

JOHN HARVEY KELLOGG

FIRST BOOK IN
PHYSIOLOGY AND
HYGIENE

John Harvey Kellogg

First Book in Physiology and Hygiene

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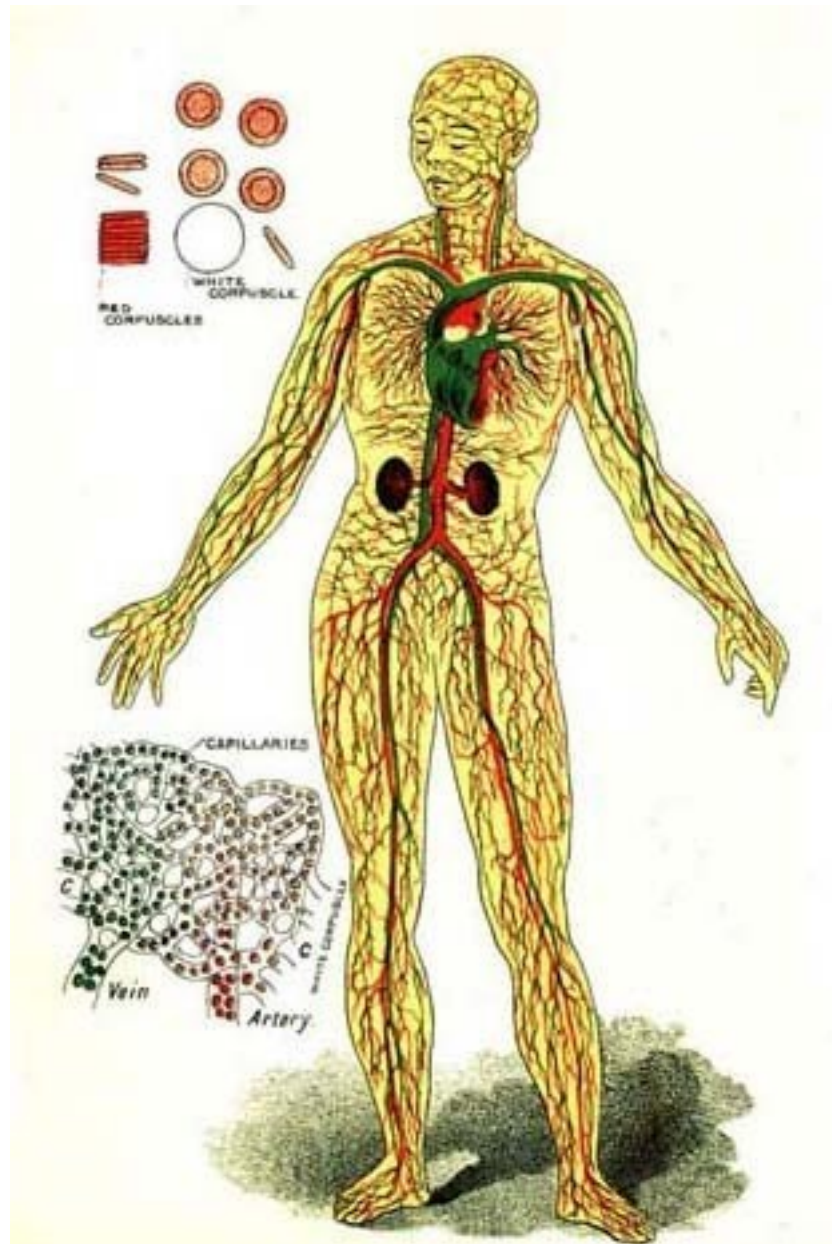


PLATE 1. THE CIRCULATION.

TO THE TEACHER

This book is intended for children. The special objects which the author has aimed to accomplish in the preparation of the work have been:

1. To present as fully as possible and proper in a work of this character a statement of the laws of healthful living, giving such special prominence to the subject of stimulants and narcotics as its recognized importance and the recent laws relating to the study of this branch of hygiene demand.

2. To present in a simple manner such anatomical and physiological facts as shall give the child a good fundamental knowledge of the structure and functions of the human body.

3. To present each topic in such clear and simple language as to enable the pupil to comprehend the subject-matter with little aid from the teacher; and to observe in the manner of presentation the principle that the things to be studied should be placed before the mind of the child before they are named. A natural and logical order has been observed in the sequence of topics. Technical terms have been used very sparingly, and only in their natural order, and are then fully explained and their pronunciation indicated, so that it is not thought necessary to append a glossary.

4. To present the subjects of Physiology and Hygiene in the light of the most recent authentic researches in these branches of science, and to avoid the numerous errors which have for many years been current in the school literature of these subjects.

There is no subject in the presentation of which object-teaching may be employed with greater facility and profit than in teaching Physiology, and none which may be more advantageously impressed upon the student's mind by means of simple experimentation than the subject of Hygiene. Every teacher who uses this book is urgently requested to supplement each lesson by the use of object-teaching or experiments. A great number of simple experiments illustrative of both Physiology and Hygiene may be readily arranged. Many little experiments are suggested in the text, which should invariably be made before the class, each member of which should also be encouraged to repeat them at home.

It is also most desirable that the teacher should have the aid of suitable charts and models.

In conclusion, the author would acknowledge his indebtedness for a large number of useful suggestions and criticisms to several medical friends and experienced teachers, and especially to Prof. Henry Sewall, of the University of Michigan, for criticisms of the portions of the work relating to Physiology.

CHAPTER I

THE HOUSE WE LIVE IN

1. Object of this Book.—The object of this book is to tell the little boys and girls who read it about a wonderful house. You have all seen some very beautiful houses. Perhaps they were made of brick or stone, with fine porches, having around them tall shade trees, smooth lawns, pretty flower-beds, walks, and sparkling fountains.

2. Perhaps some of you live in such a house, or have visited some friend who does. If so, you know that the inside of the house is even more beautiful than the outside. There are elegant chairs and sofas in the rooms, rich carpets and rugs on the floors, fine mirrors and beautiful pictures upon the walls—everything one could wish to have in a house. Do you not think such a house a nice one to live in?

3. The Body is Like a House.—Each of us has a house of his own which is far more wonderful and more curious than the grandest palace ever built. It is not a very large house. It has just room enough in it for one person. This house, which belongs to each one of us, is called the body.

