stimulants, each acting through one or more nerve centers, yet all are rank poisons, and destructive, not only of function, but of life, in excessive doses.

Hypnotics or sleep-producing drugs. In this class may be included some of the narcotic drugs, such as opium and cocaine. They operate through direct influence upon the brain. Chloral hydrate is the standard by which these drugs are judged. A pure hypnotic produces sleep, but does not relieve pain. They have secondary actions, which make their use hazardous by the unskilled.

Diuretics stimulate the function of the kidneys.

Diaphoretics act upon the sweat glands through their nerve supply, increasing perspiration.

Cathartics promote loose evacuations of the bowels, a class of drugs widely exploited by patent medicine vendors. They act in various ways, through stimulating the flow of bile, by stimulating the muscular walls of the bowels, by stimulating the secretion of the intestinal glands. Cathartics are widely used, and seldom with advantage, except for brief periods of time, and then should be selected for the special condition which calls for their use. The secondary effect of most cathartics is to intensify the abnormal condition they are used to overcome.

There are many other classes of drugs, and in each class are many drugs whose actions, in the main, are similar, yet whose differences render the choice a matter of knowledge and discrimination impossible for the layman to acquire.

There is not a function which can not be altered by drug action. There is hardly to be found a diseased function which may not be influenced for the better by the *wise* use of a drug. The converse is true. There is no drug, unless inert, which does not in some degree change a function, by acting upon one or more organs, either directly through its chemical activities, or its less well-understood, though more common, influence upon the tropic (nutrient) or other nerve centers. Not uncommonly drugs have a double action, and while beneficial in one direction are positively *harmful* in another. Yet such a drug may have its evil influence neutralized or balanced by one of opposite action combined with it. A group of drugs much used of late are good pain relievers or anodynes, yet they have a powerful depressing action upon the heart. A simple heart stimulant, combined with such drugs, eliminates, when judiciously used, the evil effect, while the desired effect is not impaired.

In this way many valuable combinations are brought about, greatly enlarging the field of scientific therapeutics. This seldom involves the use of more than one or two drugs. Often the happiest effects may be brought about in this way, and helpful action sustained over long periods.

OTHER METHODS

There are other methods of using drugs. The homeopathic method is the opposite of this physiologic.

If a remedy creates certain morbid manifestations in the healthy individual, it is administered for a similar morbid state when the result of disease. It is essential that the dose should not be sufficient to set up its physiological action. Ipecac causes, in large doses, excessive nausea and vomiting. In small doses it relieves nausea and vomiting.

Organotherapy. This branch of therapeutics, although in its infancy, promises large results. It is based primarily upon the theory that the secretions of certain organs of the body, by becoming deficient, take from the system an essential element which is necessary to the general well-being. The absence or disease of a small gland in the neck (thyroid), whose function was not known, was observed to be a constant accompaniment of a certain disease ending in insanity.

The same gland from a healthy animal was found to supply the deficiency and cure the disease when taken in small quantities. Investigation has proved the value of such remedies in a wide variety of diseases.

All use of drugs involves the wisest discrimination, based upon thorough familiarity with drug action, and with the organic structure and function of the human system, from the minute cell to the complete animal. This must be combined with knowledge of the condition and peculiarities of each patient.

DRUGS MAY HELP, NATURE CURES

While many drugs are capable of destroying cell life, there is yet to be known a drug which *can create* *a new cell.* The power which creates the new cell, the vital force, may be favorably or unfavorably influenced by drug action. Or, the same drug may work harm or benefit, according to the dose.

Some of our most useful drugs, in which small doses have an effect upon the system of great usefulness, are destructive to life in larger doses. A drug which stimulates as its primary effect either over-stimulates on continued use, and thereby may permanently weaken, or tolerance is established, and increasing doses are required to keep up its effect.

The proper use of drugs, then, is to give some organ or organs of the body temporary assistance, and thus enable them to resume their normal functions Nature *only* can effect a lasting cure.

The prescribing of drugs for diseases and their symptoms has become systematized, and through their use many lives have been lengthened, at the same time the limits of their usefulness as curative agents are becoming better established, so that useless drugging, a practice until recently almost universal, is giving place to other rational methods of cure. For example, the use of electricity, massage, baths, open air and feeding (the most successful for tuberculosis); the wide scope of surgery which has invaded the field of medicine in many affections (epilepsy, ulcer of stomach).

