AUTHORIZED PHYSIOLOGY SERIES, No. 1.

# HEALTH FOR LITTLE FOLKS.

For Primary Grades.

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# HEALTH

# FOR LITTLE FOLKS




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## INDORSEMENT.

The "Authorized Physiology Series" consists of:

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*Department of Scientific Instruction of the*
*Woman's Christian Temperance Union*

ALBERT H. PLUMB, D. D.
DANIEL DORCHESTER, D. D.
HON. WILLIAM E. SHELDON.
REV. JOSEPH COOK.

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# PREFACE.

THIS little volume, as its title indicates, is designed as a first book in the study of such laws of practical hygiene as pupils of primary grades can comprehend, and as will lead to the formation of habits essential to a healthy, happy, and useful life. Formerly these topics, under the title of physiology, were studied chiefly by advanced pupils; but recent wide-spread legislation has wisely changed this custom.

Because right or wrong habits that may affect a lifetime are early formed, the child should as early learn which to choose and why. Because only comparatively few pupils ever reach the High School, the reason is obvious why the laws so generally specify that this study shall be pursued by "all pupils in all schools" under State or National control.

Instruction in this branch, as in every other,

should begin with the very simplest facts in each division of the subject, and progress by easy stages to those more complex. Great care has been taken to select for this book such topics, including the nature and effects of alcoholic drinks and other narcotics, as are adapted to the minds of children in primary classes, and to use only child language in presenting them. Truth is just as true when told in simple language as when put into technical terms that the child can not understand.

The sentences which appear on these pages in heavy-faced type may be used as blackboard exercises for the pupils to copy in writing, or commit to memory. The subject-matter of these is either a summary of the preceding text, or important facts, or hygienic rules, that should become a part of the pupil's knowledge.

# CONTENTS.

# CHAPTER I.

## *Why we need to Eat.*

### LESSON I.

WHY do people eat breakfast, dinner, and supper every day? If you are playing ball, and the dinner-bell rings, you stop playing, put your ball in your pocket, and go to the table. Why? Because you are hungry, perhaps you say. But why should you be hungry? Your ball is not.

Do you say it is because you are alive? Why should being alive make you want to eat?

Let us see if we can not find an answer to this hard question.

There was once a little girl whose father used to stand her up against the gate-post every year when her birthday came around, and cut a notch in the post with his knife, just where the top of her head came. Every new notch was quite a distance above the last one, because every year she was a little taller than she was the year before.

And every year this little girl needed a pair of shoes larger than her last ones, and larger mittens, and it took more cloth to make her dresses. It was harder, too, each year for her father to lift her, because she was all the while growing heavier.

What do you think it was that kept adding day by day to the size and weight of this little girl's body?

"Food," some bright boy will say; and he is right. Good food builds up the body little by little each day until the boy or girl has grown to his or her full size. Now you know that children eat because they must have food to make their bodies grow.

**We need food to build up the body.**

But your father and mother come to the table, too, and they are not growing as children are. Why do they and other grown people eat? There must

be another reason for eating. Let us find that, too, if we can.

Why does your coat or dress need to be mended after you have worn it awhile? Because it wears out, you say. Yes, and so does your body.

When you are thinking, or playing, or running, your body is wearing away. Even when you are asleep it is wearing away a little every time you breathe. Why, then, does not your body soon wear out like your coat or hat or dress?

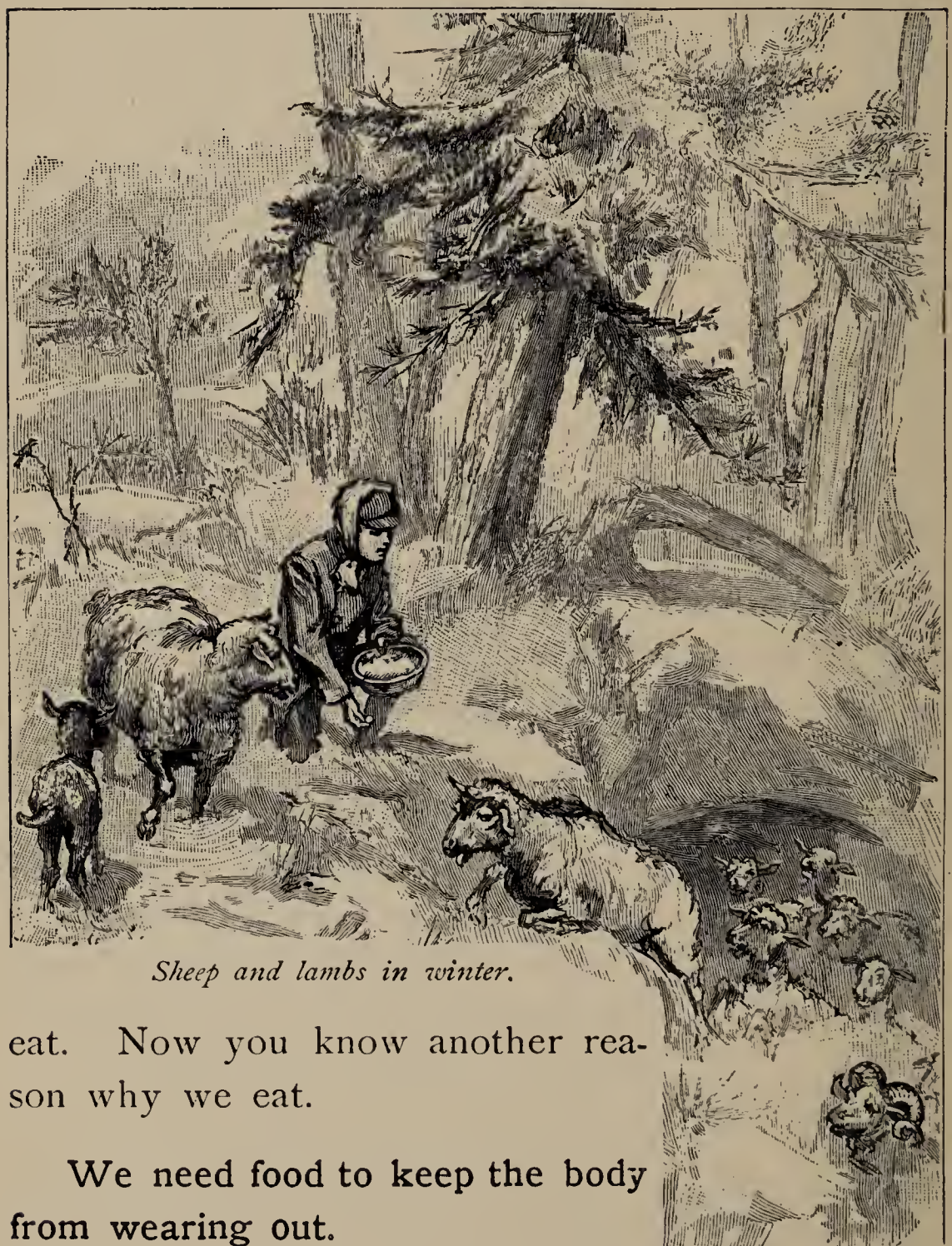
Suppose every time a tiny little thread breaks in your coat or dress you take your needle and put a new thread in its place. That would make the garment last a long time, would it not?

Careful mending, but of another kind, is going on all the time in our bodies. Your dress or coat is mended with a piece of cloth or thread; the wear of your body is mended with your food.

If we were to go without food a little while the body would begin to wear out because there would be no food to mend it. People have gone without food for forty days; but the most of us would die before that time if we should eat nothing.

Did you ever think that you might forget to eat sometimes if you were not put in mind of it? The hungry feeling which you have when you have

been without food for a few hours is to remind you that your body needs food and that you ought to



*Sheep and lambs in winter.*

eat. Now you know another reason why we eat.

**We need food to keep the body from wearing out.**

We eat because our bodies are all the time wearing out and food is needed for mending them.

But we need food for still another reason.

Did you ever see a flock of sheep with their little lambs on a cold day in spring? If you have, perhaps you noticed one or two very thin little lambs standing all drawn up as though they were cold.

These poor little lambs did not get enough to eat and they felt the cold more than the plump, well-fed lambs.

People who do not have enough to eat feel the cold more than those who have plenty of good food, for food helps to warm the body.

**We need food to keep the body warm.**

Now you know three reasons why we eat.

We eat because we must have food to make the body grow, to mend it, and to keep it warm.

**Questions.**—Why does a little girl need a larger dress every year than she did the year before?

Why must a boy's new boots be larger than his old ones?

What is it that makes children's bodies grow larger and heavier?

Why must children eat? Why is the body something like a coat or dress? Why does the body not wear out like a coat or dress? What is the body mended with? Why does a hungry lamb feel the cold more than a well-fed lamb? What tells us when the body needs food? Give three reasons why we need food.

## CHAPTER II.

### *Kinds of Food.*

#### LESSON II.

Now that we know why we need to eat, let us step into the market and order a dinner. Here are meats of all kinds and vegetables and fruits. What a variety! We may take our choice from them all.

But first we must think what time of the year it is, and whether the weather is cold or very warm. Some kinds of food are better for warm weather and others for cold weather.

If you were a little Esquimau boy or girl you would want a dinner of "whale blubber," which is almost clear fat. You would much rather have a tallow candle for dessert than the best fruit or candy.

The reason is that the Esquimau boy lives in a cold country and likes the food that is best for warming his body.

**Fatty foods are good for warming the body.**

Let us make believe we are going to market on a very cold morning. You, too, will then want to order food that is good for keeping the body warm; but we need not order "whale blubber." We shall find other kinds of fatty food.

We will order some butter to eat on our bread and to use in cooking. Good butter is a healthful fat; but if it has a strong taste it is not good and we should not eat it.

When we come to buy our meat we shall find some fat in that. There is some, too, in our milk.

How would you like some nuts? Here are hickory-nuts, butternuts, Brazil-nuts, hazel-nuts, and chestnuts. They all contain more or less fat in the shape of oil. If well chewed they are healthful, especially chestnuts when nicely roasted or boiled.

Do not buy these nuts to eat between meals or after you have eaten all the dinner or supper you want. Eat them as a part of your meal, or remember not to eat so much other food when you are to have them.

From butter, and meats, and nuts, we shall get all the fat we need.

Here is some maple sugar. You are very fond of maple sirup on your cakes in winter, and you like other sweets.

**Sweet foods are good for warming the body.**

Many plants, fruits, and vegetables have a sweet taste because they contain sugar. The juice of the sugar-cane plant contains a great deal of sugar, which may be obtained in a dry form by boiling off the water. Most of the sugar we use upon the table and in cooking is obtained in this way from the sugar-cane plant.

Maple sugar is obtained from the sap or juice of the maple tree.

Sugar is also made from a kind of beet called the sugar beet.

Most grains contain a little sugar; but it is so very little that you would scarcely notice it.

Perhaps you have found that a few grains of

wheat taste sweet after you have chewed them for a while. This sweet taste comes not so much from the sugar in the grain as from the starch, which,

*Gathering the wheat.*

strangely enough, begins to change to sugar as you chew it.

A crust of bread, too, tastes sweet when you have chewed it well, because the starch of the flour from which the bread was made changes to

sugar as it is chewed and moistened in your mouth.

We need food containing starch, therefore, for the same reason that we need food containing sugar.

**Starchy foods help to warm the body.**

What kind of foods containing starch shall we order from the market? Here are potatoes, which are little else than starch and water. You may order some potatoes; but tell the cook not to fry them. Have them baked or boiled. Nearly all foods are less healthful when fried in fat than when cooked in other ways.

Here is rice, which is another starchy food, and here is macaroni; or you may order sago or tapioca to be made into pudding for dessert.

Corn also contains starch and fat as well. Hence it is a good food to eat in the winter. We may buy canned corn, or corn-meal which may be made into muffins and corn bread.

Our bread, oatmeal, gems, muffins, cakes, and other articles of food made from flour, all come from the grains, such as wheat, rye, oats, barley, or corn. All of these grains contain starch. Starch forms a large part of food made from grains.

From all of this starch we get a great deal of

sugar, because starch turns to sugar after we have eaten it. We get sugar, too, in other ways. Our fruits, such as apples, pears, oranges, and grapes, contain sugar which forms in them while they are ripening.

But we are so fond of sweet things that we are not satisfied with the natural sugar of the fruits and grains. We put extra sugar in our fruits when we cook them or serve them on the table. We make our pies and puddings sweet with sugar, and sometimes we add it to our oatmeal or cooked wheat. We are generally in danger of eating too much sweet things rather than not enough.

If we eat much candy we shall be likely to get more sweet than is good for us; besides, we may get in the candy other things that will do us harm. Sometimes those who make candy put into it other things which are cheaper for them to use than sugar, but which make the candy unhealthful, and the coloring matter is often poisonous.

If you must have candy, it is better to make it at home out of good sugar than to eat what is sold in the stores.

We must not eat so much sweet and fatty food that we do not care for other kinds of food.

You remember that food is needed for mending

and building up the body as well as for keeping it warm. We must keep a large place in our basket for foods that will mend the body.

**Fatty and starchy and sweet foods are good for warming the body.**

**Questions.**—Why does the little Esquimaux boy need much fatty food?

What foods besides those that contain fat help to warm the body?

How do we get sugar from grains? Name some healthful starchy foods.

## LESSON III.

What can we buy for mending the body and making it grow large and strong?

Plenty of things. First, we will have some milk. The baby, you know, lives on milk for months, and grows larger and stronger every day.

Milk contains every kind of food the body needs —fat, sugar, and all; but we are so made that we can get our food from other things as soon as we have teeth for biting and chewing.

We must be very careful to use only good milk. Milk from an unhealthy cow may make us ill.

Next to milk for giving us nearly everything the

body needs for food is wheat. This is one of the grains that the farmer raises in his fields. The miller grinds the wheat into flour, and then it is ready to be made into bread.

You have heard bread called the "staff of life." We need bread as much as the lame man needs his

*Thrashing the wheat.*

staff. Nearly every one eats bread three times a day and does not grow tired of it.

We will order a loaf of bread for our dinner, but not white bread. Some parts of the wheat that we need for food are taken out of it when it is made into fine white flour. We will have Graham bread, or bread made from the whole wheat flour.

**We do not get the best bread from fine white flour.**

The farmer raises other grains besides wheat that make good food. Rye and oats are some of these.

Good bread may be made from rye flour, also from corn-meal mixed with wheat or rye flour; but neither of these kinds of bread is quite as good for constant use as bread made from wheat flour.

Oatmeal makes excellent rolls or gems. Oatmeal cookies or crackers are good. Cooked oatmeal is one of the best dishes to have for your breakfast if you wish to grow large and strong.

If you do not like oatmeal, or if it does not agree with you, you may eat instead some form of cooked wheat, as Graham mush, cracked wheat, or wheatena.

What kind of meat shall we buy? Here are beef, mutton, lamb, veal, pork, chickens, turkey, and game.

We will take beef to-day. Beef is the best kind of meat for every-day use. Sometimes we may take mutton, which is nearly as good as beef. Fish, poultry, and game will give us a variety when we become tired of beef or mutton.

We must be as careful about buying good meat

as good milk. Meat that has been kept too long or meat from a diseased animal should never be eaten, as it may make us ill.

Pork is not a safe meat to eat. It is often diseased. If it is ever used it should be very thoroughly cooked. Then, if it is diseased, it will not be so likely to injure us as it will if eaten raw or partly cooked. Many people have died from eating raw pork that was diseased.

If we do not care for meat we may eat eggs. Nearly everything we need for food is contained in the egg.

