

This edition of the 1904 text, "Object Lessons on the Human Body"

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AUTHOR'S NOTE TO THE PUPIL.

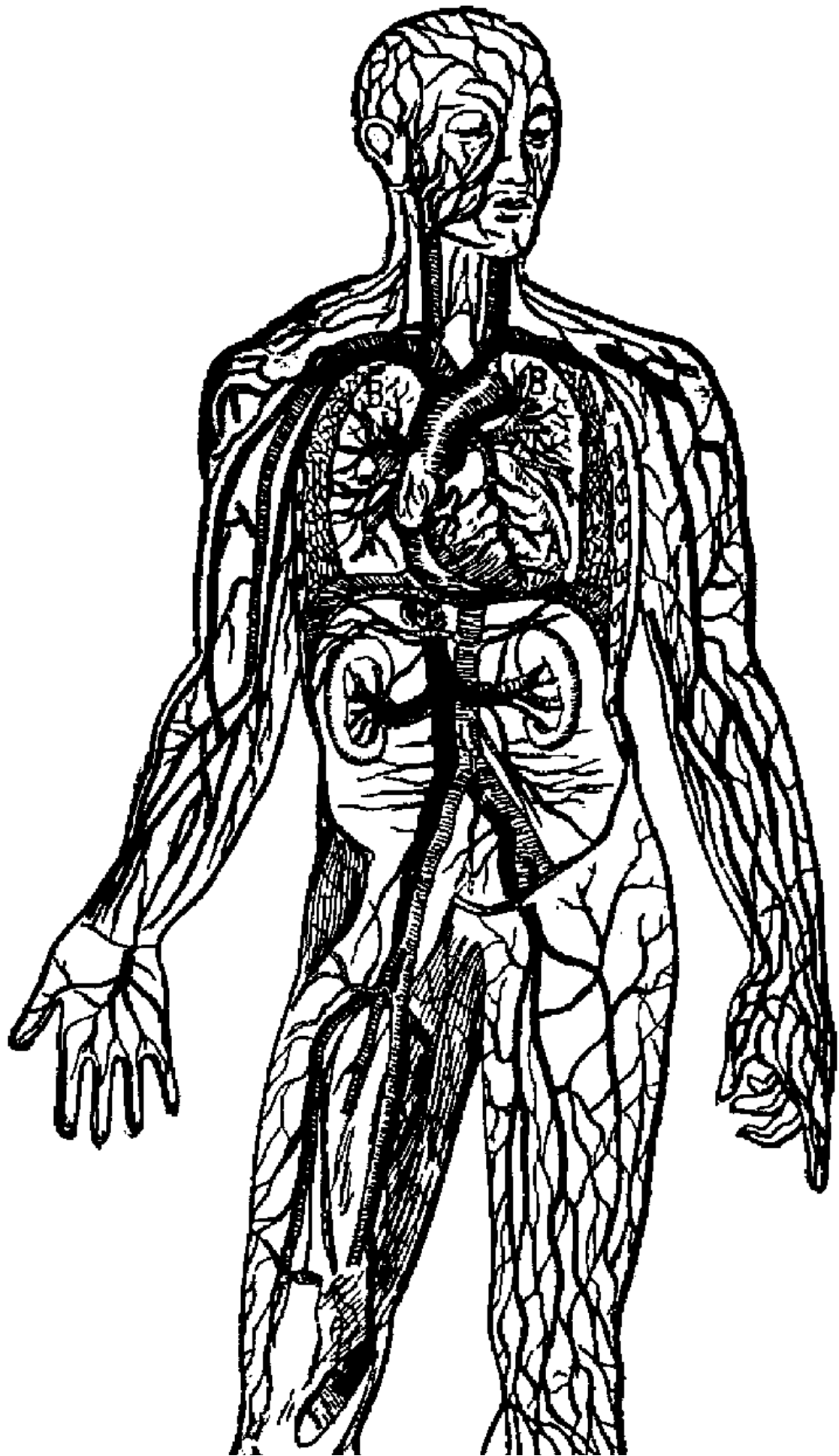
This book has been prepared to help you in learning about "the house you live in," and to teach you to take care of it.

As you study its pages, be sure to find out the meaning of every word in them which you do not understand; for, if you let your tongue say what your mind knows nothing about, you are talking *parrot-fashion*.