The public attitude is well illustrated by this incident: A dressmaker called for relief from a long train of nervous and dyspeptic symptoms. Her case was carefully reviewed, and she was advised as follows: "Join a ladies' gymnasium class. Take general exercise for an hour, in addition to the class lesson, each day. Eat only such food as your appetite demands. Take a brisk walk out of doors before each meal. Report progress in a month." There was a moment of some embarrassment, as the lady felt that the interview was ended. "But don't I get any medicine?" "No." "Well, you are the most peculiar doctor I ever heard of." She paid the fee with the remark: "Well, I hardly know what I am paying for." Yet in a month the patient returned a reformed, healthy woman, a result which probably could not be attained with the wisest use of drugs. This is the almost universal attitude at the present time, and the general public needs to be educated in the lesson taught by the incident.

THE ABUSE OF DRUGS

There is no greater responsibility to be assumed than that of advising the sick. It weighs heavily upon every practitioner, yet this great responsibility is shouldered with eagerness, not only by the sick, but by his neighbors. Where the trained scientist would hesitate, the worse than untrained layman is eager.

This general attitude is a relic of the days when ignorance of drugs was universal. No drug which has any virtue as a medicine can be taken haphazard with impunity. If not directed accurately to its appropriate purpose within the system, it is an added burden to the sick organ, or is directly destructive of function, and handicaps Nature's effort at a cure.

Widespread harm arises from the misuse and abuse of drugs. That many survive such practices is true, but what of the many who are sacrificed? The neighbor or friend recommends only such patent medicines or other drugs as have come to his limited attention. He can know nothing of the disease, or of the drug's action. The laws of most states prescribe the amount of knowledge a physician must have before he may practice his art. Nor will his word be accepted, but he must pass an examination on all branches of medicine. The people are thus safeguarded from incompetency. Yet there is no law which protects the sick from the gratuitous unskilled counsel of his friends.

The law compels the druggist to attest full knowledge of the drugs he dispenses, yet permits the public to buy and use secret nostrums or patent medicines of the most vicious and demoralizing types. No law can prevent a willing victim from accepting advice, or the giver from giving advice. A proper appreciation of personal hygiene and the self-respecting application of the same will teach the folly of the indiscriminate use of drugs.

PATENT MEDICINES

The pure food law, which contains a clause on patent medicines, will perhaps ameliorate this to a limited extent. It requires a label bearing the per cent of alcohol, morphine, opium, cocaine, heroin, chloroform, cannabis indica, chloral hydrate or acetanilid on all sealed packages. A law which would limit a nostrum to its legitimate uses would be of service. The nostrum itself, in the vast majority of cases, is not only of little or no curative value; it is demoralizing to the patient.

Even more widespread is the harm brought about by the method of the advertiser in impelling its use by the sick. First, by lying in the most unscrupulous way about the effects and cures of his nostrum. Second, by false teaching, magnifying the least important and most common of morbid sensations to be the serious disease which the nostrum will cure (a backache means Bright's disease). Third, the creation of imaginary disease by suggestion, creating hopeless wrecks of their victims. Fourth, the immoral influences upon the unformed wills and minds of the young.

These are evils apart from the promiscuous effect of misused drugs. The postoffice department, by excluding from the mails such publications as lend themselves to this sort of iniquity, would soon bring about amelioration of this evil.

COMPOSITION OF SOME PATENT MEDICINES

CONTAINING A LARGE PROPORTION OF ALCOHOL

Peruna, 28%.	Ayer's Sarsaparilla, 26%.
Paine's Celery Compound, 21%.	Hood's Sarsaparilla, 18%.
Lydia E. Pinkham's Vegetable Compound, 20%.	Hostetter's Stomach Bitters, 44%.
	Burdock Blood Bitters, 25%.

CONTAINING MORPHINE (OPIUM)

Mrs. Winslow's Soothing Syrup.	Dr. Bull's Cough Syrup.
Kopp's Baby Friend.	Fenner's Cough Honey.
	Chamberlain's Colic Remedy.