4. What is a Machine?—Do you know what a machine is? Men make machines to help them work and to do many useful things. A wheelbarrow or a wagon is a machine to carry loads. A sewing-machine helps to make garments for us to wear. Clocks and watches are machines for keeping time.

5. A Machine has Different Parts.—A wheelbarrow has a box in which to carry things, two handles to hold by, and a wheel for rolling it along. Some machines, like wheelbarrows and wagons, have but few parts, and it is very easy for us to learn how they work. But there are other machines, like watches and sewing-machines, which have many different parts, and it is more difficult to learn all about them and what they do.

6. The Body is Like a Machine.—In some ways the body is more like a machine than like a house. It has many different parts which are made to do a great many different kinds of work. We see with our eyes, hear with our ears, walk with our legs and feet, and do a great many things with our hands. If you have ever seen the inside of a watch or a clock you know how many curious little wheels it has. And yet a watch or a clock can do but one thing, and that is to tell us the time of day. The body has a great many more parts than a watch has, and for this reason the body can do many more things than a watch can do. It is more difficult, too, to learn about the body than about a watch.

7. If we want to know all about a machine and how it works, we must study all its different parts and learn how they are put together, and what each part does. Then, if we want the machine to work well and to last a long time, we must know how to use it and how to take proper care of it. Do you think your watch would keep the time well if you should neglect to wind it, or if you should break any of its wheels?

8. It is just the same with the human machine which we call the body. We must learn its parts, and what they are for, how they are made, how they are put together, and how they work. Then we must learn how to take proper care of the body, so that its parts will be able to work well and last a long time.

9. Each part of the body which is made to do some special kind of work is called an *organ*. The eye, the ear, the nose, a hand, an arm, any part of the body that does something, is an organ.

10. The study of the various parts of the body and how they are put together is *anatomy* (a-nat'-o-my). The study of what each part of the body does is *physiology* (phys-i-ol'-o-gy). The study of how to take care of the body is *hygiene* (hy'-jeen).

SUMMARY

1. The body is something like a house. It has an outside and an inside; it has hollow places inside of it, and there are many wonderful things in them.
2. The body is also like a wonderful machine.
3. It is necessary to take good care of the body in order to keep it well and useful, just as we would take good care of a machine to keep it from wearing out too soon.
4. The body has many different parts, called organs, each of which has some particular work to do.
5. In learning about the body, we have to study anatomy, physiology, and hygiene.
6. The study of the various parts of the body, how they are formed and joined together, is anatomy. Physiology tells us what the body does, hygiene tells us how to take care of it.

CHAPTER II

A GENERAL VIEW OF THE BODY

1. Parts of the Body.—What do we call the main part of a tree? The trunk, you say. The main part of the body is also called its *trunk*. There are two arms and two legs growing out of the human trunk. The branches of a tree we call limbs, and so we speak of the arms and legs as *limbs*. We sometimes call the arms the *upper extremities*, and the legs the *lower extremities*. At the top of the trunk is the head.

2. Names of the Parts.—Now let us look more closely at these different parts. As we speak the name of each part, let each one touch that part of himself which is named. We will begin with the head. The chief parts of the head are the *skull* and the *face*. The *forehead*, the *temples*, the *cheeks*, the *eyes*, the *ears*, the *nose*, the *mouth*, and the *chin* are parts of the face.

3. The chief parts of the trunk are the *chest*, the *abdomen* (ab-do'-men), and the *backbone*. The head is joined to the trunk by the *neck*.

4. Each arm has a *shoulder*, *upper-arm*, *fore-arm*, *wrist*, and *hand*. The *fingers* are a part of the hand.

5. Each leg has a *hip*, *thigh*, *lower leg*, *ankle*, and *foot*. The *toes* are a part of the foot.

6. Our hands and face and the whole body are covered with something as soft and smooth as the finest silk. It is the *skin*. What is it that grows from the skin on the head? and what at the ends of the fingers and the toes? We shall learn more about the skin, the hair, and the nails in another lesson.

7. The body has two sides, the right side and the left side, which are alike. We have two eyes, two ears, two arms, etc. We have but one nose, one mouth, and one chin, but each of these organs has two halves, which are just alike.

SUMMARY

1. The body has a head and trunk, two arms, and two legs.
2. The parts of the head are the skull and face. The forehead, temples, cheeks, eyes, ears, nose, mouth and chin are parts of the face.
3. The parts of the trunk are, the chest, abdomen, and backbone. The neck joins the head and trunk.
4. Each arm has a shoulder, upper-arm, fore-arm, wrist, and hand. The fingers belong to the hand.
5. Each leg has a hip, thigh, lower leg, ankle, and foot. The toes belong to the foot.
6. The whole body is covered by the skin.
7. The two sides of the body are alike.

CHAPTER III

THE INSIDE OF THE BODY

1. Thus far we have taken only a brief look at the outside of the body, just as if we had looked at the case of a watch, and of course we have found out very little about its many wonderful parts. Very likely you want to ask a great many questions, such as, How does the inside of the body look? What is in the skull? What is in the chest? What is in the abdomen? Why do we eat and drink? Why do we become hungry and thirsty? What makes us tired and sleepy? How do we keep warm? Why do we breathe? How do we grow? How do we move about? How do we talk, laugh, and sing? How do we see, hear, feel, taste, and smell? How do we remember, think, and reason? All these, and a great many more interesting questions, you will find answered in the following lessons, if you study each one well.

2. When we study the inside of the body, we begin to understand how wonderfully we are made. We cannot all see the inside of the body, and it is not necessary that we should do so. Many learned men have spent their whole lives in seeking to find out all about our bodies and the bodies of various animals.

3. **The Bones.**—If you take hold of your arm, it seems soft on the outside; and if you press upon it, you will feel something hard inside. The soft part is called *flesh*. The hard part is called *bone*. If you wish, you can easily get one of the bones of an animal at the butcher's shop, or you may find one in the fields.

4. **The Skeleton.**—All the bones of an animal, when placed properly together, have nearly the shape of the body, and are called the *skeleton* (skel'-e-ton). The skeleton forms the framework of the body, just as the heavy timbers of a house form its framework. It supports all the parts.

5. **The Skull.**—The bony part of the head is called the *skull*. In the skull is a hollow place or chamber. You know that a rich man often has a strong room or box in his fine house, in which to keep his gold and other valuable things. The chamber in the skull is the strong-room of the body. It has strong, tough walls of bone, and contains the *brain*. The brain is the most important, and also the most tender and delicate organ in the whole body. This is why it is so carefully guarded from injury.