We may cook eggs in a variety of ways. One good way is to break them into boiling water or milk. Another good way is to pour boiling water on the egg, and let it stand in the water, closely covered, for several minutes. In this way the egg can be cooked as hard as one likes it without becoming tough, as when boiled. Eggs are not as healthful when fried in fat as they are when cooked in other ways.

From peas and beans we get nearly the same kind of food as from meat, and they cost much less. In summer we can buy young peas in the pod; but in winter we must buy them in cans or dried. Dried peas make excellent soup.

Beans are good either boiled or baked. They also make good soup.

Other wholesome vegetables are turnips, cabbage, tomatoes, celery, beets, and lettuce.

If you were ordering your dinner in summer you would buy less meat and less sweet and fatty foods and more fruits than in winter. When the weather is very hot we all want to keep our bodies as cool as possible, and we need less heat-making foods.

**In summer we need less meat and fat and sweet food than in winter.**

Berries, apples, pears, peaches, grapes, and other delicious fruits ripen for us to eat in summer, because we need them most at that time of the year.

Some fruit is good for us all the year around. We shall find in the market in winter oranges, grapes, apples, prunes, dried apples, dried peaches, several kinds of dried berries, and nearly every kind of fruit preserved in cans. We may take our choice of all these.

If we buy canned fruit we should take that in glass or earthenware jars. Tin cans are liable to poison fruits or vegetables that are at all sour.

**In hot weather we should eat plenty of good, ripe fruit.**

**Questions.**—Why is milk a good food? What kind of milk may make us ill? What grain raised by the farmer gives us the best food? What other grains besides wheat give us good food? What is one of the best breakfast dishes for a growing boy or girl?

What kind of meat is the best for steady use?

What other kinds of meat are good? What kind is liable to be diseased? About what must we be careful when we buy meat? If we do not care for meat, what other kinds of food will take its place? How should our food in summer differ from our food in winter? Why should we not buy sour fruit in tin cans.

## CHAPTER III.

### *The Body needs Water, Salt, and Lime.*

### LESSON IV.

DID you ever think how dreadful it would be if you could get no water to drink when you are thirsty? It would be worse than having no food to eat when you are hungry. People who have been lost at sea or fastened down in mines or wells, where they could get neither food nor drink, say they suffered more from thirst than from hunger.

*Diagram showing proportion of water to rest of the body. Shaded portion represents water.*

We can live longer without food than we can without water.

Why is water so necessary to us? One reason is because water makes up a large part of our bodies. If your whole body weighs sixty pounds, the water

in it weighs forty-five pounds. About three quarters of our bodies by weight is water.

**No part of the body can do its work without water.**

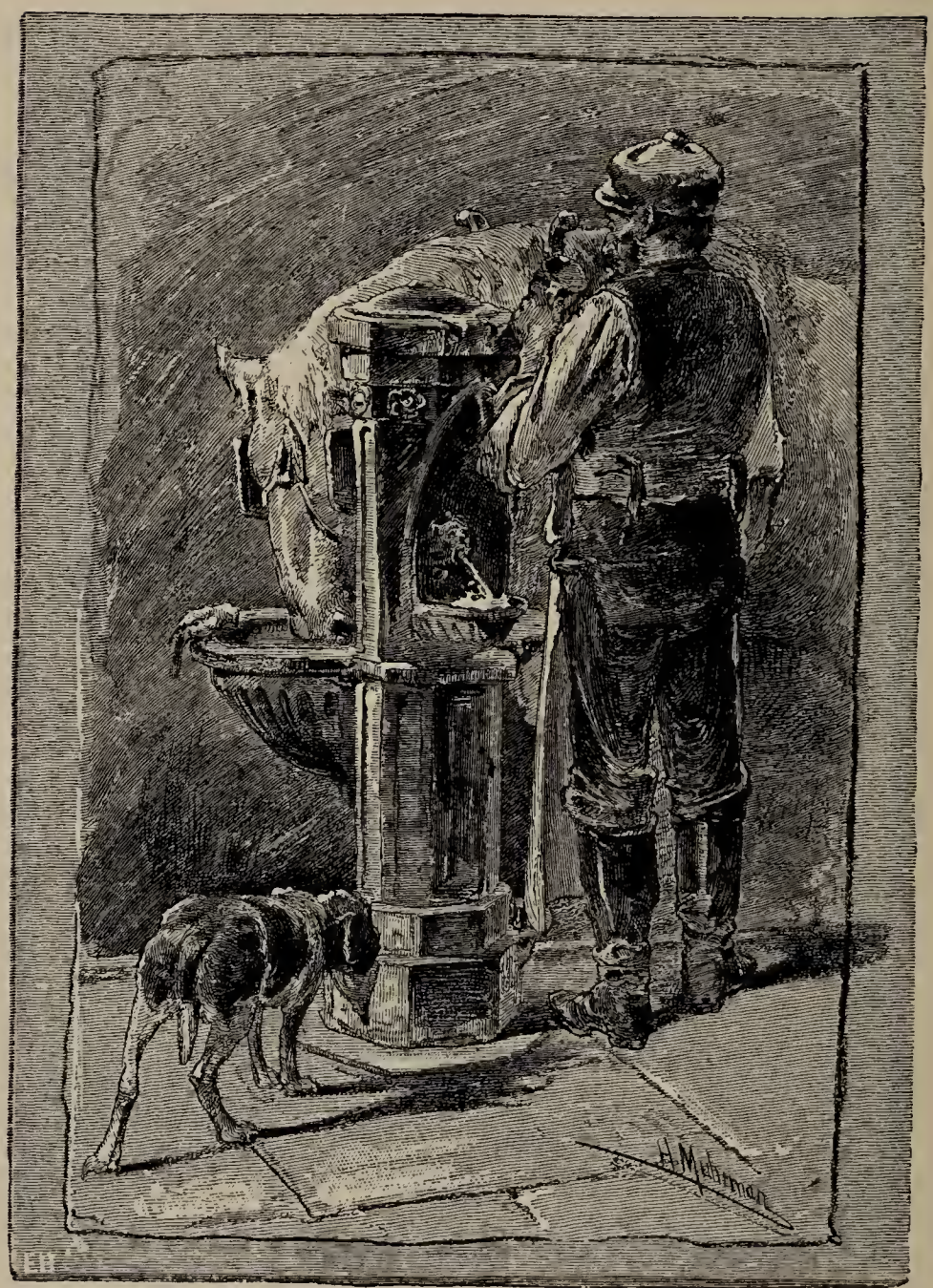
When you chew your food the water of your mouth helps to prepare the food for being swallowed. When the food reaches your stomach it finds water there, as you will soon learn.

A large part of the blood that drips from your finger when you have a cut is water. The water in the blood helps the blood to flow easily through all parts of the body.

Your flesh, that feels so soft and tender, would be hard and dry like a piece of chalk if it were not for the water in it.

Water is needed inside of the body to help keep it clean. You have learned that your body is all the time wearing away a little. The water in the blood which flows through every part of the body, as you will learn later, soaks up the worn-out matter and washes it away.

The same water does not remain in your body all the time. When you run until you are very warm you can see the water coming out through your skin. You call it per-spi-ra-tion. Sometimes



*A city drinking fountain.*

on a cold morning you say you can "see your breath." What you see is the water passing out of your body in your breath like a little cloud of

steam. It is passing out just the same on a warm day, but you can not see it.

The water that leaves the body every day must be made up by taking more.

We do not have to drink all the water the body needs each day, for we get a great deal of it in our food. Perhaps you have seen the cook put a tea-cupful of rice in a kettle with a pint or more of water to boil for dinner. When it was brought to the table it filled a large dish, yet only a tea-cupful of rice was put into the kettle and nothing but water was added, with perhaps a pinch of salt. The rice swelled and soaked up the water, and when you ate the rice you were getting some of the water your body needed.

Juicy fruits contain a great deal of water, and nearly all food contains some; but we do not get all the water the body needs from our food.

When we run hard or become very warm we are almost sure to feel thirsty. This is because the water in our bodies has been rapidly leaving them in per-spi-ra-tion and more is needed to take its place.

**Thirst tells us when our bodies need water.**

We must be careful to drink only pure water. People are sometimes made ill by drinking water

*A country drinking fountain.*

that contains impure or poisonous matter. One can not always know by the appearance of water whether it is pure or not. If you put a teaspoonful of salt in a glass of water and stir it awhile the salt melts away. It is in the water, but you can not see it. We say the water dissolves the salt. Water dissolves many things besides salt—some that are poisonous. You can know when water has salt dissolved in it by tasting it, though you can not know by looking at it; but you can not always know when water has poisonous matter dissolved in it either by seeing, smelling, or tasting it.

How, then, can we know when water is good for us to use? We must know where it comes from and whether it has been where it could soak up poisonous matter on its way to us.

We should never drink from a well that is near a cemetery, barn-yard, pig-pen, or other foul place. We should never drink water from a stream that has flowed past any unhealthful place or received any foul drainage.

**Water that is not pure should be boiled and strained before being used.**

**Questions.**—How much of our bodies is water? Why does the blood need water? How does water help to keep the body clean?

Why does the body need a fresh supply of water every day? From what do we get a great deal of water besides the water we drink? What does thirst tell us? Why should we be careful to drink only pure water? When is water most likely to be pure? From what wells or streams should we never drink?

## LESSON V.

**Lime.**—Water dissolves lime, but lime is not a poison. Our bodies need lime, though we never eat it clear. We get it in our food and drink. The growing grain takes up lime out of the earth, and when we eat the bread and other food made from the grain we get the lime.

The cow gets lime in the grass she eats and passes the lime on to us in her milk. Some water contains a great deal of lime and is called "hard" water. You can not make soap-bubbles with hard water, for it will not foam.

We need lime for our bones. In some parts of the country where there is much lime in the water the people grow to be very tall. It is thought that the lime they get in the water makes their bones grow large.

Children who do not get enough lime in their food are likely to have small, weak bones.

**Whole-wheat bread and good milk give us lime for our bones.**

**Questions.**—From what do we get the lime our bodies need? What part of the body has a special need for lime? What shows that children need to eat food that has some lime in it?

**Salt.**—Our bodies need salt. This, too, we get in our milk, vegetables, and grain; but we want more salt than such food furnishes us. We therefore put clear salt into many articles of food as they are being prepared for the table.

Nearly all animals are fond of salt, especially those that live on grass, hay, and grain, or other vegetable food. The wildest sheep in the flock will crowd about the farmer when he goes out to give them salt.

There are other salts beside the common salt we use on the table and in cooking. The chief use of some vegetables, such as lettuce, is the salts they contain.

**Questions.**—Why do we salt our food? What animals like salt? From what do we get other salts beside the common white salt used on the table?

# CHAPTER IV.

## *Drinks that contain Alcohol.*

### LESSON VI.

WHAT kind of fruit do you like best? Most boys and girls like nearly all kinds.

Good ripe fruit is a necessary part of our daily food. It is much better to spend our money for fruit than at a candy-store.

Men sometimes squeeze out the sweet juice of good fruits and make it into poisonous drinks. It is a great pity to have the fruit that is good for our use spoiled to make drinks that do us harm.

It is well for us to learn how some of these drinks are made; then we shall know why they are harmful.

**Wine.**—A harmful drink called wine is made from grapes.

To make wine men crush grapes in a press and

squeeze their juice into a big tub or vat that is put under the press to receive it.

You have often seen upon the skins of grapes a kind of dust that you could easily rub off. When grapes are being pressed the juice that flows from them washes off some of this dust and carries it into the vat.

In this dust are some very tiny things called ferments. They are so small you can not see them unless you look at them through a glass called a magnifying glass or microscope. A microscope, as you may know, makes things look many times larger than they really are.

If you should look at a ferment through a microscope you would see a very tiny speck without much shape or color. You might think it too small to do any harm; but many ferments together can do a great amount of mischief. They quickly spoil good grape-juice after it has been pressed out of the grape. How do you think they do this?

The juice of grapes is sweet, as you know, because there is sugar in it. No one puts the sugar in the grape; it forms in them while they are ripening. Just how this is done we do not know.

The ferments change this sugar of the grape-juice, after it is pressed out, into a gas and a poison. They can not do this while the juice is inside of the unbroken grape, for they do not get inside the fruit while it remains whole.

But when the juice is squeezed out of grapes and is left standing in the vat, the ferments that were on the stems and skins of the grapes begin to work upon the sugar of the juice. Other ferments, too, get into the vat from the air. Ferments are so small and light that they are easily carried about in the air.

How can we know when ferments are turning the sugar of grape-juice into a gas and a poison? We can know by the little bubbles of gas we see rising up through the juice. This gas passes out into the air, but the poison remains in the wine and makes the wine poisonous.

The name of this poison is alcohol. There is no alcohol in a sound ripe grape.

**No one should drink wine, for there is alcohol in it.**

**Alcohol.**—All poisons do not at once kill those who take only a little at a time; but a man could easily take enough alcohol to kill him at once. The

man who takes a little alcohol every day is seldom as strong a man, as wise a man, or as good a man as he would be without alcohol. The alcohol hurts his body and his mind.

Alcohol may make a father cruel to his children and to his wife. It sometimes makes a man tell falsehoods and do other bad deeds.

One of the most dangerous things about alcohol is that it can make those who take it want more alcohol. If you should begin to take wine, the alcohol in it might make you want to drink more and more wine until you cared for nothing so much as for drinking wine.

**It is the nature of alcohol to make those who take it want more alcohol.**

**Questions.**—What drink is made from the juice of grapes? How do men get the juice to make into wine? What gets into the juice as it is being pressed out? Why can you not see ferments without a magnifying glass? What do ferments do to the sugar of grape-juice? Why do they not do this while the juice is in the fruit? When do ferments begin to spoil grape-juice? How can we know when ferments are beginning to work in grape-juice? What becomes of the gas? What becomes of the poison? What is the name of this poison? Why should no one ever drink wine? What is alcohol? What may alcohol do to a man who takes a little every day? What is one of the most dangerous things about alcohol? What harm might a little wine do to you if you should drink it? Why?

## LESSON VII.

**Cider.**—Men sometimes grind up apples and press out their juice to make a drink called cider.

There are ferments on the skins of the apples just as there are on the skins of the grapes. When the apples are ground and their juice is pressed out, these ferments and others from the air get into the juice and quickly spoil it. They turn the sugar of the apple-juice into gas and alcohol.

You can see the bubbles of gas passing out of the apple-juice in a very short time after it has been pressed out of the apples. These bubbles show you that the sugar is changing and alcohol is forming.

We may eat our apples without fear of being poisoned by alcohol because the ferments can not turn the sugar of apple-juice into alcohol while the juice is inside of the apple. They begin their work very soon after the juice is pressed out.

Cider that is made in the morning will have alcohol in it by night if the weather is at all warm. It begins to be a dangerous drink as soon as it begins to have alcohol in it.

No one should think that because there is only a little alcohol in cider it is harmless, for a little

alcohol has the power to start a boy on the road to drunkenness. Every drunkard began his drinking habit by taking a little alcohol. He at first thought that a little would not hurt him; but it made him want more, and when he took more he wanted still more.

People used to think there was no harm in taking cider; but we know now that cider-drinking has made many drunkards.

As cider grows older, more and more alcohol keeps forming in it, for the ferments keep turning more of its sugar to alcohol. As this goes on, the cider is said to be growing hard.

Hard cider often has as much as one cupful of alcohol to ten cups of cider. A man can easily get drunk on hard cider.

Cider drunkards are usually very cross.

**Cider is not a safe drink because it contains alcohol.**

Cider is often made into vinegar. This is done by leaving it in a warm place until a new ferment enters it and changes the alcohol of the cider to a sharp acid. There is no alcohol in vinegar, because these ferments change the alcohol to something else.