CONTAINING COCAINE

Birney's Catarrhal Powder.	Agnew's Catarrh Powders.
Dr. Cole's Catarrh Cure.	I. C. R. Instant Catarrh Cure
Gray's Catarrh Cure.	Prentzinger's Catarrh Balsam
Crown Catarrh Powder.	Compressed Voice Tablets

CONTAINING ACETANILID

Orangeine	Cephalgine
Bromo-Seltzer	Dr. Davis's Headache Powders.
Antikamnia	Anti-Headache.
Royal Pain Powder.	Miniature Headache Powders.
Megrinine	Nerve Ease.
Ammonol	Klein's Kold Kapsules
Salacetin	Dr. Holbrook's Kold Powders.
Phenalgin.	

Note.—The above list is taken from the reports of the Massachusetts State Board of Health, and the articles on "The Great American Fraud," published in Collier's Weekly on October 7, 28, November 4, 18, and December 2, 1905, and January 13, February 17, April 28, July 14, August 4, September 1 and 22, 1906.

When the National Pure Food Law becomes operative, after January 1, 1907, it may be expected that the composition of some of the patent medicines will be changed somewhat, as the law requires that a statement be made on the label of the quantity of certain drugs.

PUBLIC HEALTH IN THE UNITED STATES

By Maurice LeBosquet, S. B.

Paper read at the Lake Placid Conference on Home Economics, September, 1906.

A few months ago, in the interest of our students, we began investigations of the work of the National and State Health Departments. If hygiene is the chief basis of home economics, the members of the Lake Placid Conference may be interested in the following report, which is by no means complete.

After some little inquiry, the health department of the central government was found to be a part of the Miscellaneous Division of the Department of the Treasury, entitled Public Health and the Marine Hospital Service. Surgeon General Walter Wyman is at the head of the Department which has charge of the marine hospitals, preventing the spread of epidemics, quarantine service and the public health. In 1905 this Department spent over a million dollars. Apparently only $20,000 was spent directly for sanitary inspection in the United States, the remainder being spent for maintaining stations and hospitals, in quarantine work, and in Cuba, South America and foreign ports.

The Board consists of 118 officers, surgeon generals and assistant surgeons, which maintains a hygienic laboratory in Washington for the examination of antitoxines, serums, etc. The Laboratory is also investigating various public health problems. The Yellow Fever Institute is continuing its investigations of yellow fever under the charge of the Public Health Department, and investigations in leprosy are in progress in the Hawaiian Islands. Other investigations are also in progress on cholera, the plague, hook-worm disease, prevalent in the southern states and Porto Rico.

Under the law of 1902 establishing the Department, the Public Health officers are authorized to hold an annual conference of the State and Territorial Health Boards in Washington. Four conferences have been held.

PUBLICATIONS

The annual report of the Department of Public Health and Marine Hospital Service—a book of about 500 pages—is made up chiefly of statistics and departmental reports, but contains a number of articles of interest. It is sent out pretty generally. The Public Health Reports are published weekly and are purely statistical, containing records of death throughout the United States.

The Hygienic Laboratory issues bulletins of technical and scientific interest. The Yellow Fever Institute has published fifteen technical bulletins relating to yellow fever.

The department issues no popular bulletins for general distribution.

Apparently the U. S. Department of Public Health is ably and efficiently administered. We know that it has done wonderful work in Cuba, the Philippines Porto Rico, and at the Isthmus of Panama. It stands ready to help out state authorities, as in the case of the recent epidemic of yellow fever in New

Orleans. The United States Department of Health should be given the credit of the discovery that yellow fever is transmitted only through the bite of the female of a certain variety of mosquito, and some of the credit for proving that malaria is transmitted in the same way by another species of mosquito.

STATE BOARDS OF HEALTH

A letter was sent out to all the prominent states asking for their last yearly report and any bulletin which they had for distribution, also that our name might be placed on the mailing list to receive future bulletins. Twelve annual and biennial reports were received, and a number of them contain interesting articles on a great variety of subjects.

In addition to the annual and biennial reports, which presumably all the State Boards of Health publish, quite a number of the state boards publish monthly, bi-monthly, or quarterly bulletins. We have received the following:

Maine—Bi-monthly bulletin, July, 1906, special tuberculosis number.

New Hampshire—Quarterly bulletin relating to pure food, sanitation, communicable diseases.

Vermont—Quarterly bulletin, special articles, pure food reports.

Massachusetts—Monthly bulletin, food and patent medicines analyses and reports of dairy inspection, mortuary statistics, reports of epidemics, showing causes.

New York—Monthly bulletin, chiefly statistics with brief articles.

Ohio—Monthly bulletin, articles and reports, yearly subscription 25 cents.