6. **The Backbone.**—The framework of the back is called the *backbone*. This is not a single bone, but a row of bones arranged one above another. Each bone has a hole through it, about as large as one of your fingers. A large branch from the brain, called the *spinal cord*, runs down through the middle of the backbone, so that the separate bones look as if they were strung on the spinal cord, like beads on a string.

7. **The Trunk.**—The trunk of the body, like the skull, is hollow. Its walls are formed partly by the backbone and the ribs and partly by flesh. A fleshy wall divides the hollow of the trunk into two parts, an upper chamber called the *chest*, and a lower called the *abdomen*.

8. **The Lungs and Heart.**—The chest contains a pair of organs called the *lungs*, with which we breathe. It also contains something which we can feel beating at the left side. This is the *heart*. The heart lies between the two lungs, and a little to the left side.

9. **The Stomach and Liver.**—In the abdomen are some very wonderful organs that do different kinds of work for the body. Among them are the *stomach*, the *bowels*, and the *liver*. There are, also, other organs whose names we shall learn when we come to study them.

10. **Care of the Body.**—We have only begun to study the beautiful house in which we live, and yet have we not learned enough to show us how great and wise is the Creator who made us and all the wonderful machinery within our bodies? If some one should give you a beautiful present, would you treat it carelessly and spoil it, or would you take good care of it and keep it nice as long as possible?

Ought we not to take such care of our bodies as to keep them in that perfect and beautiful condition in which our kind and good Creator gave them to us?

SUMMARY

1. The body has a framework, called the skeleton.
2. The skeleton is made up of many different parts, each of which is called a bone.
3. The bones are covered by the flesh.
4. The bones of the head form the skull, which is hollow and contains the brain.
5. A row of bones arranged in the back, one above another, forms the backbone. The backbone has a canal running through it lengthwise, in which lies the spinal cord.
6. The trunk is hollow, and has two chambers, one called the cavity of the chest, and the other the cavity of the abdomen.
7. The chest contains the two lungs and the heart.
8. The abdomen contains the stomach, liver, and many other very important organs.
9. Is it not our duty to take good care of our bodies as we would of some nice present from a friend?

CHAPTER IV

OUR FOODS

1. We all know very well that if we do not eat we shall rapidly lose in weight, and become very weak and feeble. Did you ever think how much one eats in the course of a lifetime? Let us see if we can figure it up. How much do you suppose a boy eats in a day? Let us say two pounds. How much does he eat in a year? There are three hundred and sixty-five days in a year; 365 multiplied by 2 equals 730. So a boy eats a good many times his own weight in a year. How much would a person eat in fifty years?

2. Our bodies are composed of what we eat. If we eat bad food, our bodies will be made out of poor material, and will not be able to do their work well. So you see how important it is to learn something about our foods. We ought to know what things are good for us to eat, and what will do us harm.

3. Foods and Poisons.—Foods are those substances which nourish the body and keep it in good working order.

4. Our foods are obtained from both animals and plants. All food really comes from plants, however, since those animals which we sometimes use as food themselves live upon the vegetables which they eat. For example, the ox and the cow eat grass and furnish us beef and milk. Chickens eat corn and other grains, and supply us with eggs.

5. The principal animal foods are milk, cheese, eggs, and the different kinds of flesh—beef, mutton, pork, fish, fowl, and wild game.

We obtain a great many more kinds of food from plants than from animals. Most plant foods are included in three classes—*fruits*, *grains*, and *vegetables*.

6. *Fruits* are the fleshy parts of plants which contain the seeds. Our most common fruits are apples, pears, peaches, plums, cherries, and various kinds of nuts. Perhaps you know of some other kinds of fruits besides those mentioned. Your teacher will tell you that tomatoes, watermelons, and pumpkins are really fruits, though they are not generally so called.

7. The seeds of grass-like plants are known as *grains*, of which we have wheat, rye, barley, corn, and rice. There are a few seeds that grow in pods, such as pease and beans, which somewhat resemble grains.

8. We eat the leaves, stems, or roots of some plants, as cabbages, celery, turnips, and potatoes. Foods of this kind are called *vegetables*.

9. There are other things, which, if we eat or drink them, will make us sick or otherwise do us harm. These are called *poisons*. Only such food as is pure and free from poisons is good or safe for us to use.

10. Narcotics and Stimulants.—There are a number of substances known as narcotics and stimulants, which, from their effects upon the body, may be classed as poisons. Tobacco, opium, alcohol, and chloral are included in this class. Death has often been caused by taking small quantities of any of these poisonous drugs. We shall learn more of the effects of tobacco and alcohol in future lessons.

SUMMARY

1. Our bodies are made of what we eat.
2. Things which will help us to grow strong and well, if we eat them, are foods.

3. We get foods from plants and animals.
4. There are several kinds of animal foods, and three classes of plant foods—fruits, grains, and vegetables.
5. Things which make us sick when we eat them, are poisons.

CHAPTER V

UNHEALTHFUL FOODS

1. Most persons eat many things which are not good for them. Some people do not stop to think whether what they eat is good for them or likely to do them harm. Sometimes, without knowing it, we eat things which are harmful to us. Do you not think that we should try to learn what is good to eat and what is not good, and then be very careful not to eat anything which is likely to do us harm?

2. Diseased Foods.—When a person is sick, he is said to be diseased. Animals are sometimes sick or diseased. Vegetables are also sometimes diseased. Animals and vegetables that are diseased are not good for food. Dishonest men, however, sometimes sell them to those who do not know that they are unfit to be eaten.

3. Pork, the flesh of the hog, is more likely to be diseased than any other kind of animal food.

4. Beef and mutton may be diseased also. Sheep and cattle are sometimes sick of diseases very much like those which human beings have. Meat which is pale, yellowish, or of a dark red color, is unhealthful, and should not be eaten. Meat should never be eaten raw. It should always be well cooked.

5. Unripe Foods.—Most vegetable foods are unfit to be eaten when green or unripe, especially if uncooked. Sometimes persons are made very sick indeed by eating such articles as green apples or unripe peaches.

6. Stale or Decayed Foods.—Food which has been allowed to stand until it is spoiled, or has become *stale*, *musty*, or *mouldy*, such as mouldy bread or fruit, or tainted meat, is unfit to be eaten, and is often a cause of very severe sickness. Canned fish or other meats spoil very quickly after the cans are opened, and should be eaten the same day.