The ferments that turn alcohol to vinegar are not the same as those that turn sugar to alcohol.

There are many kinds of ferments, and each kind has its own work to do; but one thing is true of all kinds: ferments always change the nature of the substances they work upon.

People have thought that cider must be good because the apples it is made from are good, or that wine must be good because the grapes it is made from are good. This is a mistake. The ferments change the nature of the grape-juice and apple-juice by turning their sugar to the poison alcohol.

**Questions.**—From what is cider made? What gets into the juice of the apple as it is being pressed out? What do the ferments do to the apple-juice? Why is the juice of the apple unharmed while it is in the whole apple?

How soon may you find alcohol in the pressed-out apple-juice? When does cider begin to be a dangerous drink? Why should no one think that cider is harmless when it has only a little alcohol in it? How does every drunkard begin his drinking habit? What does a little alcohol do to him? What do we know about cider-drinking? Why does more alcohol keep forming in cider as it grows older? How much alcohol is often found in hard cider? Into what is cider often made? What causes the cider to change to vinegar? Why is there no alcohol in vinegar? What do ferments always do to the substances they work upon? How do they change the nature of good grape-juice and apple-juice after these are pressed out from the fruit?

## LESSON VIII.

**Beer.**—Some drinks that have alcohol in them are made from grains, such as barley, rye, and corn.

You remember that these grains contain starch, and that starch turns to sugar when you eat it. The starch in grains will also turn to sugar if the grain is kept warm and moist.

This is what happens when the farmer sows grain in his fields. The earth where the grain lies is kept moist by the rain and warmed by the sunshine, and soon the grain begins to sprout.

If you taste of sprouting grain you find it sweet. The starch in the grain has turned to sugar to feed the little sprouts before they have roots for drawing their food from the earth.

When grain is to be used for making beer it is not put into the ground to sprout, but is piled in a heap where it is kept warm and moist.

When the brewer sees the little sprouts coming out he knows that the starch of the grain is turning to sugar. Then he heats the grain to kill the sprouts and prevent their taking up the sugar.

Next he grinds the grain, which is now called malt, and puts it in a big vat of water. The sugar

of the malt soaks out into the water and makes the water sweet.

In this way the brewer gets from dry grain a sweet liquid to make into a drink containing alcohol.

The ferments that work in the sweet grain-juice, to make beer, do not come from the grain, but from yeast which the brewer next puts into the vat. Some might get into it from the air if no yeast were put in, but the brewer prefers to use yeast. He also puts in hops, which give the beer a bitter taste.

Soon after the yeast is put into the vat of grain-juice, little bubbles of gas begin to rise through it and froth gathers on the top. The bubbles show that the sugar of the liquid is being changed to gas and alcohol.

The alcohol does not pass off like the gas, but remains in the liquid, making it poisonous. This liquid is called beer.

**No one should ever drink beer, for it is poisoned with alcohol.**

The boy who begins to drink beer soon comes to be very different from the boy who never touches it or from what he might be if he did not drink it.

The alcohol in the beer dulls his mind. He can

not learn his lessons as well; he can not even play as well, because he is not as strong as he would be without the beer.

**Beer-drinking spoils a boy's chances of being a strong, wise, or good man.**

**Home-made Beer and Wine.**—People sometimes steep roots and bark in water, add sugar and yeast, and let it stand until it has "worked," as they say. This they call home-made beer, and think it must be harmless because they put nothing bad into it.

But we know there is alcohol in it, because the yeast that was put in turned the sugar to alcohol. It was the bubbles of gas escaping as the alcohol was forming that made it "work."

**We should not drink home-made beer, for it contains alcohol.**

The juice of elderberries, currants, or other fruit is often made into wine by housewives and called home-made wine. The juice of the fruit is squeezed out and put into bottles; but the ferments get into it before it is bottled up and begin at once to change the sugar of the fruit-juice to alcohol.

All liquids that contain alcohol are poisonous drinks.

**Questions.**—From what are some kinds of alcoholic drinks made? What do grains contain? What becomes of the starch when you eat the grain? How is starch turned to sugar when the farmer sows it in his field? How does the brewer turn starch to sugar when he wishes to make beer? Why does he kill the sprouts? What does he call the grain after the sprouts are killed? How does he get the sugar out of the malt? What kind of a liquid is the water in which the malt has been soaked? What does the brewer put in this sweet liquid to make it ferment? What is yeast? What changes begin to take place in the sweet liquid after the yeast is put in? What becomes of the gas and what becomes of the alcohol? What is the liquid called? Why should no one ever drink beer? What will be likely to happen to the boy who begins to drink beer? What shows that alcohol dulls his mind? How is home-made beer made? How does alcohol come to be in it? What kind of drinks are all liquids that contain alcohol?

## LESSON IX.

### DISTILLED LIQUORS.

The alcohol in cider, beer, or wine is mixed with water. Those who learn to like alcohol by taking these drinks are likely to want drinks that contain more alcohol and less water. To make such drinks, men get rid of some of the water in liquors like cider, beer, and wine, by heating them.

You have often seen steam coming out of the nose and around the lid of the tea-kettle when it is boiling on the stove. This steam is water only

changed by heat to another form. Another name for steam is vapor.

When steam comes against a cold window-pane it is changed back into water and trickles down the window in drops. The water that is changed into vapor by heating is changed back again into its liquid form by cold.

Heat changes alcohol as well as water into vapor; but it takes less heat to change alcohol into vapor than to change water into vapor.

When wine or cider is heated to make stronger drinks the alcohol is changed to vapor before the water. It rises and thus becomes separated from the water.

This vapor is made to pass through a long cold pipe, where it is cooled, and turned into a liquid which drips from the pipe. This liquid is very strong with alcohol.

This process is called distillation and the liquors made in this way are called distilled liquors. Brandy, whisky, rum, and gin are distilled liquors. They are usually more than half alcohol.

Beer, wine, and cider do enough harm to those who drink them. Brandy, whisky, rum, and gin do still more because they contain more alcohol; but the use of the weaker drinks leads to the use of

the stronger. It is their nature to do so as it is the nature of all alcoholic drinks to lead to drunkenness.

**Beer, wine, and cider are likely to make one want stronger drinks.**

The people of Japan have this saying, which is well worth remembering: "A man took a drink; then the drink took a drink; then the drink took the man."

Water will not make a man keep wanting to drink water. Milk will not make a man want to keep drinking milk; but it is the nature of alcohol to make those who take any drink containing it want more alcohol.

**Questions.**—What is mixed with the alcohol in cider or wine? Why do men often wish to get rid of some of the water in cider or wine? What is steam? What is another name for steam? How is steam changed back into water? When a mixture of alcohol and water is heated, why does the alcohol turn to vapor first? How can it be separated from the water? What are the liquors obtained by this process called? How much alcohol do they often contain? Name some of these strong liquors. What is it the nature of alcoholic liquors to do?

# CHAPTER V.

## *How Food is changed into Blood.*

### LESSON X.

DID you ever visit a paper-mill? If you ever did, perhaps you saw old dirty rags being ground up and made into clean white paper. In some mills paper is made from straw or wood.

It is very wonderful that wood and straw and old rags can be changed into clean smooth paper.

But a more wonderful change than this takes place in your body after every meal you eat. Bread, meat, potato, and other kinds of food are changed after you swallow them; first into blood, and then into flesh, bone, skin, hair, and other parts of your body.

The first part of this wonderful change begins in your mouth when you chew your food.

**The Teeth.**—You have in your mouth two rows of strong little cutters and grinders which you call your teeth. They are hard and white and of different shapes. The front teeth are shaped for biting off the food, the back teeth for chewing or grinding it.

The work of chewing our food is very important. If it is not done well the food is likely to give us trouble afterward. It is very necessary, therefore, to have good teeth that can chew well.

The teeth are made to last a long time, especially the second teeth, which begin to come out when we are about seven years old. Each tooth has a strong, hard covering to keep it from being injured or worn away. This covering may be cracked or broken by wrong treatment, and then the tooth soon begins to decay.

No one wishes to have decayed teeth. They look bad and make the breath smell bad and they can not do their work well.

To keep your teeth from decaying you should give them good care.

**Clean your teeth every day with a soft tooth-brush.**

Unclean teeth make a person very offensive to those about him; they are also more likely to decay.

Do not pick your teeth with a pin, but use a quill or wooden toothpick. A pin or anything hard may injure the hard covering of the teeth.

**Do not try to crack nuts with your teeth.**

If you do, you may crack your teeth instead of the nuts. Teeth were not made to be used for nut-crackers or scissors.

Do not let anything very hot or very cold come against your teeth. Heat and cold may cause the hard covering of the teeth to crack.

**Chewing.**—When we chew our food the tongue pushes it between the teeth, the back teeth grind it, and the water of the mouth moistens it until it is ready to be swallowed.

I have seen little boys and girls take a mouthful

of bread or cake and then wash it down with a drink of milk or water without chewing it scarcely at all.

This is not right. The mouth has a fluid of its own called saliva that prepares the food for being swallowed better than any drink we can take.

It is this saliva that turns starch into sugar. All starchy foods therefore need to be mixed well with saliva before they are swallowed so that the starch may be turned to sugar.

It is said of one great man that he always taught his children to give as many bites as they had teeth to every mouthful of bread before swallowing it. This man has lived to be very old and is still strong and does a great deal of hard work.

Here is a rule which may save you many doctor's visits if you follow it carefully:

**Chew your food well and do not drink while you are eating.**

Do not wash your food down with milk or water, but give it time to get well moistened in your mouth.

When food is ready to be swallowed, the tongue rolls it to the back of the mouth and it drops down

into a tube called the food-pipe. This food-pipe takes the food to the stomach.

**Questions.**—What wonderful change takes place in your body after every meal you eat? Where does the change in the food you eat first begin? Why is it necessary to have good teeth? Why should you clean your teeth every day? Why should you not pick your teeth with a pin or other hard thing? Why should you never crack nuts with your teeth? What may anything very hot or very cold do to the teeth if brought against them? What takes place as we chew our food? Why should we not wash down our bread or cake with drinks? Why does the saliva of the mouth need to be mixed with starchy foods? Where does food go when it is ready to be swallowed?

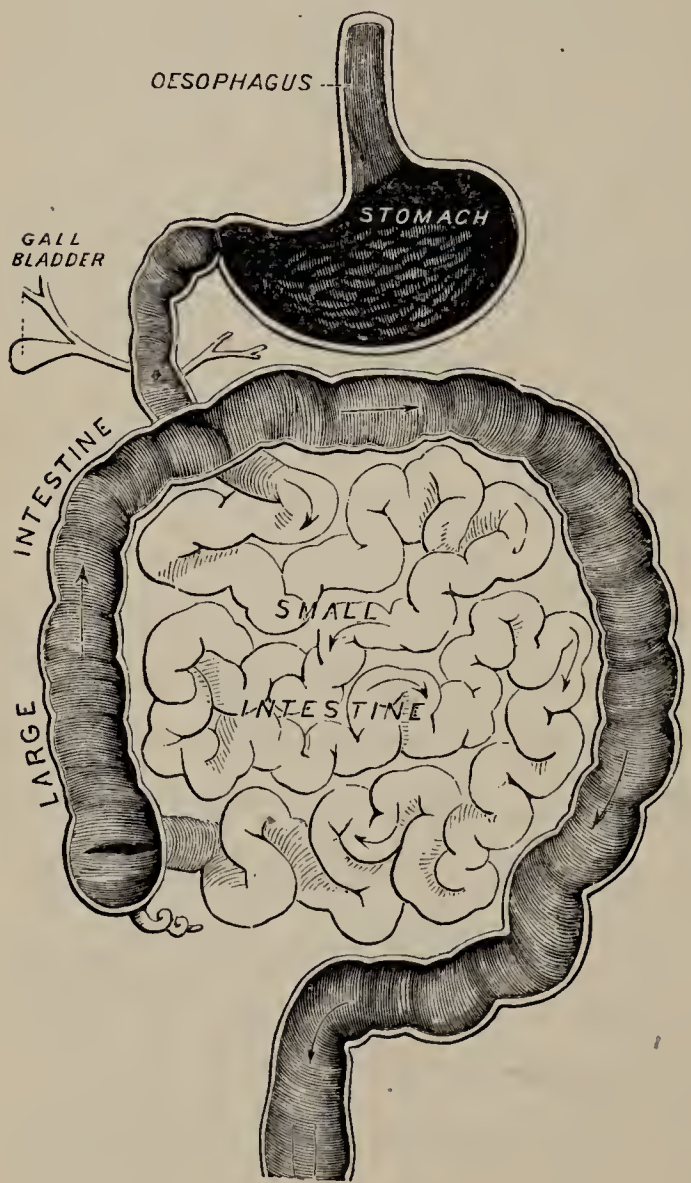
## LESSON XI.

**The Stomach.**—The stomach is a wonderful, soft, fleshy bag for preparing the food which we eat to be made into blood. It is shaped something like the body of a pigeon and lies crosswise in the body just at the waist. The boy who eats green apples is likely to have a pain that will tell him right where his stomach is to be found.

When food reaches the stomach it meets there a watery fluid called the gas-tric juice. This juice mixes with the food and begins at once to dissolve it. The stomach churns the food slowly up and

down and squeezes it around and around so as to mix it thoroughly with the gastric juice.

If you could look inside your stomach as this slow churning process is going on, after you have eaten a meal, you would see the bits of bread and meat and potato growing smaller until all the food in the stomach becomes soft and creamy — something like thickened gravy, only lighter in color.




When you swallow your food in big hard lumps the stomach is not always able to make those lumps fine. It will do its very best, for it is a faithful worker. It often tires itself out trying to do what you should have done with your sharp

teeth. Some of the food becomes so well dissolved in the stomach that it passes directly into the blood without going farther. But how do you suppose it gets from the stomach into the blood? In a very curious way indeed.

All over the inside of the stomach are many little blood-vessels with walls thinner than the thinnest tissue paper. You know that if you put a piece of tissue paper into water it will soak up some of the water.

The food that is ready to enter the blood from the stomach is so thoroughly dissolved that it can soak through the walls of the little blood-vessels much as water soaks through tissue paper, and thus it gets into the blood. You could not tell it then from the rest of the blood. In fact, it is blood.

Only a part of the food you eat is so well dissolved in the stomach that it can enter the blood from there. The rest passes out of the stomach into the bowels.

The bowels is a name given to a very long tube leading from the stomach to the lower end of the body. This tube is more than four times as long as your whole body, yet it is so snugly coiled up that it takes up only a small place in the lower part of the trunk of the body below the stomach.

In the bowels where the food first enters from the stomach, more juices mix with the food and dissolve it still more. Here are many more blood-vessels, and as fast as the rest of the food is dissolved the blood-vessels soak it up and take it into the blood. It is then ready to be carried to all parts of the body to feed and build up the body.

**Care of the Stomach.**—The stomach, like every other part of the body, is injured by making it do what it ought not to do. It is well to learn what your stomach can do and what it can not do so that you may give it only its proper work.

Your stomach was not made to chew your food for you. Your teeth were made for that. If you try to make your stomach do the work your teeth should do, it will soon become too tired to do its own work well.

Your stomach was not made to work all the time. After a meal it needs rest just as much as you do when you have been working or playing hard all day. For this reason you should not keep eating cake or nuts or candy or fruit between meals.

The stomach was not made to digest more food than the body needs. Hunger tells you how much food you need.