Indiana—Monthly bulletin, statistics, food work, brief articles.

Iowa—Monthly bulletin, news, book reviews, brief articles.

Wisconsin—Quarterly bulletin, brief articles.

Michigan — Quarterly bulletin, called "Public Health," rather long articles and extracts.

Colorado—Monthly bulletin, entirely statistical.

California—Monthly bulletin, statistics and brief extracts.

Doubtless other states issue periodical bulletins but we have not received them.

In addition to the monthly, bi-monthly or quarterly bulletins, many of the state Departments of Health issue pamphlets on the various communicable diseases, disinfection, etc. All these bulletins and pamphlets are issued primarily for the health offices in cities, towns and villages within the state of publication, but in many cases they are sent to any one interested outside of the state. Illinois is an exception to this. The office of the State Board of Health in all cases is located at the state capital, the secretary usually being the executive officer.

Michigan has undertaken educational work on hygiene to a greater extent than any other state. A law was passed in 1895 requiring every teacher to give oral and blackboard instruction relating to dangerous communicable diseases and other health matters. A series of teachers' bulletins and pamphlets was published. Over a quarter of a million of some of these have been sent out since the law was passed.

One of the teachers' bulletins contains an intering estimate on the money value of public health work. The writer, from statistics compiled before and after the health crusade gives figures that seem to show about 2,000 lives are saved annually in the state of Michigan by combating smallpox, scarlet fever, typhoid fever and consumption alone. Modestly reckoning the value of a life at $1,000, and that of a child at half price, considerably over a million dollars is saved yearly, or more than the total yearly state appropration.

In Vermont a law was passed in 1905 requiring the teachers to examine school children for defective eyesight and hearing. Charts and directions were prepared by the State Board of Health at a cost of only $700.00. Of the pupils examined, 33 per cent or nearly 15,000, were shown to be defective, the greater proportion having defective eyesight. Surely it was worth 5 cents each to find out these defects so that they might be rectified!

Many of the states have Laboratories of Hygiene and manufacture and distribute serums, anti-toxines, examine specimens for tuberculosis, diphtheria, etc., analyze public water supplies, and give advice for sewerage systems.

Although many of the State Boards of Health are performing their work admirably, and some of their bulletins are excellent, there seems to be a great deal of duplication of effort, especially in regard to printed matter. If the national govern ment could be induced to issue a series of bulletins on the preventable diseases, disinfection and other sanitary matters, for free distribution, somewhat similar to the Farmers' bulletins, a tremendous educational work for hygiene might be inaugurated. Only a few thousand dollars would be required. A recommendation to the President or to Congress from the Lake Placid Conference might help.

SUGGESTION FOR THE RESOLUTION COMMITTEE

Whereas, Living men are the most valuable possession of the state, as health is of the individual; and,

Whereas, The health of the people must depend ultimately on the education of the individual; and,

Whereas, Over 300,000 lives are lost annually in the United States, and a vast amount of illness results from contagious and infectious diseases now known to be preventable;

Resolved, That Congress be petitioned to authorize the Department of Public Health and Marine Hospital Service to issue a series of bulletins, popular in character, for free distribution throughout the United States, on the various preventable diseases, such as consumption, pneumonia, diphtheria, typhoid fever, scarlet fever, whooping cough, measles, etc., on disinfection and on other health matters, and to make an appropriation for the same.

YOU CAN HELP IN THIS WORK. WRITE TO YOUR SENATORS AND CONGRESSMAN, AND GET THE CLUBS AND ASSOCIATIONS TO WHICH YOU BELONG TO SEND A PETITION SOMETHING LIKE THE ABOVE.

PLEA FOR A NATIONAL DEPARTMENT OF HEALTH

By Professor J. Pease Norton

In the next twelve months 750,000 persons will die in the United States, whose lives could be saved by proper effort. Unless the effort is made, the lives of 750,000 will be sacrificed.

Such is the tenor of a bulletin sent out recently by the Yale Department of Social Science.

The bulletin is a plea for the establishment of a national department of health by Prof. J. P. Norton, head of the department. He says:

"There are four great wastes to-day, the more lamentable because they are unnecessary. They are, preventable death, preventable sickness, preventable conditions of low physical and mental efficiency, and preventable ignorance.

"Of the people living to-day over 8,000,000 will die of tuberculosis, and the federal government does not raise a hand to help them.