7. Adulterated Foods.—Many of our foods are sometimes spoiled or injured by persons who put into them cheap substances which are harmful to health. They do this so as to make more money in selling them. This is called *adulteration*. The foods which are most likely to be injured by adulteration are milk, sugar, and butter.

8. Milk is most often adulterated by adding water, though sometimes other things are added. Sometimes the water is not pure, and people are made sick and die. The adulteration of milk or any other food is a very wicked practice.

9. Butter is sometimes made almost wholly from lard or tallow. This is called *oleomargarine* or *butterine*. If the lard or tallow is from diseased animals, the false butter made from it may cause disease.

10. A great deal of the sugar and syrups which we buy is made from corn by a curious process, which changes the starch of the corn into sugar. Sugar which has been made in this way is not so sweet as cane sugar, and is not healthful.

11. Condiments or Seasonings.—These are substances which are added to our food for the purpose of giving to it special flavors. Condiments are not foods, because they do not nourish the body in any way, and are not necessary to preserve it in health.

12. The most common condiments are, mustard, pepper, pepper-sauce, ginger, cayenne-pepper, and spices. All these substances are irritating. If we put mustard upon the skin, it will make the skin red, and in a little time will raise a blister. If we happen to get a little pepper in the eye, it makes it smart and become very red and inflamed. When we take these things into the stomach, they cause the stomach to smart, and its lining membrane becomes red just as the skin or the eye does.

13. Nature has put into our foods very nice flavors to make us enjoy eating them. Condiments are likely to do us great harm, and hence it is far better not to use them.

14. Tobacco.—Most of you know that tobacco is obtained from a plant which has long, broad leaves. These leaves are dried and then rolled up into cigars, ground into snuff, or prepared for chewing.



TOBACCO-PLANT.

15. Tobacco has a smarting, sickening taste. Do you think it would be good to eat? Why not?

16. You know that tobacco makes people sick when they first begin to use it. This is because it contains a very deadly poison, called *nicotine*.

17. If you give tobacco to a cat or a dog, it will become very sick. A boy once gave a piece of tobacco to a monkey, which swallowed it not knowing what a bad thing it was. The monkey soon became sick and died.

18. Many learned doctors have noticed the effects which come from using tobacco, and they all say it does great harm to boys, that it makes them puny and weak, and prevents their growing up into strong and useful men. If tobacco is not good for boys, do you think it can be good for men? Certainly you will say, No.

SUMMARY

1. Both animals and plants are sometimes diseased. Flesh obtained from sick or diseased animals is unfit for food.
2. Unripe, stale, and mouldy foods are unfit to be eaten and likely to cause severe illness.
3. Foods are sometimes spoiled by having things mixed with them which are not food, or which are poisonous.
4. The foods most liable to be adulterated in this way are milk, sugar, and butter.
5. Tobacco, while not actually eaten, is thought by some persons to be a food, but it is not. It is a poison, and injures all who use it.
6. Boys who use tobacco do not grow strong in body and mind.

CHAPTER VI

OUR DRINKS

1. Water is really the only drink. It is the only substance which will satisfy thirst. All other fluids which we drink consist mostly of water. Thus, lemonade is lemon-juice and water. Milk is chiefly water. Wine, beer, cider, and such liquids contain alcohol and many other things, mixed with water.

2. Why we Need Water.—If we should wet a sponge and lay it away, it would become dry in a few hours, as the water would pass off into the air. Our bodies are losing water all the time, and we need to drink to keep ourselves from drying up.

3. Water is also very necessary for other purposes. It softens our food so that we can chew and swallow it, and helps to carry it around in the body after it has been digested, in a way about which we shall learn in future lessons.

4. Still another use for water is to dissolve and wash out of our bodies, through the sweat of the skin, and in other ways, the waste and worn-out particles which are no longer of any use.

5. Impure Water.—Most waters have more or less substances dissolved in them. Water which has much lime in it is called hard water. Such water is not so good to drink, or for use in cooking, as soft water. That water is best which holds no substances in solution. Well-water sometimes contains substances which soak into wells from vaults or cesspools. Slops which are poured upon the ground soak down out of sight; but the foul substances which they contain are not destroyed. They remain in the soil, and when the rains come, they are washed down into the well if it is near by. You can see some of the things found in bad water in the illustration given on opposite page.

6. It is best not to drink iced water when the body is heated, or during meals. If it is necessary to drink very cold water, the bad effects may be avoided by sipping it very slowly.

7. Tea and Coffee.—Many people drink tea or coffee at their meals, and some persons think that these drinks are useful foods; but they really have little or no value as foods. Both tea and coffee contain a poison which, when separated in a pure form, is so deadly that a very small quantity is enough to kill a cat or a dog. This poison often does much harm to those who drink tea or coffee very strong for any great length of time.



A DROP OF IMPURE WATER MAGNIFIED.

8. Alcohol (al'-co-hol).—All of you know something about alcohol. Perhaps you have seen it burn in a lamp. It will burn without a lamp, if we light it. It is so clear and colorless that it looks like water. The Indians call it "fire-water." Alcohol differs very much from foods. It is not produced from plants, as fruits and grains are; neither is it supplied by Nature ready for our use, as are air and water.

9. Fermentation.—When a baker makes bread he puts some yeast in the dough to make it "rise," so the bread will be light. The yeast destroys some of the sugar and starch in the flour and changes it into alcohol and a gas. The gas bubbles up through the dough, and this is what makes the bread light. This is called *fermentation* (fer-men-ta'-tion). The little alcohol which is formed in the bread does no harm, because it is all driven off by the heat when the bread is baked.



FERMENTATION.

10. Any moist substance or liquid which contains sugar will ferment if yeast is added to it, or if it is kept in a warm place. You know that canned fruit sometimes spoils. This is because it ferments. Fermentation is a sort of decay. When the juice of grapes, apples, or other fruit is allowed to stand in a warm place it "works," or ferments, and thus produces alcohol. Wine is fermented grape-juice; hard cider is fermented apple-juice.

11. Beer, ale, and similar drinks are made from grains. The grain is first moistened and allowed to sprout. In sprouting, the starch of the grain is changed to sugar. The grain is next dried and ground, and is then boiled with water. The water dissolves the sugar. The sweet liquid thus obtained is separated from the grain, and yeast is added to it. This causes it to ferment, which changes the sugar to alcohol. Thus we see that the grain does not contain alcohol in the first place, but that it is produced by fermentation.