**When you are no longer hungry, you have eaten enough.**

If you eat more than you should, you make your stomach do more work than it ought, and so you will be likely to tire your stomach with overwork.

Everything you swallow has to go into your stomach. There is no other place for it to go; and the stomach has to get rid of it. Remember this when you see something you would like to eat but know you have eaten enough already.

The stomach can not do its work well unless it is kept sufficiently warm. If you cool it by drinking ice-water or eating ice-cream while at your meals, it has to stop working until it gets warm enough to go on.

The stomach can digest some kinds of food more easily than it can others. It can not digest rich puddings, cakes, pies, and hot bread as easily as it can oatmeal porridge, wheat-meal mush, good whole wheat bread a day or two old, or other wholesome food. Pork is not as easy to digest as beef or mutton.

Very highly seasoned foods are not good for the stomach. Pepper, ginger, mustard, horse-radish, and strong spices are too hot and biting to be used very freely. You know how they make your mouth

smart and burn if you take much of them. The stomach is lined with a very thin delicate skin as tender as the lining of the mouth, and hot things hurt it as surely as they hurt your mouth, only you do not feel it as much.

You should never injure your stomach by drinking wine, cider, beer, rum, or any liquor that has alcohol in it. Alcohol is hot and biting, like mustard, pepper, and ginger; but it is worse than these, for it can do harm in other ways that mustard and ginger can not do. It hurts the tender lining of the stomach, and when much of it is used it often makes sores on the inside of the stomach.

Alcohol also injures the gastric juice and makes it unable to dissolve the food as it should. Alcohol also hardens the food in the stomach and makes it less easy for the gastric juice to dissolve. In these and other ways alcoholic drinks give people weak stomachs.

**No drink that has alcohol in it is good for the stomach.**

No one who wishes to have a healthy stomach should use tobacco. Tobacco contains a strong substance that is dissolved by the saliva and thus gets into the stomach. This weakens the stomach and

makes it less able to keep up the churning motion that mixes the food with the gastric juice. Many tobacco smokers and tobacco chewers are troubled with weak stomachs.

**Smoking or chewing tobacco injures the stomach.**

**Questions.**—What is the stomach? What mixes with the food when it reaches the stomach? What does this juice do to the food? How does food look when the stomach has finished its work? Why should you never swallow your food in big lumps? How does some of the food get into the blood from the stomach? Where does the remainder of the food go? What is that part of the body called the bowels? Where is this long tube packed away? What mixes with the food in the bowels? What do these juices do to the food? How does it get into the blood when it is dissolved? How may the stomach be injured? Why should the stomach not be kept at work all the time? How may you know when you have eaten enough? What harm may come from taking too much ice-water or ice-cream with your meals? What kinds of food are hard for the stomach to digest? How do pepper, mustard, ginger, and other hot substances affect the stomach? What does alcohol sometimes do to the lining of the stomach? What does alcohol sometimes do to the gastric juice? What does it do to the food in the stomach? How does tobacco often harm the stomach?

# CHAPTER VI.

## *The Blood.*

### LESSON XII.

DID you ever see a large river with boats sailing up and down on it? Here is a picture of one with a city on its banks. Some of the boats are carrying wheat, corn, vegetables, and other kinds of food to the people who live in the city where these things can not be raised.

Thus the river brings food to the people by floating the boats that carry the food. The river also

helps to keep the city clean. Pipes called drains run from all the houses to the river. Through these pipes unclean and waste matter flows from the houses into the river, and the river carries it away. The water of the river is very impure after it has received foul matter from all these drains, and it flows away to the ocean to be purified.

Inside of our bodies is a wonderful stream that in some ways is like a river. It carries food to all parts of the body and washes away waste and worn-out matter from all parts. This wonderful stream is the blood.

**The Blood.**—You know how blood looks, for you have seen it coming out in red drops when you have scratched or cut yourself. You have learned, too, that blood is made from food.

When you are well and eat the right kind of food, the blood carries to every part of the body just the kind of food every part needs. The bones get what they need for making more bone; the stomach gets what it needs for making gastric juice. No part is left to starve.

But if you eat cakes and candy when you should eat bread and butter, some parts of your body will have to go hungry. The blood will not have in it what all parts need.

**Blood made from good, wholesome food is better than that made from pie, cake, or candy.**

The blood needs good air, too, as well as food. If you spend most of your time shut up in the house the blood will become bad for want of pure air. To keep your blood pure you should run and play out of doors some time every day unless you are ill or the weather is too stormy. Grown people, too, need exercise in the open air as well as children.

**Take exercise in the open air to keep your blood pure.**

The blood often gets impure from the things we eat or drink. When people take such drinks as wine, beer, or cider, the alcohol in them quickly soaks through the little blood-vessels of the stomach and gets into the blood.

No part of the body needs alcohol. It does not feed any part, and it prevents many parts from getting the food they need. It is a poison when it goes into the stomach and when it is in the blood. Wherever it goes it does harm, as you will learn in later lessons.

**Do not poison your blood with beer, wine, cider, or tobacco.**

**Questions.**—Why is the blood in our bodies something like a great river? What kind of food must you eat in order to have good blood that will feed all parts of the body? What kinds of food will not make good blood for feeding all parts? What besides good food does the blood need? What kind of drinks makes bad blood? What does alcohol do wherever it goes?

## LESSON XIII.

**The Blood-vessels.**—How does the blood get to every part of the body? Does it run around loose wherever it may happen to go? No, indeed. It stays all the time inside of little hollow tubes called blood-vessels. When you cut yourself you cut open some of these tubes, and the blood runs out just as water runs out of a bursted rubber hose.

The blood-vessels are of many sizes. Some are as large as your little finger; some are smaller than the finest hair. But, however small they may be, they are still hollow tubes through which the blood can flow.

Perhaps you wonder how the blood can carry food to all parts of the body if it is always shut up in the blood-vessels. You remember how the food gets into the blood from the stomach by soaking

through the thin walls of the small blood-vessels. It gets out in the same way by soaking out through the thin walls of the small blood-vessels all over the body.

Every part of the body has its share of these small blood-vessels with walls thinner than tissue paper. The kind of food needed by each part soaks out of the blood through these thin walls when it comes to the place where it is needed.

*The family pump.*

**The Heart.**—What do you think keeps the blood moving in the blood-vessels? It does not always flow down hill like a river. The blood which was down in your feet two or three minutes ago may now be in your hands or head.

This is another strange thing. How can the blood get from your feet up to your head when you are standing up? It must flow up hill; but blood can not flow up hill of itself any more than water can. Water is sometimes made to flow up hill by means of pumping-machines. Men have invented some wonderful machines for pumping water from wells and rivers up into houses or into reservoirs on the tops of high hills. Fire-engines force water through long pipes high up into burning buildings.

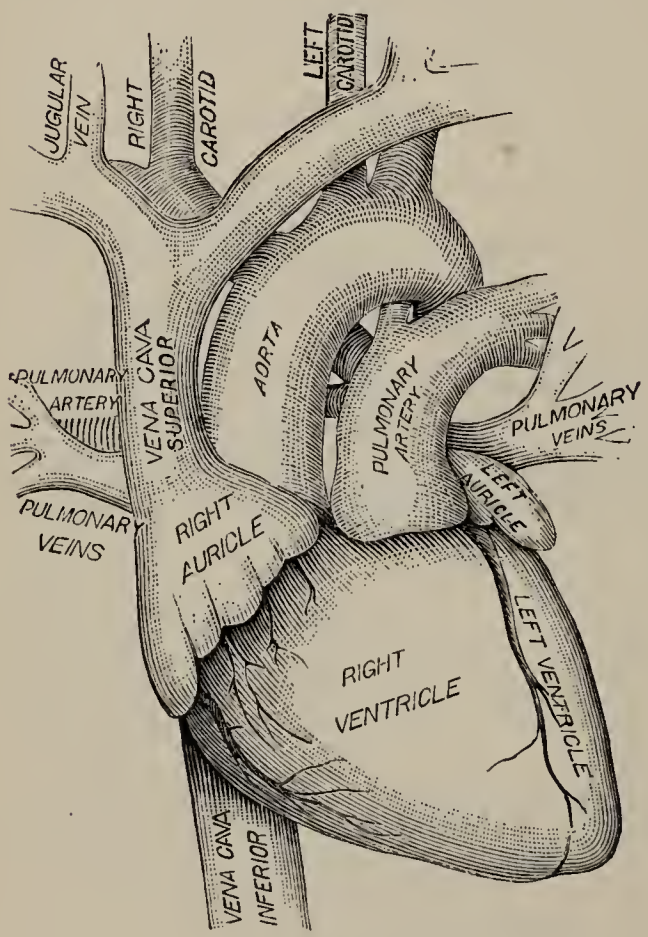
The most wonderful of all pumping-machines is the heart.

You know where your heart is, for you have felt it going thud! thud! against your chest when you have been running.

The heart is never still a minute. It is always pumping the blood through the blood-vessels; but you do not always notice its action. When you run fast it has to beat harder and make the blood flow faster than when you are quiet, and then you feel it beating.

You can see from this picture how your heart looks. It is about as large as your fist and has four hollow places or rooms inside. These rooms are placed two above and two below, like the rooms in a two-story house.

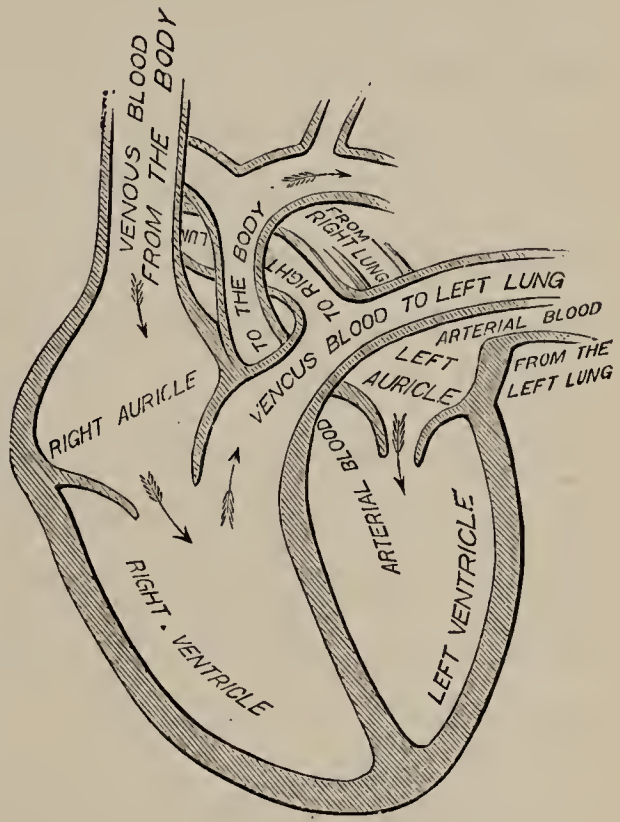
The blood flows from large blood-vessels into the upper rooms of the heart until they are full, or nearly full. Then the walls of these rooms quickly squeeze together like the bulb of a syringe when you press it. This forces the blood out of the upper rooms into the lower rooms. It can not go back into the blood-vessels again because little flaps called valves close like tight-fitting doors against the opening of the blood-vessels and keep the blood from going back.




When the lower rooms of the heart are full they too squeeze together and force the blood out into

the blood-vessels that carry it away from the heart. About a tumblerful of blood is forced out of the heart at every beat.

**Arteries and Veins.**—The blood-vessels that bring blood to the heart are called veins. Those that carry blood away from the heart are called arteries.




The blood flowing to the heart in the veins moves slowly and evenly, like a man who is returning home tired by a long journey.

The blood flowing away from the heart through the arteries flows more swiftly and with sudden spurts. At your wrist you can feel an artery swell out each time the blood spurts through it. You call it your pulse. The doctor knows by feeling your pulse how fast your heart is beating, for at every beat the arteries swell out with the fresh quantity of blood the heart forces into them. Each new quantity of blood thus forced into the blood-vessels gives

a sudden push to the blood in front of it, and so keeps the whole stream rushing through all the arteries.

The large artery that receives blood from the heart for all parts of the body soon branches out into smaller arteries. Some of these branches go to the head, some to the legs, some to the arms, and some to other parts. Each new branch sends out more and smaller branches until the smallest ones finally branch into the many hair-like blood-vessels with very thin walls that run through every part of the body.

From the smallest arteries the blood flows on through the hair-like blood-vessels into the smallest veins. These join together and form larger ones until they all unite in two large veins that carry the blood back to the heart.

**Questions.**—What keeps the blood from flowing where it ought not to go? Why does the blood flow out when you cut yourself? About how large are the largest blood-vessels in your body? What is the size of the smallest ones? How can the blood feed the body when it is shut up in blood-vessels? What keeps the blood moving in the blood-vessels? What is the heart always doing? Why do you notice the beating of your heart more when you run than when you are quiet? How large is the heart? How is it divided? From what does the blood flow into the heart? What forces it out of the heart? Into what does the blood go as it leaves the heart? What are the blood-vessels that bring the blood to the heart

called? What are those called that carry the blood away from the heart? How does the blood move through the veins? How does it move through the arteries? Why does the doctor feel your pulse? Into what do the large arteries divide? Where do these branches go? What kind of blood-vessels are at the ends of the arteries? Into what does the blood flow as it passes out of these very small blood-vessels? Where do the veins carry the blood?

## LESSON XIV.

**How the Heart and Blood-vessels may be injured.**—You can not begin to think how much work your heart does every day. The largest engines men have ever made can not lift as much, according to their size, as your busy little heart.

The heart is never lazy. There is more danger that it will tire itself with overwork than that it will ever become lazy.

**Alcoholic drinks tire the heart by making it beat too fast.**

These drinks are also likely to make too much fat in the heart.

The heart has to be very strong to squeeze the blood out with enough force to send it through all the blood-vessels. A heart that has much fat in it is too weak to do this.

Alcohol weakens the heart by making it overwork and by causing too much fat to form in it.

Tobacco also makes the heart beat faster than it should. It weakens it and makes it unsteady. Among boys who smoke cigarettes many are found who have weak and unhealthy hearts, caused by this foolish and harmful habit.

Blood-vessels are elastic—something like a rubber band. When you stretch a rubber band it springs back. The walls of the arteries stretch as the blood spurts through them and then spring back.

If you stretch a rubber band over a large book and keep it there a long time, it will not always spring back when you take it off. It loses its power of springing back by being stretched too much.

When a person is in good health his blood-vessels will stretch just a little, but not too much. If a man takes a drink of wine or beer or other alcoholic drink, the alcohol weakens the blood-vessels so that they stretch more than they should. The man's face grows red because all the little blood-vessels just under the skin are stretched too much and are too full of blood.

If the man keeps on drinking wine or beer every day, the little blood-vessels may remain stretched all the time. Like the rubber band that is kept

stretched too long, they lose their power of springing back.

Alcohol sometimes causes the coats of the blood-vessels to grow thin. They are then liable at any time to cause death by bursting.

**Drinks that have alcohol in them injure the blood-vessels.**

**Questions.**—How does the work done by your heart compare with the work done by a large engine? How do drinks that have alcohol in them tire the heart? In what other way are they likely to injure the heart? Would too much fat in the heart make it weaker or stronger? What does tobacco often do to the heart? What shows this to be true? In what respect are the blood-vessels like a rubber band? How does alcohol injure the blood-vessels? Why does a man's face grow red after he has taken an alcoholic drink? What does alcohol sometimes do to the coats of the blood-vessels?