"The Department of Agriculture spends $7,000 000 on plant health and animal health every year but, with the exception of the splendid work done by Drs. Wiley, Atwater and Benedict, Congress does not directly appropriate 1 cent for promoting the physical well-being of babies. Thousands have been expended in stamping out cholera among swine, but not $1 was ever voted for eradicating pneumonia among human beings.

"In fact, the department of agriculture has expended during the last ten years over $46,000,000 But not a wheel of the official machinery at Washington was ever set in motion for the alleviation or cure of diseases of the heart or kidneys, which will carry off over 6,000,000 of our entire population. Eight millions will perish of pneumonia, and the entire event is accepted by the American people with a resignation equal to that of the Hindoo, who, in the midst of indescribable filth, calmly awaits the day of the cholera.

"During the next census period more than 6,000,000 infants under 2 years of age will end their little spans of life, while mothers sit by and watch in utter helplessness. And yet this number could probably be decreased by as much as one-half. But nothing is done."

Prof. Norton recommends the creation of a national department of health, having as its head a secretary who shall be a member of the cabinet. Under this department there should be created fourteen bureaus, as follows: Infant hygiene, education and schools, sanitation, pure food, registration of physicians and surgeons, drugs, druggists and drug manufacturers, control of institutions of public and private reliefs, correction, detention, and residences, organic diseases, quarantine, health information, immigration, labor conditions, research.

Such a department of health, Prof. Norton argues, might not only save 750,000 lives annually, but would add greatly to the productive wealth of the nation.

Estimating wages at $1 a day, Prof. Norton shows that $1,444,000,000 are lost every year by illness. A national department of health could save $500,000,000 of the amount every year.

BIBLIOGRAPHY

The Human Mechanism, Hough and Sedgwick. ($2.00, postage 18c.)

Manual of Personal Hygiene, Walter L. Pyle. ($1.50, postage 14c.)

Personal Hygiene, Alfred H. Woodhull. ($1.00, postage 10c.)

Nature and Health, Edward Curtis. ($1.25, postage, 12c.)

The Art of Right Living, Ellen H. Richards. (50c., postage 6c.)

A Natural Method of Physical Training, Chickley. ($1.50, postage 10c.)

How to Get Strong and How to Stay So, Blakie. ($1.00, postage 12c.)

Physiology for High Schools, Macy. ($1.10, postage 12c.)

Story of the Living Machine, Conn. (35c., postage 6c.)

What a Young Girl Ought to Know, Mrs. Mary Wood Allen. ($1.00, postage 10c.)

What a Young Woman Ought to Know, Mrs. Mary Wood Allen. ($1.00, postage 10c.)

What a Young Wife Ought to Know, Mrs. Emma F. A. Drake. ($1.00, postage 10c.)

Beauty Through Hygiene, Mrs. Emma Walker. ($1.00, postage 10c.)

The Four Epochs of Woman's Life, Anna Galbraith. ($1.50, postage 14c.)

Care of the Teeth, Samuel A. Hopkins. (75c., postage 6c.)

School Hygiene, Charles Porter. ($1.25, postage 10c.)

Medical Inspection of School Children, Babcock. Published by Maltine Co., Brooklyn, N. Y. Free. (Postage 8c.)

TECHNICAL BOOKS.

A Text of Physiology, Howell. ($4.00, postage 34c.)

The Work of the Digestive Glands, Pawlow. ($2.00, postage 16c.)

Recent Advance in Physiology and Bio-chemistry, Leonard Hill. ($5.00, postage 26c.)

Note.— Any of the above books may be borrowed by members of the School for the cost of postage. Send stamps with request.

SUPPLEMENTAL PROGRAM ARRANGED FOR CLASSES ON

PERSONAL HYGIENE

MEETING I

(Study pages 1-29)

General Principles

Personal Hygiene, Pyle. Introduction. ($1.75, postage 18c.)
The Art of Right Living, Richards. ($0.50, postage 6c.)

The Human Machine

The Human Mechanism, Hough and Sedgwick; Chapters I–VII, XV. ($2.00, postage 18c.)

Physiology for High Schools, Macy; Chapters I–VI. ($1.10, postage 12c.)

Personal Hygiene, Pyle; Hygiene of the Brain and Nervous System. ($1.75, postage 18c.)

Story of the Living Machine, Conn. "The Cells." ($0.35, postage 6c.)

MEETING II

(Study pages 29-45)

The Senses

The Human Mechanism, Chapter XIV. "The Sense Organs."