12. All fermented liquids contain more or less alcohol, mixed with water and a good many other things. Rum, brandy, gin, whiskey, and pure alcohol are made by separating the alcohol from the other substances. This is done by means of a still, and is called *distillation*.



DISTILLATION.

13. You can learn how a still separates the alcohol by a little experiment. When a tea-pot is boiling on the stove and the steam is coming out at the nozzle, hold up to the nozzle a common drinking-glass filled with iced water, first taking care to wipe the outside of the glass perfectly dry. Little drops of water will soon gather upon the side of the glass. If you touch these to the tongue you will observe that they taste of the tea. It is because a little of the tea has escaped with the steam and condensed upon the glass. This is distillation.

14. If the tea-pot had contained wine, or beer, or hard cider, the distilled water would have contained alcohol instead of tea. By distilling the liquid several times the alcohol may be obtained almost pure.

15. Alcohol kills Animals and Plants.—Strong alcohol has a deadly effect upon all living things. Once a man gave a dog a few tablespoonfuls of alcohol, and in a little while the dog was dead. If you should pour alcohol upon a plant it would die very soon.

16. A man once made a cruel experiment. He put some minnows into a jar of water and then poured in a few teaspoonfuls of alcohol. The minnows tried very hard to get out, but they could not, and in a little while they were all dead, poisoned by the alcohol. A Frenchman once gave alcohol to some pigs with their food. They soon became sick and died.

17. Alcohol not a Food.—There are some people who imagine that alcohol is good for food because it is made from fruits and grains which are good for food. This is a serious mistake. A person can live on the fruits or grains from which alcohol is made, but no one would attempt to live upon alcohol. If he did, he would soon starve to death. In fact, men have often died in consequence of trying to use whiskey in place of food.

18. We should remember, also, that people do not take alcohol as a food, but for certain effects which it produces, which are not those of a food, but of a poison.

19. Many people who would not drink strong or distilled liquors, think that they will suffer no harm if they use only wine, beer, or cider. This is a great mistake. These liquids contain alcohol, as do all fermented drinks. A person will become drunk or intoxicated by drinking wine, beer, or cider—only a larger quantity is required to produce the same effect as rum or whiskey.

20. Another very serious thing to be thought of is that if a person forms the habit of drinking wine, cider, or other fermented drinks, he becomes so fond of the *effect they produce* that he soon wants some stronger drink, and thus he is led to use whiskey or other strong liquors. On this account

it is not safe to use any kind of alcoholic drinks, either fermented or distilled. The only safe plan is to avoid the use of every sort of stimulating or intoxicating drinks.

21. It has been found by observation that those persons who use intoxicating drinks are not so healthy as those who do not use them, and, as a rule, they do not live so long.

22. This is found to be true not only of those who use whiskey and other strong liquors, but also of those who use fermented drinks, as wine and beer. Beer drinkers are much more likely to suffer from disease than those who are strictly temperate. It is often noticed by physicians that when a beer-drinker becomes sick or meets with an accident, he does not recover so readily as one who uses no kind of alcoholic drinks.

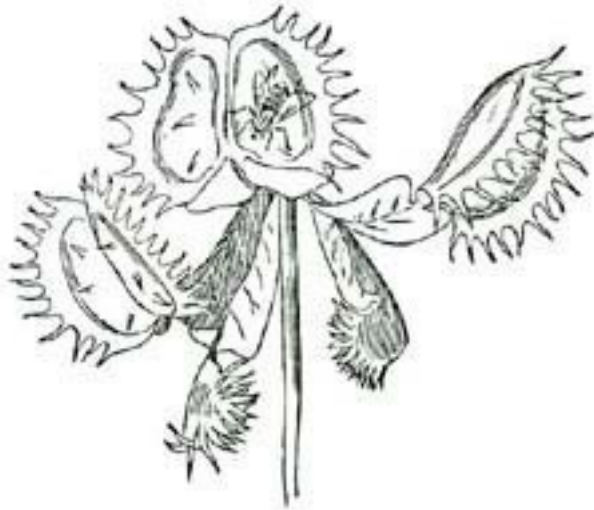
23. Alcoholic drinks not only make people unhealthy and shorten their lives, but they are also the cause of much poverty and crime and an untold amount of misery.

SUMMARY

1. Water is the only thing that will satisfy thirst.
2. In going through our bodies, water washes out many impurities. We also need water to soften our food.
3. The purest water is the best. Impure water causes sickness.
4. Good water has no color, taste, or odor.
5. Tea and coffee are not good drinks. They are very injurious to children, and often do older persons much harm.
6. Alcohol is made by fermentation.
7. Pure alcohol and strong liquors are made by distillation.
8. Alcohol is not a food, it is a poison. It kills plants and animals, and is very injurious to human beings.
9. Even the moderate use of alcoholic drinks produces disease and shortens life.

CHAPTER VII

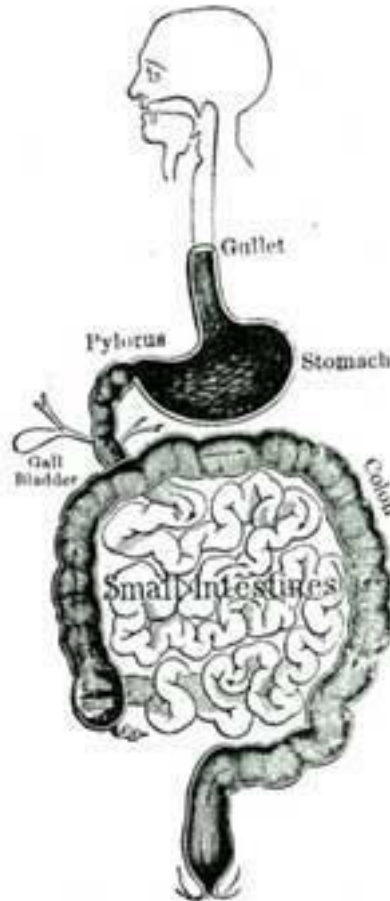
HOW WE DIGEST



VENUS'S FLY-TRAP.