## CHAPTER VII.

### *How the Blood is Purified.*

### LESSON XV.

DID you ever try to sit perfectly still? You found that you could keep your hands still and your feet still and your head still for several minutes, perhaps, but there was one part of your body you could not keep still more than a few seconds. at a time. Your chest would keep swelling out and then falling back in spite of all you could do. It would only keep still while you held your breath, and you could not hold your breath long. One can live several days without eating or drinking, but no one can live for more than five minutes without breathing.

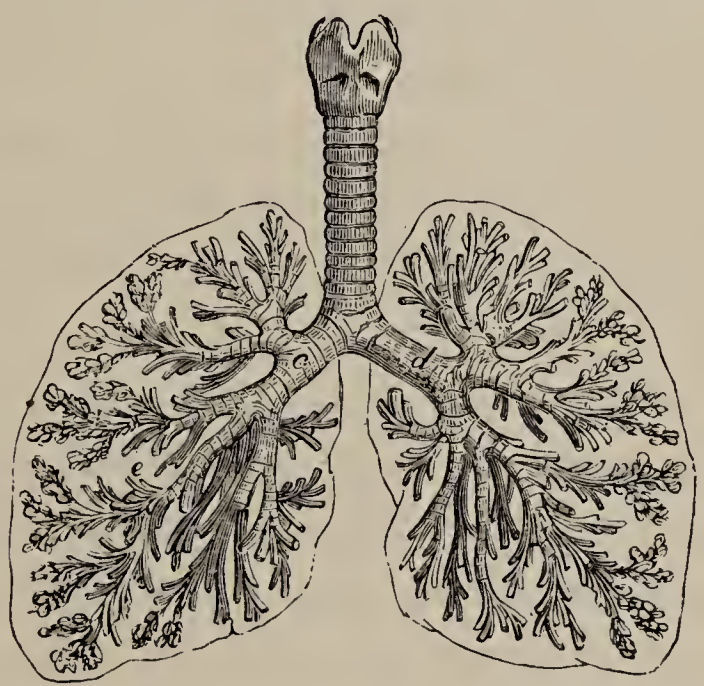
What happens when you breathe? Watch and see. Your chest swells out and you feel the air going into your nostrils. Then your chest falls in again and you feel the air coming out. Where does the air go to when you breathe it in?

From your nose it passes down through the back

part of your mouth into a small pipe in the front part of your throat. This pipe is called the wind-pipe. You can feel the wind-pipe in the front of your throat. It is stiff and hard because there are in it hoops of gristle that keep it always open.

From the wind-pipe the air goes to your lungs.

**The Lungs.**—What are the lungs and how do they look? Suppose you had a cluster of grapes and by some means you could take out the inside of each grape and leave the skins whole on the stems; and suppose the stems were all hollow so you could blow into them as you can through a goose-quill.



By blowing into the end of the large stem of the bunch you could "blow up" the whole bunch of grape-skins just as you blow up a bladder. If you should then press the whole bunch together the air

would rush out of each grape as it does out of the blown-up bladder when you squeeze it.

The lungs are made up of many little roundish sacs or cells fastened to hollow tubes much as grapes are fastened in a bunch by their stems. Each cell, which is called an air-cell, has a very thin skin called its wall. In the walls of the air-cells are many little blood-vessels which have also very thin walls.

You remember that we said the blood was much like a great river? Besides carrying food and drink to all parts of the body, it washes away waste and worn-out matter.

When the water of a river becomes foul with the waste matter from people's houses it flows away to the ocean, where it mixes with the great salt waves and is tossed about by the winds until it is cleansed.

There is no ocean where the blood can go to be cleansed. It must be purified in the body. The same blood that took up impure matters must soon go back to the same place again; but it must not carry the impurities with it. These the blood must get rid of before it comes around again.

The lungs is the place prepared for the special purpose of cleansing the blood.

**How the Blood gets to the Lungs.**—The heart, you remember, has four rooms in it—two under and

two upper ones. Blood enters the two upper rooms from the veins and passes out of the two lower rooms into the arteries. The blood that is sent out all over the body comes from only one of these lower rooms—the one on the left side of the heart. From the lower room on the right side of the heart the blood goes directly to the lungs.

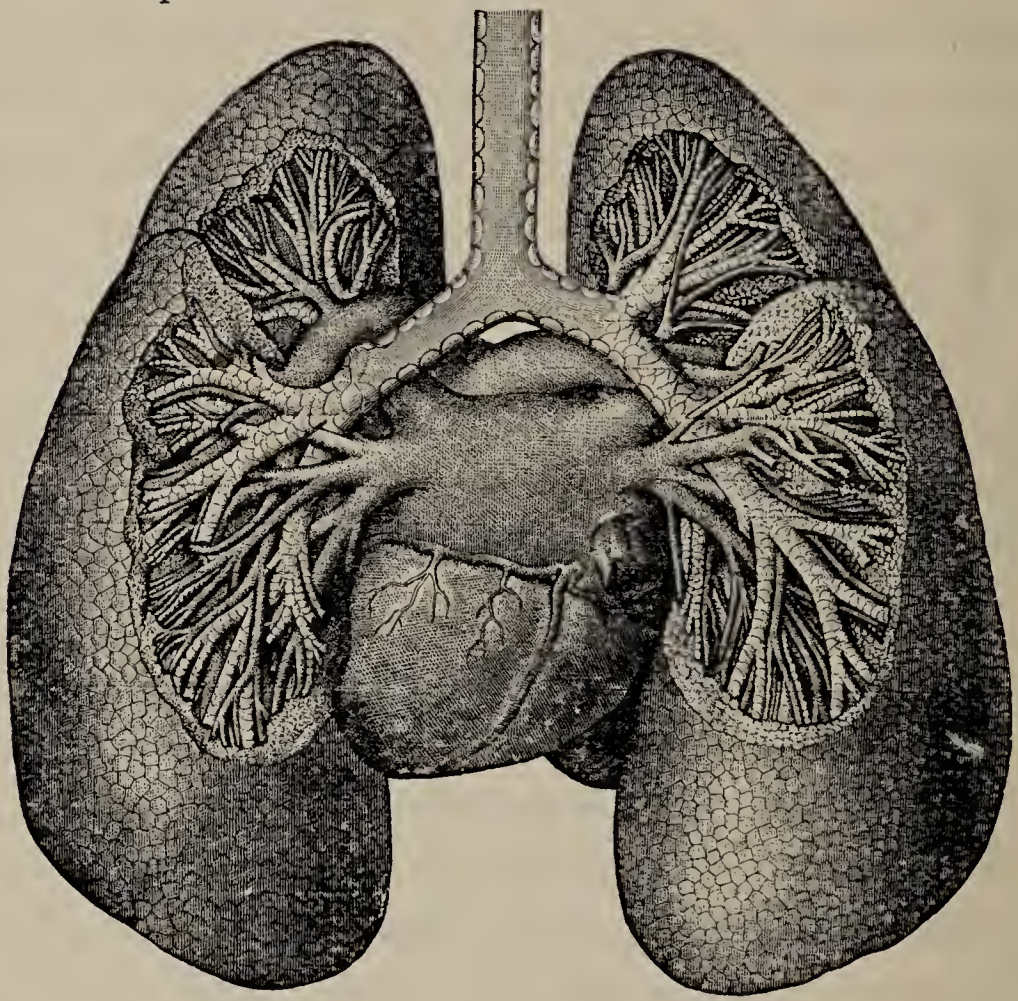
The artery that carries the blood to the lungs like the other arteries divides into many small branches. From these branches come the many little blood-vessels with very thin walls that lie in the walls of the air-cells.

The air we breathe in rushes into all the little air-cells to meet the blood. The blood rushes from the heart into the tiny blood-vessels in the thin walls of the air-cells to meet the air.

There is nothing, then, between the blood and the air but the thinnest of thin walls. Through these the part of the air needed to purify the blood can easily pass into the blood; and some of the impure matters in the blood can pass out into the air through the same thin walls. These impurities are carried out of the lungs by the air as we breathe it out.

The blood that goes to the lungs from the heart is very dark because of the impurities in it. When

it leaves the lungs again it is bright red, because it has been purified.



Where does the blood go when it leaves the lungs? Back again to the heart, to be sent out over the body.

The left lower and left upper room of the heart are always filled with bright-red blood that has just been cleansed in the lungs. The right upper and right lower rooms are always filled with dark blood that has come from the veins and is on its way to

the lungs to be cleansed. It is this dark blood in the veins that makes the veins look blue.

Now you know the whole long journey that the blood makes.

First it comes out of the left lower room of the heart and rushes through the arteries that carry it to the very small blood-vessels all over the body. It is then bright red. While on its way through the small blood-vessels it gives out food and takes up waste matter. This causes it to lose its bright-red color and turn dark.

From the small blood-vessels the dark blood flows sluggishly through the veins to the right upper room of the heart. The heart sends it out from the right lower room to the lungs to be purified.

From the lungs it comes back to the left upper room of the heart, to be sent out of the left lower room again all over the body.

**Questions.**—Why is your chest always swelling out and in? What is the longest time one can live without breathing? What do you take in when you breathe? Where does this air go to? Of what are the lungs made up? What are these tiny cells called? What kind of walls have these air-cells? What are in these walls? Why does the blood have to go to the lungs? How does the blood go to the lungs? How does the air get there? What is between the blood and the air in the lungs? What passes through these thin walls into the blood? What passes out of the blood into the air in the lungs? What is the color of the blood as it goes to the

lungs? What is its color as it leaves the lungs? Where does the blood go when it leaves the lungs? Where does it go from the heart? Describe the journey the blood makes from the time it leaves the right side of your heart until it gets back to the same place again.

## LESSON XVI.

**Pure Air.**—No one should breathe impure air; and yet we make the air impure by breathing it. Every breath we throw out from our lungs spoils nearly half a barrel of air.

If you remain shut up in a room with the doors and windows closed you soon have to breathe over again the air that you have spoiled with your breath. If a number of people are in the room at the same time, the air is made impure so much the quicker.

We can not help making the air bad when we breathe; but we can help breathing over again the air we have spoiled. All we have to do is to open the doors and windows of our houses. The bad air will go out of itself and good air will come in of itself if we only give it a chance.

Out-door air is like the water in the ocean—it is always in motion. Air in a shut-up room is like water in a tub, a marsh, or a still pond. When impurities get in it they remain in it.

Sometimes the air out of doors has only a little motion. You can just feel it blowing gently against your cheek, and you say a breeze is blowing. Sometimes the air moves in strong gusts that flutter your clothes and snatch off your hat. You call that a wind.

Both winds and breezes help to purify the air.

Trees and plants, too, have something to do with keeping the air pure. Some of the poisons we breathe out are just what the trees and plants take in through their green leaves to make them grow. The wind that comes dashing past our open windows drives our impure air off over the meadows and woods, where this poisonous part is taken from it by the trees and plants.

In this way out-door air is kept pure for us to breathe.

But we are often careless about having pure out-door air to breathe. We shut ourselves up in our houses with all the doors and windows closed and breathe bad air over and over again, making it worse with each breath.

Our houses should be so built that the bad air can be always going out and the good air coming in; but if we have to live in houses that are not so built we must find ways of keeping the air pure. In

warm, pleasant weather we can have our windows wide open all the time. In cold weather we can have them open a little crack most of the time, and once in every little while we can open them wide for a minute or two. While we do this we may put on a shawl or wrap if we feel cold.

When you go into a house from the pure outdoor air your nose tells you very quickly whether the air inside is good or bad; but when you have been in a room for some time your nose gets used to the bad air and does not warn you of it.

A good way to find out whether the air in a room is bad or not is to go out of doors for a few minutes and then come back. If the room smells close it needs airing.

People are sometimes afraid to let fresh air into their rooms through fear of taking cold. These people usually have colds a great deal of the time because their blood is poisoned by breathing impure air.

We may have good air to breathe and still guard ourselves from taking cold.

We should always have our sleeping-rooms so arranged that pure air is coming into them all night and the bad air is escaping. If we sleep in a room where there is no stove or heater and it is too cold

to have the windows open, we can open a window in a room where the stove is and leave the door open between that room and the sleeping-room.

All the doors and windows of a sleeping-room should be thrown wide open every morning, and all the bedding and night-clothes should be thoroughly aired.

The doors and windows of the whole house ought to be opened every morning to let out the air that has been kept there all night. If there are sick or delicate persons in the house while this is being done, they should be well wrapped up to prevent them from being chilled.

Other things besides the impurities in our breath spoil the air. A lamp burning in a room helps to use up the part of the air that should go into the blood from the lungs.

The air of a room full of people where many lights are burning in the evening is very soon made unfit to breathe unless plenty of fresh air is kept coming in.

A school-room should always be well aired as soon as the pupils have left it at the close of school and before they enter it again in the morning.

No decaying meat, fruit, or vegetable should ever remain near our houses. The poisons that get into

the air from such things often cause very dangerous sickness.

The air is often poisoned by bad drains. If we have reason to think that impurities escape from a drain in or near our house we should have it repaired at once.

Filth of all kinds makes the air impure. Dirty floors, walls, ceilings, dirty pails or other vessels, soiled clothes—all give off impurities that are carried about in the air. The dust of our rooms helps to make the air impure. When we sweep and dust a room we should have all the windows and doors open so that the dust can go out. We should be careful to brush the dust off from picture-frames, books, and everything in the room after sweeping, so that it may not be flying about afterward for us to breathe.

Soap and water, brooms and dusters vigorously used, and plenty of sunlight, are all needed to keep the air of our rooms pure. These may all be called friends to good health.

**How the Lungs may be Injured.**—Bad air not only poisons the blood, but it injures the lungs. Many people die of wasting lung diseases that might have been avoided by having pure air to breathe.

**Keep your lungs healthy and your blood pure by breathing pure air.**

The lungs may also be injured by wearing clothing so tight that it does not leave the lungs room enough. They may also be injured by allowing the shoulders to stoop and cramp the chest.

Give your lungs plenty of room by wearing loose clothing and by sitting or standing erect.

The lungs may be injured by the use of alcoholic drinks.

When a person has poisoned his blood by drinking wine or beer the lungs help to get rid of the poison. Some of the alcohol passes out of the blood into the air-cells of the lungs and is breathed out with the other impurities in the form of a vapor so fine that it can not be seen. It is this that gives the sickening smell to the breath of the person who has been taking these bad drinks.

The alcohol that passes out of the blood through the lungs is the same biting poison that went into the stomach. It has power to hurt the delicate air-cells of the lungs as well as the delicate lining of the stomach. It causes the small blood-vessels to stretch and makes the lungs more liable to colds and coughs. It often causes hoarseness.

Alcohol sometimes causes a disease of the lungs which can not be cured.

Tobacco smoke injures the delicate lining of the

nose and throat and the little tubes that take air to the lungs. If one has a cough it is made worse by breathing tobacco smoke. The breath of a person who uses tobacco always smells very bad.

Air that has tobacco smoke in it is unfit to breathe. It is bad enough for a person to spoil with tobacco smoke the air he has to breathe himself; but it is worse for him to spoil in this way the air which other people have to breathe.

**Do not injure your lungs with bad air, tobacco or alcoholic drinks.**

**Questions.**—How do we make the air of our rooms impure? Why is the air in a close room worse than the air out of doors? How do the trees and plants help to purify the air? How can we have pure air in our houses? How can we tell when the air of a room is getting bad? How should our sleeping-rooms be arranged? How should we air our sleeping-rooms every morning? How should the whole house be aired every morning? Why do we need more air in a room when a lamp is burning? Why should no decaying meat, fruit, or vegetable be allowed near our houses? In what other ways may air be made impure? Why is it necessary to keep our houses swept and dusted? What does bad air do to the blood and the lungs? How are the lungs injured with alcoholic drinks? What lung disease does alcohol sometimes cause? What does tobacco smoke do to the nose and throat? How does it keep the lungs from getting their proper supply of pure air? Has a person a right to puff tobacco smoke into the air that other people have to breathe?