Text Book of Physiology, Howell. Chapter XV, "Cutaneous and Internal Sensations;" Chapter XVI, "Taste and Smell." ($4.00, postage 34c.)

The Eyes

Personal Hygiene, Pyle. "Hygiene of the Eye."

The Human Mechanism. Chapter XXII.

Physiology for High Schools, Macy. Chapter VIII.

Nature and Health, Curtis. Chapter V. ($1.25, postage 12c.)

Text Book of Physiology, Howell. Chapter's XVII, XVIII, XIX.

Hearing

Personal Hygiene, Pyle. "Hygiene of the Ear."
Nature and Health, Curtis. Chapter VI.
Text Book of Physiology, Howell. Chapter XX.

Topic: Testing the Eyesight and Hearing of School Children. See "Medical Inspection of School Children," Prize Essay on Preventive Medicine, published by Maltine Company, Brooklyn, N. Y. (Free from the publishers; from the School, 8c.) Also Report of Vermont State Board of Health (4c, from the School).

Sample chart for testing eyesight with directions for use, loaned for 10c postage.

(Select a composite set of answers to the Test Questions on Part I and send to the School, with a report on Meetings I and II.)

MEETING III

(Study pages 45-56)

Digestion of Food

The Human Mechanism. Chapter VIII and pages 44–52.
Text Book of Physiology, Howell. Chapter VII and "Enzimes and their Action," pages, 657–665.
Work of the Digestive Glands, Pawlow. "The Psychic Juices." ($2.00, postage 16c.)
Personal Hygiene, Pyle. "Hygiene of the Digestive Apparatus."
Food and Dietetics, Hutcherson. Chapter XXIII. ($3.00 postage 26c.)

The Blood and Circulation

The Human Mechanism. Chapter IX.
Text Book of Physiology. Chapters XXII, XXIV.
Physiology for High Schools. Chapter XII.
Personal Hygiene, Woodhull. Chapter IV.

Respiration

The Human Mechanism. Chapter X.

Personal Hygiene, Woodhull. Chapter III.

Life and Health. Chapter I.

MEETING IV

(Study pages 54-104)

Nutrition

The Human Mechanism. Chapter XIII.

Text Book of Physiology. Chapters XLVII, XLVIII.

See article in *Food and Dietetics*, on "Proteid Metabolism," Folin; and article in *American Journal of Physiology* January 1905. (From the School, 4c.)

Recent Advances in Physiology and Bio-chemistry, Hill. Chapters X, XI, XII, XIII. ($5.25, postage 28c.)

Heat Product and Regulation

The Human Mechanism. Chapter XII.

Text Book of Physiology. Chapter LI.

Elimination

The Human Mechanism. Chapter XI.

(Select and send answers to the Test Questions on Part II and report on Meetings III and IV.)

MEETING V

(Study pages 105-136)

Hygiene of the Nervous System

The Human Mechanism. Chapter XVIII.

Personal Hygiene, Pyle. Pages 275–314.

Personal Hygiene, Woodhull. Pages 47–51.

Hygiene of Feeding

See *Food and Dietetics,* Norton. Volume VI of the "Library."

The Human Mechanism. Chapters XIX, XX.

Personal Hygiene, Pyle. Pages 26–48

Nature and Health. Chapters II, III, IV.

Food and Dietetics, Hutcherson. Chapters I, II, III, XXVII, XXVIII.

MEETING VI

(Study pages 137-187)

Hygiene of the Skin and Appendages

The Human Mechanism. Chapter XXI, Colds; Chapter XXIV, Bathing.

Personal Hygiene, Pyle. Pages 52–67; 82–92.

Personal Hygiene, Woodhull. Pages 124–133.

Nature and Health. Pages 204–210.

Clothing

The Human Mechanism. Chapter XXV and XXIII, Hygiene of the Feet.

Personal Hygiene, Pyle. Pages 72–81.

Nature and Health. Pages 191–203.

Physical Exercise

The Human Mechanism. Chapter XVII.

Personal Hygiene, Pyle. Pages 315--348.

Nature and Health. Pages 250–273.

How to Get Strong and How to Stay So, Blakie. ($1.00, postage 12c.)

A Natural Method of Physical Training, Checkley. ($1,50, postage 8c.)

(Send answers to the Test Questions on Part III, with a report of the last two meetings.)

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