And do not forget that you must pay for all the knowledge you obtain, whether you are rich or poor. Nobody else can pay for you. You, your own self, must *pay attention* with your own mind, through your own eyes and ears, *or do without knowledge*.

Be wise: gain all the knowledge you can concerning everything worth knowing, and use it for the good of yourself and other people.

"KNOWLEDGE IS POWER."



PART I.

FORMULA FOR INTRODUCTORY LESSONS.

1. My body is built of bones covered with flesh and skin; the blood flows through it, all the time, from my heart. I breathe through my nose and mouth, and take the air into my lungs.

2. The parts of my body are the head, the trunk, the limbs.

3. My head.

The crown of my head.

The back of my head.

The sides of my head.

My face.

My forehead.

My two temples.

My two eyes.

My nose.

My two cheeks.

My mouth.

My chin.

My two ears.

My neck.

My two shoulders.

My two arms.

My two hands.

My trunk.

My back.

My two sides.

My chest.

My two legs.

My two knees.

My two feet.

I am sitting erect.

QUESTIONS FOR THE FORMULA.

1. Tell about your body.
2. Name the parts of the body.
3. Name the parts of the head, trunk, and limbs.

[6]

THE NOSE AND THE MOUTH.

Be sure to keep your mouth closed when you are not talking or singing, especially when you are walking, running, or *asleep*. The two nostrils are outside doors, always open to admit the air, and inside of the upper part of the nose there are two other openings, through which it passes into the throat. Air which goes this way is warmed, cleansed, and moistened, but that which is breathed directly through the mouth is not so well prepared for its work in the lungs.

Do not use your mouth as a box or a pin-cushion; the pin, or whatever you have put into it, may slip into your throat and cause your death.

QUESTIONS ON THE INTRODUCTORY LESSONS.

Of what is the body built?—"Of bones."

What covers the bones?—"Flesh."

What covers the flesh?—"Skin."

What flows through the body?—"Blood."

Where does the blood flow from?—"The heart."

When does the blood flow from the heart?—"Every time the heart beats."

Show with your hand how the heart beats.

When does the heart beat?—"All the time."

What happens when the heart stops beating?—"We die."

What do you see on the back of your hand, beneath the skin?—"Veins"

What is in the veins?—"Bad blood."

What are the veins?—"Pipes for the bad blood to pass through."

Where do the veins carry the bad blood?—"To the heart."

Where does the heart send the bad blood?—"To the lungs."

What happens to the bad blood when in the lungs?—"It is made pure."

What makes the bad blood pure?—"The air."

How does the air get into the lungs?—"Through my nose, mouth, and windpipe."

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What is breathing?—"Letting the air into and out of my lungs, through my nose, mouth, and windpipe."

When do you breathe?—"All the time."

What do you breathe?—"Air."

What do you breathe through?—"My nose, mouth, and windpipe."

Where do you get the air?—"Everywhere."

Where do the lungs send the pure blood?—"To the heart."

Where does the heart send the pure blood?—"All through the body."

How does the heart send the pure blood through the body?—"Through pipes called arteries."

What kind of blood passes through the arteries?—"Pure blood."

What kind of blood passes through the veins?—"Impure blood."

What carries the pure blood through the body?—"The arteries."

What carries the impure blood through the body?—"The veins."

What makes blood?—"Food and drink."

What is food?—"Anything good to eat."

What is drink?—"Anything good to drink."

Name some kinds of wholesome food.—"Meat, potatoes, oranges, apples, etc."

Name some kinds of wholesome drink.—"Water, milk, lemonade, etc."

What do you mean by wholesome food?—"Food that will make good blood."

What do you mean by wholesome drink?—"Drink that will make good blood."

What does the blood make?—"Bones, flesh, skin, hair, nails, and cartilage."

What use is the blood to the body?—"It makes the body grow, and keeps it alive." [8]

Name some kinds of poisonous drinks.—"Rum, brandy, ale, cider, etc."

What do you mean by poisonous drinks?—"Drinks which hurt or poison the body."

Why do you say that rum and the other drinks you have named are poisonous?—"Because they do harm to every part of the body."

Which part do they hurt most?—"The head or brain."

What harm do they do to the brain?—"They make it unfit to do its work."

What work does the brain do?—"Thinking."

Then what harm do rum, brandy, wine, and these other drinks do to the brain?—"They make it unfit to think."

What other poison do some people use?—"Tobacco."