1. Did you ever see a Venus's fly-trap? This curious plant grows in North Carolina. It is called a fly-trap because it has on each of its leaves something like a steel-trap, by means of which it catches flies. You can see one of these traps in the picture. When a fly touches the leaf, the trap shuts up at once, and the poor fly is caught and cannot get away. The harder it tries to escape, the more tightly the trap closes upon it, until after a time it is crushed to death.

2. But we have yet to learn the most curious thing about this strange plant, which seems to act so much like an animal. If we open the leaf after a few days, it will be found that the fly has almost entirely disappeared. The fly has not escaped, but it has been dissolved by a fluid formed inside of the trap, and the plant has absorbed a portion of the fly. In fact, it has really eaten it. The process by which food is dissolved and changed so that it can be absorbed and may nourish the body, is called *digestion* (di-ges'-tion).



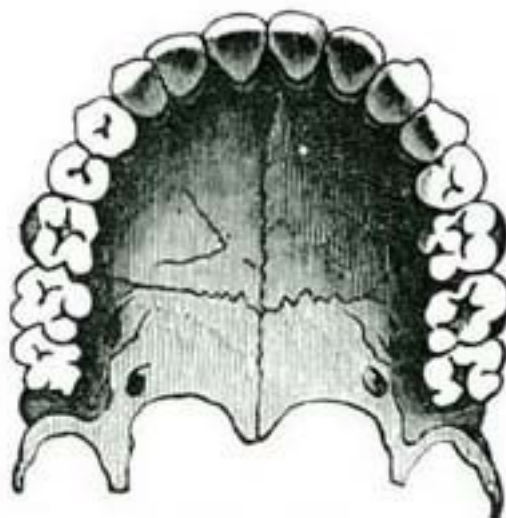
THE DIGESTIVE TUBE.

3. The Venus's fly-trap has a very simple way of digesting its food. Its remarkable little trap serves it as a mouth to catch and hold its food, and as a stomach to digest it. The arrangement by which our food is digested is much less simple than this. Let us study the different parts by which this wonderful work is done.

4. **The Digestive Tube.**—The most important part of the work of digesting our food is done in a long tube within the body, called the *digestive tube* or *canal*.

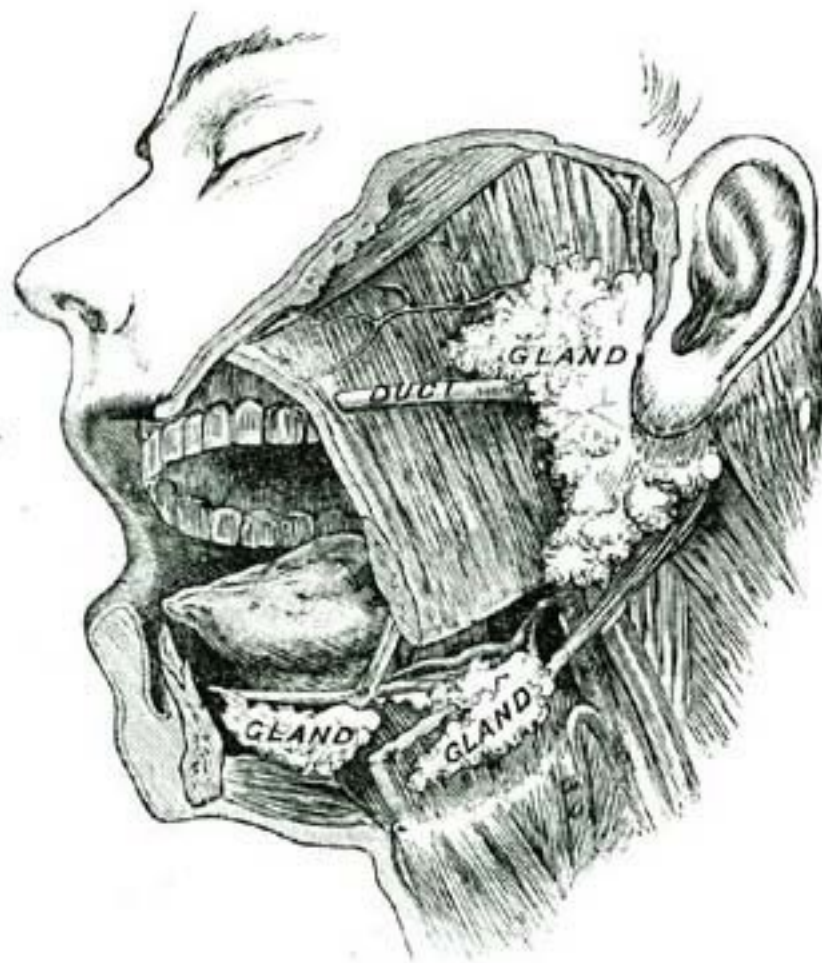
5. This tube is twenty-five or thirty feet long in a full-grown man; but it is so coiled up and folded away that it occupies but little space. It begins at the mouth, and ends at the lower part of the trunk. The greater part of it is coiled up in the abdomen.

6. **The Mouth.**—The space between the upper and the lower jaw is called the *mouth*. The lips form the front part and the cheeks the sides. At the back part are three openings. One, the upper, leads into the nose. There are two lower openings. One of these leads into the stomach, and the other leads to the lungs. The back part of the mouth joins the two tubes which lead from the mouth to the lungs and the stomach, and is called the *throat*. The mouth contains the *tongue* and the *teeth*.



THE TEETH.

7. The Teeth.—The first teeth, those which come when we are small children, are called *temporary* or *milk teeth*. We lose these teeth as the jaws get larger and the second or *permanent* teeth take their place. There are twenty teeth in the first set, and thirty-two in the second. Very old persons sometimes have a third set of teeth.



SALIVARY GLANDS.

8. The Salivary (sal-i-vary) **Glands.**—There are three pairs of *salivary glands*. They form a fluid called the *saliva* (sa-li'-va). It is this fluid which moistens the mouth at all times. When we eat or taste something which we like, the salivary glands make so much saliva that we sometimes say the mouth waters. One pair of the salivary glands is at the back part of the lower jaw, in front of the ears. The other two pairs of glands are placed at the under side of the mouth. The saliva produced by the salivary glands is sent into the mouth through little tubes called *ducts*.

9. The Gullet.—At the back part of the throat begins a narrow tube, which passes down to the stomach. This tube is about nine inches long. It is called the *gullet*, *food-pipe*, or *œsophagus* (e-soph'-a-gus).