## CHAPTER VIII.

### *The Framework of the Body.*

### LESSON XVII.

DID you ever see a jelly-fish? If you have not, you have seen jelly. You know that if you turn a glass of jelly out on a plate the jelly will not stand up firm like a block of wood, but will shake and quiver and flatten out on the plate.

The flesh of our bodies is not firm like a block of wood, but is soft and jelly-like. If there were nothing to hold it in place it would sink down in a

shapeless mass; but we have a strong framework of bones that holds our flesh in place.

You have seen fish-bones and chicken-bones, and perhaps other bones in different kinds of meat on the table.

If the bones of a chicken after the meat is taken off should all be placed together just as they were when the chicken was alive, you would have the skeleton or frame-work of the chicken. The bones of a fish or of any animal placed together in the same way would form the skeleton of the fish or other animal.

The bones of a human body are sometimes put together after the person is dead in order that people may study them and learn their use. They form, when thus united, what is called the skeleton of the human body.

A little colored boy was once greatly frightened to hear that there was such a thing as a skeleton inside of him. He ran right out of school without waiting to learn how very necessary his skeleton was to him.

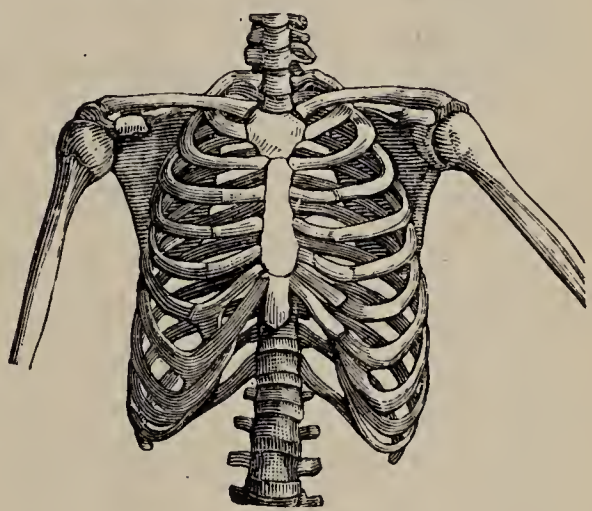
There are over two hundred bones in the skeleton of the human body.

The bones of the head form a hollow place—something like the inside of an egg-shell, only very much stronger—for holding the brain, which is the most

precious part of the body. The brain is very soft and delicate, and would be easily injured if it were not well protected by the strong bones of the head called the skull.

The heart and lungs are also very important parts of the body that might be easily injured if they were not well protected.

Strong bones called ribs curve around from the backbone behind to the breast-bone in front and form a kind of cage where the heart and lungs are kept safe from outside injury.



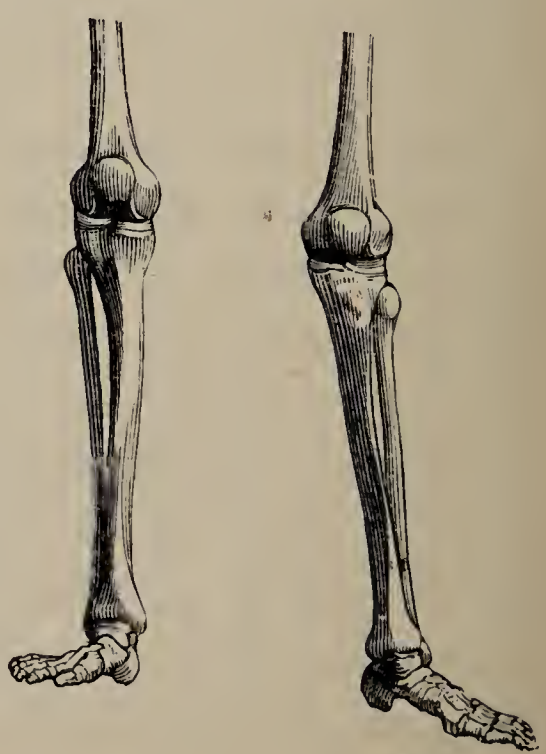
Some silly girls and women think they look better if they have very small waists. For this reason they squeeze their waists with tight clothing that presses in the ribs, and sooner or later injures the health. Whatever injures the health will soon injure good looks.

People who have good sense, and who know how the human body is made, do not like to see a pinched waist. It shows that the heart and lungs are too crowded to do their work well and that the liver and stomach are pushed down where they

do not belong and where they crowd upon other parts. A person with such a pinched waist can not breathe naturally. She can not be as well and strong, nor as easy and graceful in her motions as she could be if she wore loose-fitting clothing.

No sensible girl will try to make her waist smaller by pinching it. She will wear loose clothing that will not crowd the ribs out of their proper place, and injure both her health and her good looks.

The bones of the legs and arms are not made to inclose and protect anything, but to hold up our bodies and enable us to make many motions that we could not possibly make without them. The bones of the legs, which have to bear the weight of the whole body, are very strong. The bones of the arms are smaller but are shaped much like those of the legs. In most animals the limbs that correspond to our arms, such as the



fore-legs of the cat or dog, have to help bear the weight of the body; but in man the whole weight is borne by the legs, and the arms are left free for other uses.

Our houses, furniture, books, machinery, and other wonderful works would never have been made but for the great variety of motions men are able to make with their hands and arms.

**The Joints.**—Boys sometimes try to walk on stilts. They can take long strides when they are up on high stilts, but their walking is very stiff and awkward.

If the bones of our legs were one straight piece like a stilt we should make just such ungainly movements whenever we tried to walk; but the bones of our legs, and arms as well, are in several pieces united by joints which allow them to bend freely.

Some of these joints bend only back and forth like the hinge of a door. Some allow a bend in any direction. The joint at the hip is one of this kind. Joints at the hips, the knees, the ankles and toes, all bend as we walk.

We move our arms by bending joints at the shoulder, the elbow, and the wrist. Each finger has three hinge-joints that allow the bones to fold up

against each other, as when we double up the fist or grasp anything in the hand.

**What Bones are made of.**—If you put a bone in a slow fire for two or three hours and then take it out it will be very brittle. A light blow will make it crumble. Put another bone into a mixture of acid and water and leave it a few days, and when you take it out it will be like gristle. It will bend easily but will not break.

Bone is made up chiefly of gristle and lime.

When you put the bone in the fire the gristle is burned out and the brittle lime is left. When you put the bone in acid the lime is taken out and the gristle is left.

The bones of old people contain more lime than gristle. For this reason they break very easily. The bones of young children contain more gristle than lime. For this reason they do not break as easily as those of old people.

**Care of the Bones.**—When we are growing our bones need lime to make them strong and hard. If we eat the right kind of food we get enough lime for our bones; but if we eat cake and white bread when we should eat oatmeal and good Graham or whole wheat bread, our bones may not get all the lime they need.

**Children who do not have proper food often have weak bones.**

When the bones are young and tender they are easily bent out of shape. The backbone may become crooked by sitting long at a time with one shoulder raised higher than the other. When you write you should not sit with one arm on a high desk and the other hanging several inches below. Your desk should be of such a height that you can rest your elbows upon it without either stooping over or raising your shoulders.

We may become "round-shouldered' by sitting bent over too much. Such a position cramps the chest and does not allow the lungs enough room. Lungs that are cramped in a narrow chest are very liable to become diseased.

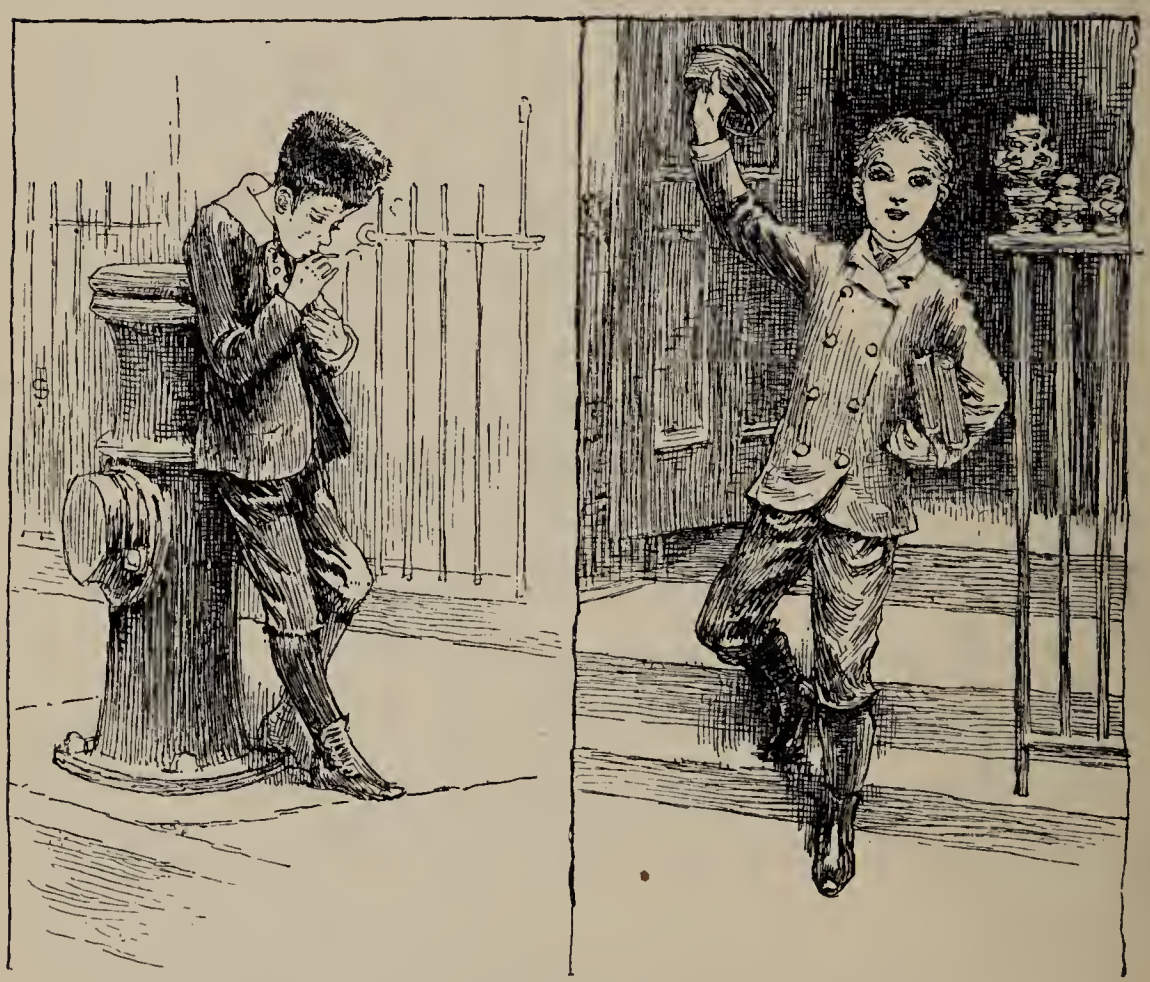
You should sit and stand erect with your shoulders thrown back to give your lungs plenty of room.

The bones of the feet may be bent out of shape by tight shoes. No person can walk gracefully with feet crippled in this way.

Do not wear tight shoes, nor pinch your waist with tight clothing.

The bones need good blood to make them grow. Alcohol and tobacco injure the blood and make it

less fit for feeding the bones. It has been found that tobacco often stunts the growth of the bones. Boys who use it seldom have as fine a form as they would if they were wise enough to let it alone.



People, as well as plants and animals, are so made that they must do their growing while they are young. Whatever growth we lose in our growing days can never afterward be made up.

**No wise boy will stunt his growth with tobacco or alcoholic drinks.**

**Questions.**—Why does the body need a framework? What is the framework of the body? What is a skeleton? What can we learn from a skeleton? Of what use is the skull? What do the ribs protect? Why should the ribs never be pressed in with tight clothing? Why are the bones of the legs large and strong? Of what use are joints? At what places do you find joints in your arm? Of what two kinds of material are bones chiefly made up? Why do the bones of old people break easily? Why do the bones of children bend easily? What must we have in our food in order to make the bones grow strong? How may the backbone be bent out of shape? How do we become round-shouldered? What part of the body does not have room enough if the chest is cramped? How may the bones of the feet be injured? What kind of blood must the bones have to make them grow? How are the bones injured by using tobacco? Why should we be careful to do nothing that will stop our growth while we are young?

## CHAPTER IX.

### *The Muscles.*

### LESSON XVIII.

How is it that we can lift our arms, move our fingers, raise our legs as we walk, and make many other motions?

Look at your arm a moment. There is some weight to it with all its bones, blood, blood-vessels, and other parts. Yet you can lift it so easily that you never think of its being heavy.

But what lifts it? The bones can not lift themselves, nor the blood-vessels, nor the skin. There must be something in it that lifts all these.

Bend your hand toward the under side of your arm and look at your wrist as you do so. You can see something that looks like strong white cords standing out just underneath the skin.

If you will examine the leg of a chicken or turkey the next time you have one for dinner, you will see in it near the foot just such cords as those

in your wrist. Follow these cords up the leg of the turkey and you will see that they gradually enlarge and change into bundles of dark lean meat.

It is this lean meat that moved the turkey's leg when it was alive. This lean meat is called muscle.

**Muscles.**—All our motions are made by muscles.

Did you ever play with a "bouncing-ball"? A rubber string is fastened by one end to the ball and by the other end to a ring that you slip over your finger.

When you throw the ball the rubber stretches out; but it quickly shortens and brings the ball back toward your hand.

The muscles of the living body are something like a rubber string; they will stretch and shorten. When muscle shortens we say it contracts.

Every motion of the body is made by the contraction or shortening of some muscle.

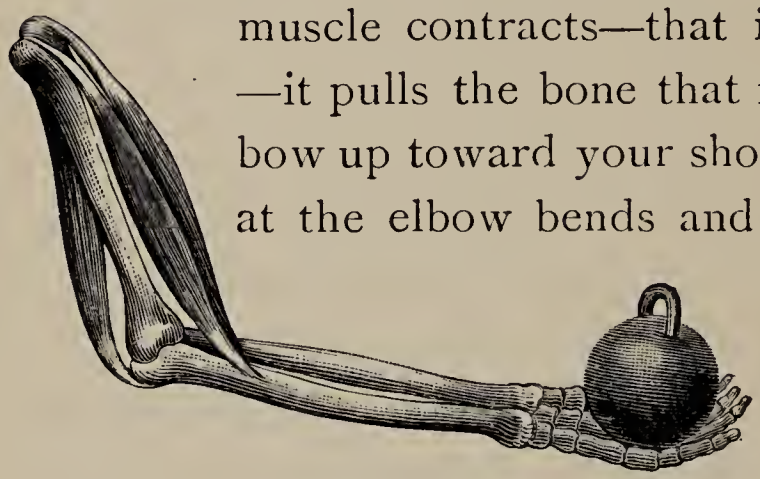
Nearly every muscle is fastened to two different bones. When the muscle contracts it brings the bones nearer together, just as the rubber string by contracting brings the bouncing-ball nearer your hand.

Let us see how this is done.

Suppose your arm is hanging straight down from

your shoulder and you wish to raise your hand to your head.

There is a muscle which is fastened by one end to your shoulder and by the other end to a bone in your arm below the elbow. When this muscle contracts—that is, grows shorter—it pulls the bone that is below your elbow up toward your shoulder. The joint at the elbow bends and allows the bone below to come up against the one above it.