When do children use tobacco?—"When they chew tobacco; when they smoke cigars or cigarettes."

How much does tobacco poison hurt children?—"More than it hurts anybody else."

In what way does it hurt children?—"It keeps children from growing fast; from being strong and healthy; and from learning as well as they ought."

How does it do all this mischief to children?—"It poisons their lungs, their heart and blood, and their brain."

PART II.

FORMULA FOR THE PARTS AND JOINTS OF THE BODY:

1. My limbs are my two arms and my two legs.

2. My arm has two parts:

my upper arm, my fore-arm;

and three joints:

my shoulder joint, my elbow joint, my wrist joint.

3. My hand is used in holding, throwing, catching, and feeling:

the palm of my hand,

the back of my hand,

my fingers,

my thumb,

my forefinger,

my middle finger,

my ring finger,

my little finger,

my knuckles,

my finger joints,

my nails,

the tips of my fingers,

the veins,

the ball of my thumb,

and the lines where the flesh is bent.

4. My leg has two parts:

my thigh, and my lower leg;

and three joints:

my hip joint, my knee joint, my ankle joint.

5. My foot is used in standing, walking, running, skating, and jumping:

my instep,

my toes,

the sole of my foot,

the ball,

the hollow,

the heel,

my toe joints,

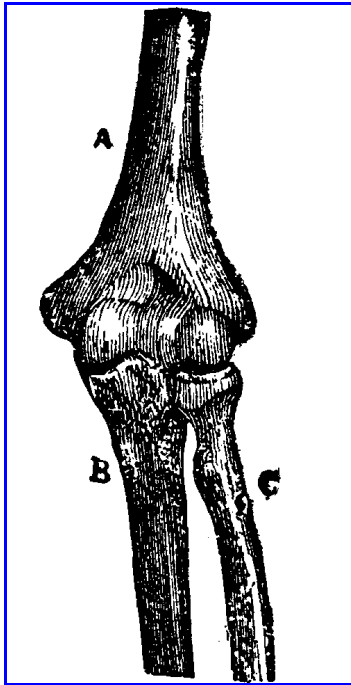
and my toe nails, which protect my toes.

[10]

QUESTIONS FOR THE FORMULA.

1. Which are your limbs?
2. Tell about your arm.
3. Tell about your hand.
4. Tell about your leg.
5. Tell about your foot.

Some joints, as those of the skull, are immovable; some, as those of the spine, may be moved a little; and others more or less freely, as those of the limbs. In machines, the parts which move upon each other need to be oiled, to keep them from wearing out; but the joints of our bodies oil themselves with a thin fluid, called *synovia*. This fluid resembles the white of an egg, and comes from a smooth lining inside of the joints. The ends of the bones which form joints are covered by gristle or *cartilage*, and are fastened together by very strong, silvery white bands, called *ligaments*. A sprain is caused by overstretching or tearing some of these ligaments.



THE ELBOW JOINT.
(A hinge joint.)



THE HIP JOINT.
(A ball-and-socket joint.)

[11]

QUESTIONS ON THE LIMBS AND JOINTS OF
THE BODY.

What is the trunk of your body?—"All the body but the head and limbs."

Which are your limbs?—"My two arms and my two legs."

How many limbs have you?—"Four."

How many parts has your arm?—"Two parts: my upper arm and my fore-arm."

How many parts has your leg?—"Two parts: my thigh and my lower leg."

How many joints has your arm?—"Three joints: my shoulder joint, my elbow joint, my wrist joint."

How many joints has your leg?—"Three joints: my hip joint, my knee joint, my ankle joint."

What are joints?—"Bending places."

How many kinds of joints have you?—"Two: hinge joints, and ball-and-socket joints."

What kind of a joint is the shoulder joint?—"A ball-and-socket joint."

Why do you call the shoulder joint a ball-and-socket joint?—"Because at the shoulder the arm may move in any direction."

Tell how the shoulder joint is made.—"The upper end of the bone of the upper arm is rounded and fastened in a hollow place called a socket."

Which of the joints of the arm and hand are hinge joints?—"The elbow joint, the wrist joint, the thumb joint, the finger joints."

Which of the joints of the leg and foot are hinge joints?—"The knee joint, the ankle joint, the toe joint."

Which of the joints of the leg is a ball-and-socket joint?—"The hip joint."