10. The Stomach.—At the lower end of the œsophagus the digestive tube becomes enlarged, and has a shape somewhat like a pear. This is the *stomach*. In a full-grown person the stomach is sufficiently large to hold about three pints. At each end of the stomach is a narrow opening so arranged that it can be opened or tightly closed, as may be necessary. The upper opening allows the food to pass into the stomach, the lower one allows it to pass out into the intestines. This opening is called the *pylorus* (py-lo'-rus), or gate-keeper, because it closes so as to keep the food in the stomach until it is ready to pass out.

11. In the membrane which lines the stomach there are many little pocket-like glands, in which a fluid called the *gastric juice* is formed. This fluid is one of the most important of all the fluids formed in the digestive canal.



GASTRIC GLAND.

12. The Intestine(in-tes'-tine).—At the lower end of the stomach the digestive canal becomes narrow again. This narrow portion, called the *intestine*, is about twenty-five feet long in a grown person. The last few feet of the intestine is larger than the rest, and is called the *colon*. This long tube is coiled up and snugly packed away in the cavity of the abdomen. In the membrane lining the intestines are to be found little glands, which make a fluid called *intestinal juice*.

13. The Liver.—Close up under the ribs, on the right side of the body, is a large chocolate-colored organ, called the *liver*. The liver is about half as large as the head, and is shaped so as to fit snugly into its corner of the abdomen. The chief business of the liver is to make a fluid called *bile*, which is very necessary for the digestion of our food.

14. The bile is a bitter fluid of a golden-brown color. It is carried to the intestine by means of a little tube or duct, which enters the small intestine a few inches below the stomach. When the bile is made faster than it is needed for immediate use, it is stored up in a little pear-shaped sac called the *gall-bladder*, which hangs from the under side of the liver.

15. The liver is a very wonderful organ, and does many useful things besides making bile. It aids in various ways in digesting the food, and helps to keep the blood pure by removing from it harmful substances which are formed within the body.

16. The Pancreas(pan'-cre-as).—The *pancreas* is another large and very important gland which is found close to the stomach, lying just behind it in the abdominal cavity. The pancreas forms a fluid called the *pancreatic juice*, which enters the small intestine at nearly the same place as the bile.

17. The Spleen.—Close to the pancreas, at the left side of the body, is a dark, roundish organ about the size of the fist, called the *spleen*. It is not known that the spleen has much to do in the work of digestion, but it is so closely connected with the digestive organs that we need to know about it.

18. Please note that there are five important organs of digestion. The mouth, the stomach, the intestines, the pancreas, and the liver.

19. Also observe that there are five digestive fluids, saliva, gastric juice, bile, pancreatic juice, and intestinal juice.

SUMMARY

1. The process of dissolving and changing the food so that it may be absorbed and may nourish the body is digestion.

2. The work of digestion is chiefly done in the digestive tube or canal, which is about thirty feet in length.

3. The mouth contains the teeth, and has three pairs of salivary glands connected with it, which make saliva.

4. The gullet leads from the mouth to the stomach.

5. The stomach is pear-shaped, and holds about three pints.

6. It has an upper and a lower opening, each of which is guarded by a muscle, which keeps its contents from escaping.

7. The lower opening of the stomach is called the pylorus.

8. The stomach forms the gastric juice.

9. The intestines are about twenty-five feet long. They form the intestinal juice.

10. The liver lies under the ribs of the right side. It is about half as large as the head. It makes bile.

11. When not needed for immediate use, the bile is stored up in a sac called the gall-bladder.

12. The pancreas is a gland which lies just back of the stomach. It makes pancreatic juice.

13. The spleen is found near the pancreas.

14. There are five important digestive organs—the mouth, the stomach, the intestines, the liver, and the pancreas.

15. There are five digestive fluids—saliva, gastric juice, intestinal juice, bile, and pancreatic juice.

CHAPTER VIII

DIGESTION OF A MOUTHFUL OF BREAD

1. Let us suppose that we have eaten a mouthful of bread, and can watch it as it goes through all the different processes of digestion.

2. **Mastication.**—First, we chew or masticate the food with the teeth. We use the tongue to move the food from one side of the mouth to the other, and to keep the food between the teeth.

3. **Mouth Digestion.**—While the bread is being chewed, the saliva is mixed with it and acts upon it. The saliva moistens and softens the food so that it can be easily swallowed and readily acted upon by the other digestive juices. You have noticed that if you chew a bit of hard bread a few minutes it becomes sweet. This is because the saliva changes some of the starch of the food into sugar.

4. After we have chewed the food, we swallow it, and it passes down through the œsophagus into the stomach.

5. **Stomach Digestion.**—As soon as the morsel of food enters the stomach, the gastric juice begins to flow out of the little glands in which it is formed. This mingles with the food and digests another portion which the saliva has not acted upon. While this is being done, the stomach keeps working the food much as a baker kneads dough. This is done to mix the gastric juice with the food.

6. After an hour or two the stomach squeezes the food so hard that a little of it, which has been digested by the gastric juice and the saliva, escapes through the lower opening, the pylorus, of which we have already learned. As the action of the stomach continues, more of the digested food escapes, until all that has been properly acted upon has passed out.

7. **Intestinal Digestion.**—We sometimes eat butter with bread, or take some other form of fat in our food. This is not acted upon by the saliva or the gastric juice. When food passes out of the stomach into the small intestine, a large quantity of bile is at once poured upon it. This bile has been made beforehand by the liver and stored up in the gall-bladder. The bile helps to digest fats, which the saliva and the gastric juice cannot digest.

8. The pancreatic juice does the same kind of work that is done by the saliva, the gastric juice, and the bile. It also finishes up the work done by these fluids. It is one of the most important of all the digestive juices.

9. The intestinal juice digests nearly all the different elements of the food, so that it is well fitted to complete the wonderful process by which the food is made ready to enter the blood and to nourish the body.

10. While the food is being acted upon by the bile, the pancreatic juice, and intestinal juice, it is gradually moved along the intestines. After all those portions of food which can be digested have been softened and dissolved, they are ready to be taken into the blood and distributed through the body.

11. **Absorption.**—If you put a dry sponge into water, it very soon becomes wet by soaking up the water. Indeed, if you only touch a corner of the sponge to the water, the whole sponge will soon become wet. We say that the sponge absorbs the water. It is in a somewhat similar way that the food is taken up or absorbed by the walls of the stomach and intestines. When the food is absorbed, the greater part of it is taken into the blood-vessels, of which we shall learn in a future lesson.