Most bones have two or more muscles fastened to them—one to pull the bone in one direction, and another to pull it in the opposite direction.

In nearly every motion we make we use more than one muscle. To simply close the hand requires the use of several muscles all acting together.

The muscles which move your hand and fingers are in the fleshy part of your arm, below the elbow, and are fastened to the bones of the hand by cords. These are the cords you see at your wrist as you bend your hand back and forth.

You can easily see the reason for this wise ar-

rangement. Muscles are thick and fleshy and take up a good deal of room. Cords take up but little room. If the muscles reached all the way to the fingers they are to move, your wrist would be as large as your arm and your fingers would be quite too large and clumsy for much use.

Up in the arm the muscles are out of the way, and yet they do their work by pulling the strong cords that are fastened to the bones which they are to move.

Nearly all muscles end in cords or bands.

Each muscle has its own work to do and is kept separate from its neighbors by a very thin skin closely wrapped around it, something as oranges are wrapped in tissue paper to keep them from touching each other; but the gauze-like skin that wraps each muscle is far more delicate than tissue paper, and is laid on without a fold, a wrinkle, or a seam.

You can see some of this delicate wrapping around the muscles of the turkey's leg. Perhaps you can find, too, the particular muscle that pulls each of the turkey's toes.

The muscles of the body are of many shapes and sizes. Some are long and narrow like ribbons. Some are flat and spread out like fans. Some are round and thick.

The heart is a hollow muscle, very thick and strong, as it must be in order to send out the blood with such force.

The muscles of our arms, legs, and some others contract only when we wish them to. The muscles of the heart contract without our thinking about it. So do the muscles that draw the chest in and out as we breathe and that keep the stomach in motion when there is food in it to be mixed with gastric juice.

If we had to think about all such motions before making them we would be obliged to lie awake at night to keep our hearts beating. Boys and girls who have the bad habit of forgetting would often forget to have their dinners properly attended to after eating; and I am very sure that all of us would forget to attend to our breathing when we were hard at work or play.

**Questions.**—How are all our motions made? What are muscles? To what are nearly all muscles fastened? When a muscle shortens what does it do to the bones to which it is fastened? Where are the muscles that move your hand and fingers? Why do we need cords as well as muscles for pulling the bones? How are the muscles kept separate from each other? Why does the heart need to be made of muscle? Why do we not have to think about making the heart beat? What other muscles act without our thinking about them?

## LESSON XIX.

**How to have Strong Muscles.**—Boys always like to show how strong their muscles are. They like to see who can lift the heaviest weight, who can run the fastest and farthest, or climb the highest tree.

*See My Muscle.*

The boy or girl who comes out ahead in such trials of strength is the one who has the best muscles all in the best order.

To have good strong muscles several things are necessary:

We must use them. Muscles grow strong by being used. They become weak by not being used.

Most children like to run and play a great deal. This is well, for it gives exercise to a good many muscles. The boy who is too lazy either to work or play will not have strong muscles.

The muscles must have rest as well as exercise. To use them too long after they are tired makes them weaker instead of stronger.

Running is a good exercise; but one who is not used to it must be careful not to run too far at first. When we run the heart has to beat rapidly to send the blood out as fast as it is needed. A long run when one is not used to it may strain the heart so that it will never be as strong afterward.

In running, as in every other exercise, we can train our muscles to do a great deal if we use them some every day and stop when they are tired. Each day they will then be able to do a little more before becoming tired.

Walking is another exercise that calls a good many muscles into use. It takes a baby a long time to learn to walk because he has to learn to use so many muscles all at once.

The boy in the country who walks a mile or two every day to school is likely to have stronger muscles than the boy in the city who walks only a block or two and sits in the house most of the time when he is not in school.

Girls need exercise as much as boys. They should run, walk, roll hoops, coast, play ball, and

other out-door games, so that they may have active muscles and grow up to be strong, healthy women. In order that all their muscles may be thus freely exercised, they should wear no clothing that is tight about the waist. All articles of dress should be loose-fitting to allow easy movements.

**If you would have good muscles you must take exercise every day.**

Good food is necessary to good muscles.

The best food for the muscles is not the richest, but that which contains what the muscles need, such as good whole wheat bread or mush, oatmeal, milk, eggs, beans, peas, good meat and fish.

Whatever helps to make good blood is good for the muscles, for the muscles are made from the blood.

Good food, good air, sunlight, and exercise are all good friends to healthy muscles.

Tobacco is an enemy to good muscles; it makes them weak and flabby.

If you watch the boy who smokes cigarettes you will see that it is usually hard work for him to sit up straight or to stand without leaning against something. The tobacco makes his muscles weak. It is the nature of tobacco to weaken the muscles.

Beer, wine, cider, and other drinks that have alcohol in them are also enemies to good muscles.

You remember that the muscles are lean meat. Alcoholic drinks sometimes cause this lean meat to turn to fat. Fat has no power to contract and pull the bones. Whenever a muscle, therefore, begins to change to fat it begins to grow weak.

Sometimes when the muscle itself is not changed to fat by the use of these drinks, it is crowded and made weak by the fat that collects around it.

The heart is sometimes made fatty and weak by the use of drinks that have alcohol in them.

Beer is a drink that very often causes unhealthful fat to form in the muscles of those who drink it.

A beer drinker often grows large and heavy and looks as if he were very strong; but his strength does not hold out long when put to the test. It is no match for that of the man who has not injured his muscles with alcohol and tobacco, but has kept them healthy by proper food and exercise.

Soldiers on a march, sailors, miners, and all men who work with their muscles find upon a fair trial that alcoholic drinks make their muscles weaker instead of stronger. They can do more and better work when they do not take these drinks than when they do.

Men who are trying to make their muscles strong for a race or other test of strength find that they grow strong faster when they avoid both alcohol and tobacco.

**Alcoholic drinks and tobacco are enemies to good muscles.**

**Questions.**—What kind of muscles must a boy have to bring him out ahead in a race? What kind of muscles shall we have if we do not use them? Why is it well for children to run and play? What do muscles need after they have had hard exercise? What are some good kinds of exercise? What kind of food is good to make good muscles? Name four good friends to the muscles. Why is tobacco an enemy to good muscles? What kind of drinks are enemies to good muscles? What often forms in the muscles of those who drink alcoholic liquors? Why does fat make the muscles weaker instead of stronger? What drink is very liable to cause unhealthy fat to form in the muscles? What shows that alcohol does not give people strength? What do men find about alcohol and tobacco when they are trying to make their muscles strong for a race?

## CHAPTER X.

### *Brain and Nerves.*

#### LESSON XX.

WITH what part of the body do we think? With our fingers or toes?

Oh, no, you say, with the brain.

If you are asked where the brain is, you are ready to say at once "In the head"; but if you are asked what the brain is, you may not be so ready to tell.

The brain is a mass of soft matter, part gray and part white. It is wrapped in a soft covering, a kind of skin that lies just underneath the skull.

The gray part of the brain is on the outside of the brain mass, just underneath the covering. It is creased with many little folds and wrinkles, so that it looks something like the kernel of a hickory-nut. Underneath the gray part is the white part of the brain.

The brain is divided by a deep crease into two parts, something as a hickory-nut is.

The hard bony case called the skull incloses the brain and shuts it safely away from everything that might injure it. Sometimes a heavy blow breaks the skull or jars it so much that the brain inside is stunned.

*The Brain.*

When a person's brain is stunned he does not know anything. His eyes are just as good as ever, but they do not see. His ears may be unhurt, still he does not hear when you speak to him.

We say that we see with our eyes and hear with our ears; but it is the brain that knows what the eyes see and what the ears hear. It is the brain that knows when a pin is pricking the flesh or the hand is touching a hot stove. If the brain is stunned, the hand may be badly burned and no hurt will be felt.

But, you may say, how can the brain know what is going on all over the body when it is so tightly shut in by the skull?

Have you ever been in a telephone office? How

does the person there know what people in all parts of the city and in villages miles away are saying to him?

*Section of the Head, showing the Brain.*

He knows because there are wires running out from the central office to the places where these people are, and messages may be sent back and forth over these wires.

So the brain knows what is going on all over the body because messages are sent to it, not over wires, but over little soft, white, thread-like fibers called nerves.

**The Nerves.**—Nerves are of two kinds—those that carry messages to the brain to tell it what is going on all over the body, and those that carry

messages from the brain to the muscles telling them when to contract and make the bones move.

Suppose you are walking some day in your garden where there is a rose-bush with a rose on it. As soon as your eyes see the rose, the nerves that lead from the eye to the brain carry the message, "There is a lovely rose on that bush."

The message is not given in these words. That would take too long; but these words tell what the brain knows when it gets the message.

Quickly then the brain sends a message to the muscles that move the feet, ordering them to make the feet go fast and take you to the rose-bush.

Messages from the eye keep telling the brain how near you are to the bush, and as soon as you reach it the brain sends orders to the muscles of your arm to raise your hand and to press your fingers together to pick the rose.

All this takes a good many messages; but many others that we have not noticed are being sent at the same time.

As you came near the bush your eyes probably saw a thorn by the side of the rose. The brain was at once told of this, and it telegraphed the muscles of your hand to keep your fingers pulled away from the thorn.

As soon as the rose was picked, the brain ordered the muscles in your arm to raise your hand to your face so that your nose could smell the rose. Then over the nerves running from the nose to the brain went messages telling the brain how sweet the rose smelled.

The nerves that carry messages to the brain are called nerves of sense, because all the messages they carry are about things that are found out by some of our five senses, either seeing, hearing, smelling, tasting, or feeling.

The nerves that carry messages from the brain to the muscles telling them when to move are called nerves of motion.

All our actions are guided by the messages which the brain sends to the muscles by the nerves of motion.

The muscles of the legs and arms and some others must wait for orders from the brain before moving, else we should be like people who have St. Vitus's dance.

Had the muscles of your legs begun to move you away from the rose-bush before the rose was picked, or had the muscles of your hand failed to pull your fingers away from the thorn at just the right time, some of your pleasure in picking the rose would have been spoiled.

All the nerves that run from the brain to the various parts of the body leave the brain through small holes in the skull. Nearly all of them leave in one large bundle called the spinal cord.

**The Spinal Cord.**—The spinal cord comes out of the brain through a small hole in the bottom of the skull and hangs down in a long hollow tube made for it inside of the backbone.

If you have ever examined the small bones that form the backbone of an animal you have seen a small, round hole in the middle of each bone.

When these little bones are all joined together, as they are in the living animal, the hole in each little bone comes just over the hole in the one beneath it. Thus all together they form a long, hollow tube with thick, bony walls. In this tube the spinal cord hangs.

Every little way there are holes opening out of the sides of these small bones, and out of the holes come nerves that run to the arms, legs, and other parts of the body.

It is very important that the spinal cord should be protected, as it is by its strong bony case, for if it is injured the brain can not send messages to any of the parts below the injury. The limbs will not move, however much the brain may wish them to,

because the muscles can get no orders from the brain. The connection is broken. A person in this condition is said to be paralyzed.

**Questions.**—With what part of the body do we think? Where is the brain? How does the brain look? How is the brain protected? What is the condition of a person whose brain is stunned? Why is the brain something like a telephone office? How many kinds of nerves are there? What does each kind do? Which are the nerves of sense? Which are the nerves of motion? How are all the muscles which move our limbs guided? What would be the consequences if they were not? How do the nerves come out of the skull? What is the spinal cord? Where is it placed? What forms the long, hollow tube in the backbone for holding the spinal cord? How do the nerves which branch out from the spinal cord find their way out of this tube? Why is it very important that the spinal cord should be well protected?

## LESSON XXI.

**Care of the Brain.**—From the time you open your eyes in the morning until you close them at night your brain is constantly receiving messages from the nerves of sense and sending out orders by the nerves of motion. Like other parts of the body, it gets tired and needs rest.

Sleep is the rest of the brain. The best time for sleep is at night, when there is no light to attract the eyes and few sounds to fall upon the ears.

Children need more sleep than grown people. They should be in bed soon after dark that their brains may be well rested by the morning.

When the brain is tired by any one kind of work a change of work rests it. When we are tired with study it is well to run out doors and play.

The brain grows stronger by being used. The boy or girl who studies hard and learns his lessons well is training his brain to do good work for him in after years.

The brain is working when we are drawing, modeling, carving, sewing, or doing other work with the fingers, as well as when we are studying from books.

**Idle habits make weak brains.**

The brain needs a great deal of blood, and, like other parts of the body, it needs good blood.

Blood that is made impure by improper food or bad air makes the brain dull. We must have our sleeping-rooms well aired and spend some time each day in the pure out-door air and sunlight if we would have clear, strong brains.

Alcohol is a poison that injures the brain and nerves.

The drunken man reels and staggers as he walks, because his brain is injured with alcohol. He is almost as badly off as he would be if his brain were stunned. His nerves can not carry messages correctly to his muscles, and his brain is so deadened that it can not receive or send messages correctly. It is the nature of alcohol to dull and deaden the brain and nerves.

If a man drinks only a little beer, wine, or other alcoholic liquor, the alcohol causes the little blood-vessels in his brain to stretch and let too much blood flow to the brain. The man then becomes excited. If he drinks more his good sense is soon gone. He talks loudly and foolishly, or he gets angry without a cause and begins to fight and quarrel. He is often unkind to his wife and children, and is very likely to do bad deeds that he would not do if the best part of his brain were not deadened by alcohol.

Many men are now in prison for crimes they would never have committed had not their brains been poisoned with alcoholic drinks.

A brain that is often injured by alcohol soon becomes very different from a healthy brain. The alcohol causes it to shrink and harden. It can not think so well and is more likely to think bad thoughts than good ones.

**Alcohol is a brain and nerve poison.**

Tobacco dulls the nerves and makes the brain stupid. Boys who use tobacco are almost sure to fall behind those in their classes who do not use it, because they can not study as well.

To be wise and good one must have a good brain; but we can not have good brains if we poison them with alcohol or tobacco.

It is the nature of alcohol and tobacco to deaden the nerves and injure the brain.

**Questions.**—What is the brain doing all day? What does it need when night comes? How does the brain rest? When is the best time for sleep? In what other way may the brain be rested when it is tired with one kind of work? Why does the brain need exercise every day? What is good training for the brain? What kind of a brain do idle habits make? What kind of blood does the brain need? What kind of blood makes the brain dull? How does alcohol act on the brain and nerves? Why does a drunken man reel and stagger as he walks? What does a little alcohol do to the brain? How does it make a man act? How has alcohol brought many men to prison? What changes is alcohol likely to make in the brain that has been injured by it many times? What kind of thoughts is a man likely to think when his brain becomes thus injured? What does tobacco do to the brain? Why are boys who use tobacco almost sure to fall behind in their classes? What must we not do if we would have good brains? What is it the nature of alcohol and tobacco to do?

## CHAPTER XI.

### *Our Five Senses.*

### LESSON XXII.

**Seeing.**—If you ever sat for your picture you remember the curious machine the picture-man pointed at you while you were sitting. Inside of this machine was something that made an exact picture of you in a very short time.

You may be surprised to know that your eyes are constantly making pictures for you from the time you open them in the morning until you close them at night.

The trees, the flowers, the faces of your friends, everything you look at, is formed into little pictures on the inside of your eyes.

Just where these pictures are made are little nerves that tell the brain how the pictures look.

As soon as you close your eyes the picture is gone.

People's eyes differ in color. Some are blue, some gray, some black or brown. The part that gives color to the eye is a curious curtain for letting just the right amount of light into the eye. In the middle of the curtain is the round black spot called the pupil. It is simply a hole in the curtain.