Where is the heel?—"At the back part of the foot."

Where is the ball of the foot?—"On the sole of the foot, behind the great toe."

Where is the hollow of the foot?—"In the middle of the sole of the foot." [12]

Where is the sole of the foot?—"On the bottom of the foot."

Where is the instep?—"Between the ankle joint and the toes."

Where is the lower leg?—"Between the knee joint and the ankle joint."

Where is the thigh?—"Between the hip joint and the knee joint."

Where is the upper arm?—"Between the shoulder joint and the elbow joint."

Where is the fore-arm?—"Between the elbow joint and the wrist joint."

Where are the toe joints?—"Between the parts of the toes."

Where are the finger joints?—"Between the parts of the fingers."

Where is the ankle joint?—"Between the lower leg and the foot."

Where is the knee joint?—"Between the thigh and the lower leg."

Where is the hip joint?—"Between the trunk and the thigh."

Where is the wrist joint?—"Between the fore-arm and the hand."

Where is the elbow joint?—"Between the upper arm and the fore-arm."

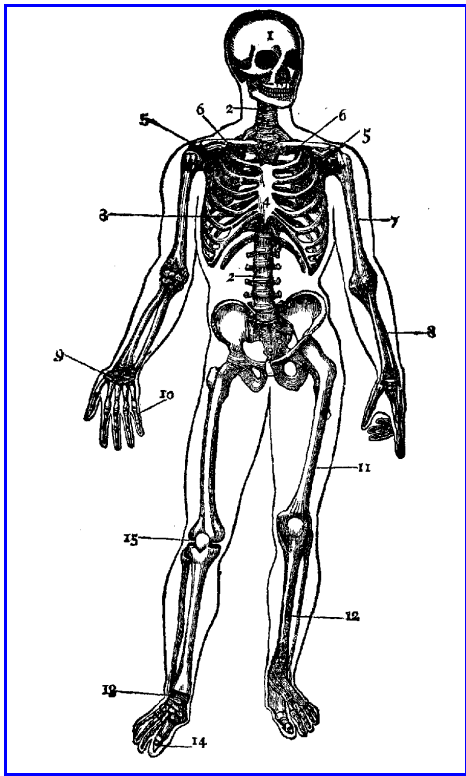
Where is the shoulder joint?—"Between the trunk and the upper arm."

Where are the tips of the fingers?—"At the ends of the fingers."

Where is the ball of the thumb?—"On the palm of the hand, below the thumb."

Where is the palm of the hand?—"On the inside of the hand, between the wrist and fingers."

1. The skull.



2. The spine.
3. The ribs.
4. The breastbone.
5. The shoulder blades.
6. The collar bones.
7. The bone of the upper arm.
8. The bones of the forearm.
9. The bones of the wrist.
10. The bones of the fingers.
11. The bones of the thigh.
12. The bones of the lower leg.

THE SKELETON.

13. The bones of the ankle.
14. The bones of the toes.
15. The kneecap.

PART III.

FORMULA FOR THE LESSON ON THE BONES OF THE BODY.

1. My bones are hard; they make my body strong. There are about two hundred bones in my body.
2. The bones of my head are
my skull and my lower jaw;
my face has fourteen bones; my ear has four small bones; at the root of my tongue is one bone.
3. The bones of my trunk are
my spine,
my ribs,
my breastbone,

my two shoulder blades,

and my two collar bones.

4. My upper arm has one bone; my fore-arm has two bones; my wrist has eight bones; from my wrist to my knuckles are five bones; my thumb has two bones; each finger has three bones, making nineteen bones in my hand.

5. My thigh has one bone; my lower leg has two bones; my knee-pan is the cap which covers and protects my knee; in my foot, near my heel, are seven bones; in the middle of my foot are five bones; my great toe has two bones; each of my other toes has three bones; making twenty-six bones in my foot.

QUESTIONS FOR THE FORMULA.