12. **Liver Digestion.**—After the food has been absorbed, the most of it is carried to the liver, where the process of digestion is completed. The liver also acts like an inspector to examine the digested food and remove hurtful substances which may be taken with it, such as alcohol, mustard, pepper, and other irritating things.

13. The Thoracic Duct.—A portion of the food, especially the digested fats, is absorbed by a portion of the lymphatic vessels called *lacteals*, which empty into a small vessel called the *thoracic duct*. This duct passes upward in front of the spine and empties into a vein near the heart.

SUMMARY

How a mouthful of food is digested:

1. It is first masticated—that is, it is chewed and moistened with saliva.
2. Then it is swallowed, passing through the œsophagus to the stomach.
3. There it is acted upon, and a part of it digested by the gastric juice.
4. It is then passed into the small intestine, where it is acted upon by the bile, the pancreatic fluid, and the intestinal juice.
5. The digested food is then absorbed by the walls of the stomach and intestines.
6. The greater portion of the food is next passed through the liver, where hurtful substances are removed.
7. A smaller portion is carried through the thoracic duct and emptied into a vein near the heart.

CHAPTER IX

BAD HABITS IN EATING

1. Eating too Fast.—A most common fault is eating too fast. When the food is chewed too rapidly, and swallowed too quickly, it is not properly divided and softened. Such food cannot be easily acted upon by the various digestive juices.

2. Eating too Much.—A person who eats food too rapidly is also very likely to injure himself by eating too much. The digestive organs are able to do well only a certain amount of work. When too much food is eaten, none of it is digested as well as it should be. Food which is not well digested will not nourish the body.

3. Eating too Often—Many children make themselves sick by eating too often. It is very harmful to take lunches or to eat at other than the proper meal-times. The stomach needs time to rest, just as our legs and arms and the other parts of the body do. For the same reason, it is well for us to avoid eating late at night. The stomach needs to sleep with the rest of the body. If one goes to bed with the stomach full of food, the stomach cannot rest, and the work of digestion will go on so slowly that the sleep will likely be disturbed. Such sleep is not refreshing.

4. If we wish to keep our digestive organs in good order, we must take care to eat at regular hours. We ought not to eat when we are very tired. The stomach cannot digest well when we are very much fatigued.

5. Sweet Foods.—We ought not to eat too much sugar or sweet foods, as they are likely to sour or ferment in the stomach, and so make us sick. Candies often contain a great many things which are not good for us, and which may make us sick. The colors used in candies are sometimes poisonous. The flavors used in them are also sometimes very harmful.

6. Fatty Foods Hurtful.—Too much butter, fat meats, and other greasy foods are hurtful. Cream is the most digestible form of fat, because it readily dissolves in the fluids of the stomach, and mixes with the other foods without preventing their digestion. Melted fats are especially harmful. Cheese, fried foods, and rich pastry are very poor foods, and likely to cause sickness.

7. Eating too many Kinds of Foods.—Children should avoid eating freely of flesh meats. They ought also to avoid eating all highly-seasoned dishes, and taking too many kinds of food at a meal. A simple diet is much the more healthful. Milk and grain foods, as oatmeal, cracked wheat, graham bread, with such delicious fruits as apples, pears, and grapes, are much the best food for children.

8. Avoid Use of Cold Foods.—We ought not to take very cold foods or liquids with our meals. Cold foods, ice-water, and other iced drinks make the stomach so cold that it cannot digest the food. For this reason it is very harmful to drink iced water or iced tea, or to eat ice-cream at meals. These things are injurious to us at any time, but they do the greatest amount of harm when taken with the food.

9. Things sometimes Eaten which are not Foods.—Things which are not foods are often used as foods, such as mustard, pepper, and the various kinds of seasonings. Soda, saleratus, and baking-powders also belong to this class. All of these substances are more or less harmful, particularly mustard, pepper, and hot sauces.

10. Common Salt.—The only apparent exception to the general rule that all condiments and other substances which are not foods are harmful is in the case of common salt. This is very commonly used among civilized nations, although there are many barbarous tribes that never taste it. It is quite certain that much more salt is used than is needed. When much salt is added to the food, the action

of the digestive fluids is greatly hindered. Salt meats, and other foods which have much salt added to them, are hard to digest because the salt hardens the fibres of the meat, so that they are not easily dissolved by the digestive fluids.

11. Care of the Teeth.—The teeth are the first organs employed in the work of digestion. It is of great importance that they should be kept in health. Many persons neglect their teeth, and treat them so badly that they begin to decay at a very early age.

12. The mouth and teeth should be carefully cleansed immediately on rising in the morning, and after each meal. All particles of food should be removed from between the teeth by carefully rubbing both the inner and the outer surfaces of the teeth with a soft brush, and rinsing very thoroughly with water. A little soap may be used in cleansing the teeth, but clear water is sufficient, if used frequently and thoroughly. The teeth should not be used in breaking nuts or other hard substances. The teeth are brittle, and are often broken in this way. The use of candy and too much sweet food is also likely to injure the teeth.

13. Some people think that it is not necessary to take care of the first set of teeth. This is a great mistake. If the first set are lost or are unhealthy, the second set will not be as perfect as they should be. It is plain that we should not neglect our teeth at any time of life.

14. Tobacco.—When a person first uses tobacco, it is apt to make him very sick at the stomach. After he has used tobacco a few times it does not make him sick, but it continues to do his stomach and other organs harm, and after a time may injure him very seriously. Smokers sometimes suffer from a horrible disease of the mouth or throat known as cancer.

15. Effects of Alcohol upon the Stomach.—If you should put a little alcohol into your eye, the eye would become very red. When men take strong liquors into their stomachs, the delicate membrane lining the stomach becomes red in the same way. Perhaps you will ask how do we know that alcohol has such an effect upon the stomach. More than sixty years ago there lived in Michigan a man named Alexis St. Martin. One day he was, by accident, shot in such a way that a large opening was made right through the skin and flesh and into the stomach. The good doctor who attended him took such excellent care of him that he got well. But when he recovered, the hole in his stomach remained, so that the doctor could look in and see just what was going on. St. Martin sometimes drank whiskey, and when he did, the doctor often looked into his stomach to see what the effect was, and he noticed that the inside of the stomach looked very red and inflamed.

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