When you go from a dark room into a strong light, little muscles fastened to the inner rim of the curtain quickly draw it more closely around the pupil. This shuts out some of the light and keeps it from blinding your eye.

When you go from a light room into a dark room the muscles loosen their hold on the curtain and let it draw away from the pupil. This lets more light into the eye, and you soon begin to see dimly where at first you could see nothing.

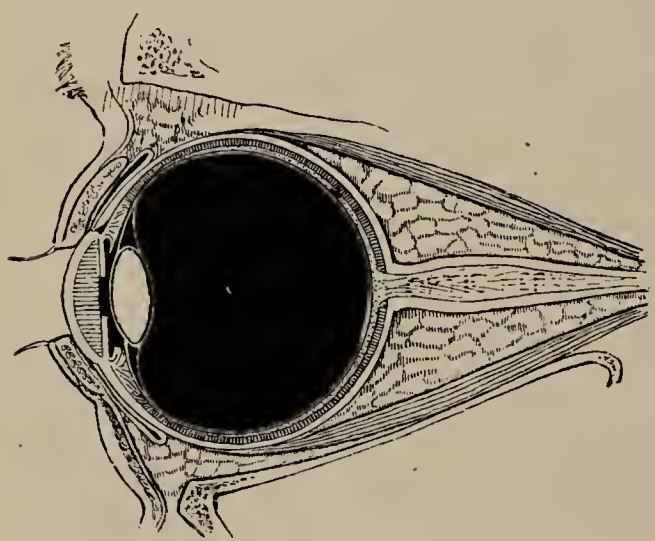
It is a great blessing to have good eyes and a great misfortune to lose the use of them or have them injured in any way.

The eyes may be injured by too strong a light. It is bad to read or write with the sun shining on your book or to look at a blackboard when you have to face a window close beside it.

You should not sit facing a bright lamp in the

evening when you are reading or sewing. Sit so that the lamp-light shines over your left shoulder.

The eyes may be badly strained by trying to read or sew in a poor light. You are very apt to strain your eyes if you read until dusk, after the sun has set. A good rule is to stop and look away from your book for a minute, then look back again. If you can not then see the print easily without straining your eyes and holding your book nearer the light you should stop reading at once.



You should not read when you are lying down. The eyes are not then in the right position for such work and are likely to be strained.

You should not read when you are ill. Like other parts of the body, the eyes are too weak then for work.

When anything gets into the eye, quickly take hold of the eyelashes of the upper lid and draw the lid away from the eye. Hold it steadily away until the tears come and they will wash out the cause of

the trouble. As you hold the lid with one hand you may rub it gently with the other, but be careful not to rub the lid against the eye. Anything sharp, like a piece of cinder, would be likely to injure the eye-ball if pressed against it by hard rubbing.

**Hearing.**—Our ears are almost as useful to us as our eyes. How much one has missed who has never heard a bird sing, never heard good music, nor the voices of his friends calling his name!

The part of the ear that we see is not the real hearing part. It is only the open end of a tube for catching sounds. At the other end of the ear tube, deep in the head, are little nerves so delicate that they feel the sound and send messages about it to the brain.

You should never put anything hard into your ears. The tube that leads to the hearing part is only about an inch long, and across its inner end is stretched a very thin, delicate kind of skin called the drum of the ear. If the drum gets broken the hearing is gone.

A very loud noise close to the ear, or even a box on the ear, may break the drum.

**Touch.**—The little nerves that run thickly through all parts of the skin give us the sense of touch. There are more of these in some parts of the

body than in others. There are more just underneath the tips of the fingers than on the back of the hand, as you can tell by trying to feel anything with the back of your hand.

People who are blind are able to learn a great deal about things by the sense of touch.

The senses of smell and of taste are a kind of sense of touch.

When a lump of sugar dissolves in the mouth it touches some very delicate nerves in the tongue, and these let the brain know about it.

The sense of taste gives us pleasure in eating; but we should not eat for pleasure. We should be guided by our reason.

The sense of smell tells the mind about odors.

Some odors are pleasant to us and others are very unpleasant. We like to smell a rose, but we dislike the smell of any decaying matter. We hurry away from it, which is just what the sense of smell is intended to make us do.

The particles that come from decaying things are poisonous and might make us ill. The sense of smell leads us to shun the air that contains them.

**Alcohol and the Senses.**—The right action of all our senses depends upon the nerves and brain. It is

the nature of both alcohol and tobacco to dull the sense by dulling the brain and nerves.

The nerves of sight are sometimes badly injured by alcohol and tobacco. Doctors tell us of persons who have lost their eye-sight from the use of these poisons, but have gained it again after the bad habit of using them had been given up.

A small quantity of an alcoholic liquor has been found to make the sense of hearing less keen for a short time, while the continued use of alcoholic drinks often blunts the sense of taste so that a person does not taste delicate flavors. Tobacco also blunts the nerves of taste.

Our senses were given to us for use and enjoyment. To needlessly injure them by taking into our bodies things which are by nature poisonous is to injure our chances of success in life and to deprive ourselves of a great deal of pleasure.

**Questions.**—What are your eyes doing for you as long as you have them open? Where are these pictures formed? How does the brain know about them? What is the colored part of the eye? What is the pupil of the eye? Of what use is this curtain? How may the eyes be injured? How should the lamp be placed when you are reading or sewing by it? What harm comes from reading or sewing in a poor light? Why should you not read when lying down? Why should you not read when you are ill? What is a good thing to do when specks get in your eye? What is the outside part of the ear? Where is the hearing part? How does the brain

know about sounds? Why should you never put anything hard in your ear? In what other ways may the drum-head be injured? What gives us the sense of touch? Why can you feel better with the ends of your fingers than with the back of your hand? What tells your brain that sugar is sweet when it is dissolving in your mouth? How does the brain find out about odors? Of what use is the sense of smell? Upon what does the right action of all our senses depend? How do alcohol and tobacco dull the senses? What do alcohol and tobacco often do to the nerves of sight? How do they affect the nerves of taste? For what are our senses given to us? What will be the consequences if we blunt or injure them?

## CHAPTER XII.

### *The Skin.*

### LESSON XXIII.

WHEN you buy a pair of new gloves you try them on to see how they fit. Gloves that fit well are not tight in one place and loose in another, but just snug all over your hand.

Good gloves will stretch over your joints when you bend your fingers, and shrink back again as your fingers straighten. We say the kid of such gloves is elastic. A glove that is very elastic does not wrinkle as badly as one that is not elastic. Few gloves are so elastic that they do not wrinkle some.

The skin is a covering that fits the whole body much better than any glove can fit the hand. There are no seams in the skin where it has been sewed together and is likely to rip. You do not have to button it on and it never wears out. If you rub a hole in it or cut it anywhere it soon mends itself.

The skin is elastic. It stretches over all your

joints as you bend them and shrinks back again when you straighten them.

The skin is thin and soft and yet tough enough to protect all the delicate parts underneath it.

The skin is double, like a glove that has a lining in it. The outside skin is made up of little scales, but they are so small you can not see them. These scales are constantly wearing off. When you take off the garment you have worn next to your skin all day and shake it at night, these little dead scales shake off like fine dust. If you shake the garment in the morning in the sunlight, you will be surprised to see how much of this scaly dust has worn off your body in a single day.

In some places, like the soles of the feet and the

palms of the hand, the outside skin becomes thick and hard in order to better protect the tender skin just beneath.

When you blister your hand, water gathers between the inner and the outer skin. The outer skin looks white, and if you pierce it with a needle it will not hurt; but if you touch the tip of the needle to the red skin just underneath, you jump because of the pain.

This is because tiny nerves run so thickly through every part of the inner skin that the point of the finest needle will find one wherever it is put down.

The inner skin is also thickly set with blood-vessels. You can not pierce it anywhere without opening some tiny tube from which the blood will come.

Besides the nerves and blood-vessels, there are thousands of other tiny tubes in the skin.

You know how the water you call perspiration comes out of your skin when you get very warm. How do you think it gets out? It comes out through very little tubes called sweat pores.

The sweat pores in the skin have very thin walls like the very small blood-vessels that run close beside them. Water from the blood carrying waste

matter from the inside of the body soaks out of the blood-vessels into these sweat pores. From these it flows out through little openings in the skin.

With a strong microscope you can see these little openings of the sweat pores all over the skin. There are hundreds of them on the tip of your finger.

The sweat tubes, besides carrying away waste, serve to keep the body cool when it is likely to become too warm.

You perhaps know that when the floor of a room is washed on a hot day the air of the room is cooled. This is because some of the heat in the air is taken to dry up the water on the floor.

When you get very warm, the water that comes out through the pores of your skin helps to cool you off by taking some of the heat of your body for drying away the water.

Thus the skin helps to keep the body from being overheated.

Some perspiration is all the time passing out through the pores of the skin—not enough to be seen, but just enough to keep the skin soft and moist.

**Care of the Skin.**—The pores of the skin are very liable to get stopped up by the dust of the air and

the dead scales that wear off from the skin itself. It is just as important to keep these pores open as it is to keep open the pipes that carry away drainage from our houses.

The pores of the skin serve as drain-pipes for the body, and if they are allowed to get stopped up so that waste matter can not pass off through them it will make us ill.

How shall we keep the drain-pipes of the skin open? By keeping the skin clean.

At night when we go to bed we should take off the under-clothing we have worn during the day, shake it well, and let it air. In the morning when we put it on we should shake well and air the clothing we have worn next to the skin during the night. We should not sleep at night in clothing that has been worn during the day.

But this is not enough. The skin needs to be frequently washed with water. If the waste matter that has been carried out through the perspiration is allowed to remain on the skin it may soak back again. It also gives an unpleasant odor to the skin and clothing, and thus makes the uncleanly person repulsive to others.

We may not all have bath-tubs in our houses with hot and cold water always ready; but we can all

have a wash-basin, water, soap, sponges, and towels, and these are all we need for taking a good bath every day.

The morning is the best time for a bath—just after we leave our beds. A quick sponging then with cold water and a thorough rubbing with dry towels not only cleanses the skin, but sets the blood to flowing briskly and healthfully.

A cold bath every morning hardens the skin and makes us very much less liable to take cold. Nearly every one can soon get used to such a bath and learn to take it so as to enjoy it.

Those whose skins are very sensitive to cold water can begin with warm water and sponge off with cold water afterward, bathing and rubbing only a part of the body at a time.

Some very delicate persons are not benefited by a cold bath. If the skin does not get warm with the rubbing and the person feels chilly some time afterward, for such a one a cold bath is not the best kind. A brisk rubbing with a dry brush is good for those who can not bathe often. A warm bath is better taken just before going to bed at night.

No one should bathe soon after eating. The blood is then needed in the stomach and should not be drawn away to the skin.

In summer boys like to "go swimming" in a stream or pond. This is a good way to take a bath, but it is not well to go in the water when very warm nor to stay in too long.

A healthful skin is necessary to good health, and adds much to one's good looks. The skin is sometimes made unhealthful and loathsome by alcoholic drinks. The face is disfigured by red blotches. Sores break out and do not heal readily. The blood-vessels of the skin are injured, and the blood does not circulate as it should. Too much blood remains in one place, making the skin look red, or too little leaves it pale and sickly-looking.

**Questions.**—In what way is the skin something like a glove? In what ways is it better than a glove? Why does the skin need to be elastic? In what way is the skin like a glove that has a lining in it? What is always wearing off the outer skin? Why does the skin grow thicker in some parts than in others? Why has the outer skin no feeling in it? What shows that the inner skin is very closely set with nerves? What besides nerves are very abundant in the skin? What is carried out through the sweat tubes? How may you see the openings of the sweat pores? How does the perspiration help to cool the body on a hot day? How may the openings of the pores become stopped up? Why is it necessary to keep them open? How may we do this? What should we do at night with the clothing we have worn next to the skin during the day? What should we do in the morning with the clothing we have worn at night? Why is bathing necessary? What good are we likely to get from a cold bath every morning? Why is it not well to bathe just after eating?

## LESSON XXIV.

**The Hair and Nails.**—The hair and nails are a part of the skin and grow out of it.

Animals have hair or wool and birds have feathers all over their bodies to serve them as clothing. Man has no need of these, for he has a brain that teaches him how to fashion his clothes.

The hair of the head serves to protect the skull from injury, and is also a great adornment when well cared for.

The hair has an oily dressing of its own put up in tiny oil bags at the root of each hair. Careful brushing and combing every day spreads this oil over the hair and makes it soft, smooth, and glossy.

The nails are a shield to the ends of the fingers and toes. If there were no nails on the ends of our fingers we should find it hard work to pick up a pin or handle small objects with our finger-tips.

We should always keep our finger-nails clean and well trimmed. Few things are more disgusting to a cleanly person than to see finger-nails bordered with lines of black dirt.

**Clothing.**—The skin, as you have learned, is thickly set with small blood-vessels. The blood that

comes rushing into these from the heart and lungs and other inside parts is very warm and it keeps the skin warm.

We do not heat our rooms to warm us, as we sometimes say. We are always warmer than the air around us unless it is on a very hot day in summer. Neither do we wear clothing to warm us, for we are much warmer than our clothes.

It is a law in nature that warm bodies give off some of their heat to colder bodies around them. We are constantly giving off some of our heat to the air and to other things around us that are colder than we are.

When the air of our rooms is very much colder than we are, we light fires to warm the air so that it may not take so much heat from our bodies.

We wear clothing to keep the heat of our bodies from passing off into the air.

In summer when the air is very warm it does not take so much of our heat. It leaves us so much that we are often very uncomfortable. We then wear thin clothing that will keep in just as little heat as possible.

Linen, silk, and cotton make suitable clothing for hot weather, because they allow the heat to pass through them very readily. Woolen does not allow

the heat to pass through so easily, and for this reason is more suitable for winter wear.

In climates where the weather changes suddenly it is best to wear light woolen garments next to the skin, even in hot weather, to prevent losing too much heat when the air grows suddenly colder.

**Alcohol and Cold.**—One of the worst mistakes people have ever made is to think that alcohol will warm them. It does seem at first to do this, for it causes the little blood-vessels in the skin to stretch, and the warm blood that then comes into them in greater quantities than before makes the skin feel warmer; but the blood is more quickly cooled in the skin than in the warm inside parts, and when more blood than usual is in the skin next to the air it is more quickly cooled. For this reason the "gin sling" or hot-rum punch a man takes to warm him up when he is going out in the cold cools him instead of warming him. At the same time it deadens his nerves so that he does not know he is growing cold, and he neglects to protect himself from the cold.

In very hot weather men often take alcoholic drinks to cool them off. Again they make a mistake. The blood is sent to the skin in large quantities, but the hot air is now little if any cooler than

the blood. It does not cool the blood as it does in colder weather; but the drinker's nerves are deadened by the alcohol and he does not feel the heat so much as he did before taking the drink. He thinks he is cooler and exposes himself to the heat, as he would not do if he knew his real condition.

**Alcohol does not help a person to bear heat or cold.**

**Questions.**—Of what use is the hair? How may it be kept in good condition? Of what use are the nails? What care do the nails need? How is the skin kept warm? Why do we warm the air of our rooms? Why do we wear clothing? Why do we wear less clothing in summer than in winter? What kind of cloth makes the most comfortable clothing for hot weather? What for cold weather? Why does a little alcohol seem to make one warmer? Why does a person who takes an alcoholic drink before going out in the cold soon begin to grow colder instead of warmer? Why does he not feel the cold as quickly? Why does a person think an alcoholic drink on a hot day cools him?

THE END.

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