1. Tell about your bones.

2. Tell about the bones of the head.

3. Tell about the bones of the trunk. [16]

4. Tell about the bones of the arm and hand, beginning with the upper arm.

5. Count the bones of the hand.

6. Tell about the bones of the leg and foot, beginning with the thigh.

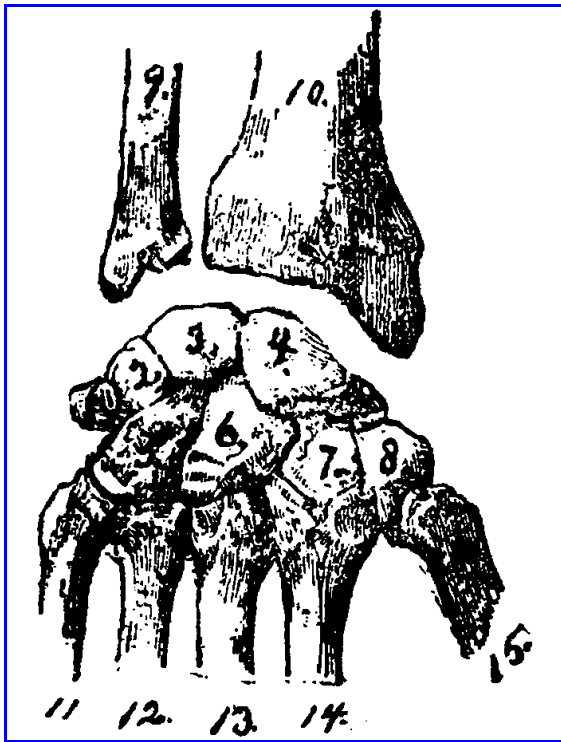


FIG. A.

1, 2, 3, 4, the upper row of the bones of the wrist.

5, 6, 7, 8, the lower row of the bones of the wrist.

9, 10, the lower ends of the bones of the fore-arm.

11, 12, 13, 14, 15, the upper ends of the bones of the palm of the hand.

The bones of the wrist are so firmly fastened together that they are seldom put out of place. The upper row joins with the bones of the fore-arm, the lower with those of the palm of the hand.

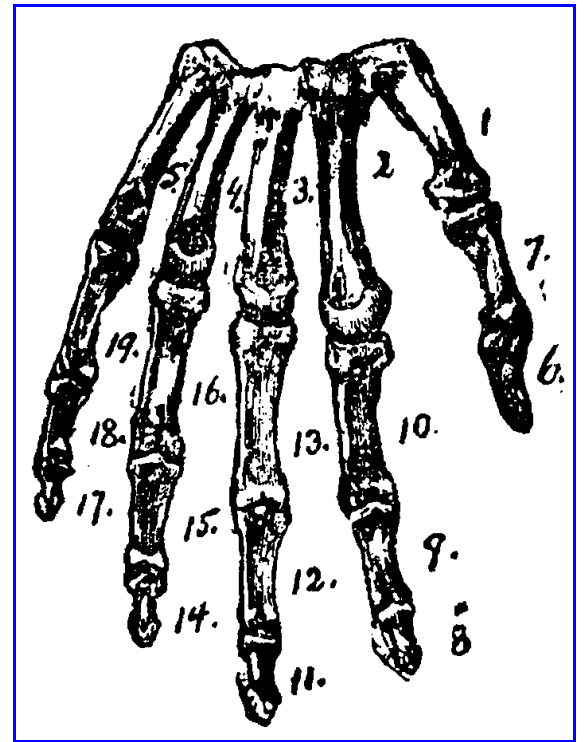


FIG. B.

1, 2, 3, 4, 5, the bones of the palm of the hand.

6, 7, the bones of the thumb.

8, 9, 10, the bones of the first or fore-finger.

11, 12, 13, the bones of the second or middle finger.

14, 15, 16, the bones of the third or ring finger.

17, 18, 19, the bones of the fourth or little finger.

QUESTIONS ON THE BONES.

How many bones in the body?—"About two hundred."

Of what use are the bones to the body?—"They make the body strong; they form the framework of the body."

How many bones in the face?—"Fourteen."

How many bones in the ear?—"Four small bones."

How many bones at the root of the tongue?—"One."

How many bones in the upper arm?—"One."

How many bones in the fore-arm?—"Two."

How many bones between the wrist and the knuckles?—"Five."

How many bones in the thumb?—"Two."

How many bones in each of the fingers?—"Three."

How many bones in the whole hand?—"Nineteen."

How many bones in the hand and arm?—"Thirty."

How many bones in the thigh?—"One long bone."

How many bones in the lower leg?—"Two."

How many bones in the heel?—"Seven."

How many bones in the middle of the foot?—"Five."

How many bones in the great toe?—"Two."

How many bones in each of the other toes?—"Three."

How many bones in the whole foot?—"Twenty-six."

How many bones in the foot and leg?—"Thirty."

How many bones in two arms and two hands?—"Sixty."

How many bones in two legs and two feet?—"Sixty."

How many bones in the limbs?—"One hundred and twenty."

Where is the knee-pan?—"Over the knee joint."

Where is the longest bone of the body?—"In the thigh."

Where are the smallest bones of the body?—"In the ear."

Point to the collar bones.

Point to the shoulder blades.

How many collar bones have you?—"Two."

How many shoulder blades have you?—"Two."

Point to the spine.

Point to the breastbone.

Point to the skull.

[18]

EXERCISE FOR COUNTING THE BONES OF THE HAND.

FOR PRIMARY CLASSES.

I.

1. Close both hands.
2. Raise the forefinger of the right hand, as the index or pointing finger.
3. Place the index finger upon the lower thumb joint of the left hand.
4. Draw the index finger down to the wrist, over the bone between the thumb knuckle and the wrist, and count "One."
5. Place the index finger on the knuckle of the first finger.
6. Draw the index finger down to the wrist, over the bone leading from the first finger to the wrist, and count "Two."
7. So on, for each of the three other bones of the hand. Repeat until no mistake is made in touching or counting.

II.

1. Raise the thumb, and place the index finger of the right hand on the middle of the upper part of the thumb for bone "Six"; then
2. On the lower part of the thumb for bone "Seven." Repeat from the beginning, until the children can touch and count each bone properly.

III.

1. Keep the thumb erect; raise the first finger of the left hand.
2. Place the index finger on the bone between the tip and the first joint of the first finger for bone "Eight."
3. Between the first and middle joint for bone "Nine."
4. Between the middle and third joint for bone "Ten." Review, from the beginning, until the class can touch and count every bone as directed.

IV.

1. Keep the thumb and forefinger erect; raise the second finger and touch, as in the lesson on the first finger bones, "Eleven," "Twelve," and "Thirteen." Review. [19]
2. Proceed in the same manner for the third and fourth fingers, always beginning with the bone nearest the tip of the finger, and touching that at the lowest part last.

If the exercise has been properly performed, every child will say "Nineteen" as its index finger touches the lowest bone of the little finger, and all the fingers of every left hand will be outspread.

THE BONES

OF THE HEAD:

Skull	8
Face, including the lower jaw	14
Tongue	1
Ears	8
	—
	31

OF THE TRUNK:

Spine	24
Ribs	24
Breastbone	8
Shoulder blades	2
Collar bones	2
	—
	60

OF THE UPPER LIMBS:

Upper arms	$1 \times 2 = 2$
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Fore-arms	$2 \times 2 = 4$
Wrists	$8 \times 2 = 16$
Hands	$19 \times 2 = 38$
	—
	60

OF THE LOWER LIMBS:

Thighs	$1 \times 2 = 2$
Knee-pans	$1 \times 2 = 2$
Lower legs	$2 \times 2 = 4$
Feet	$26 \times 2 = 52$
	—
	60

Total, 211, not including the teeth.^[1]

We teach the children to say "about two hundred," because there is not always the same number of bones in the body. In some parts two or three bones unite and form one bone. For example: the breastbone of a child is made up of eight pieces; some of these unite as it becomes older, so that when fully grown it has but three pieces in this bone.

[1] The teeth are not bone, but a kind of soft, bone-like substance, called *dentine*. Common ivory is dentine.

[20]

PART IV.

FORMULAS FOR THE LESSONS ON THE ORGANS OF SENSE.

1. *The Eyes*.—My eyes are to see with.

My eye is like a ball in a deep, bony socket. The black circle in the centre is the pupil or window of my eye;

the colored ring is the iris or curtain; the white part is the eyeball.

My upper and lower eyelids cover and protect my eyes.

My eyebrows are for beauty, and keep the perspiration from rolling into my eyes.

My eyes are washed by teardrops every time I wink my eyelids.

2. *The Ears*.—My ears are to hear with:

the rim of my ear,

the flap of my ear,

the drum of my ear.

The drum of my ear is protected by a fence of short, stiff hairs, and by a bitter wax about the roots of these hairs.

3. *The Nose*.—My nose is to smell and breathe with; it is in the middle of my face:

my two nostrils,

the bridge of my nose,

the cartilage,

the tip of my nose.

My nostrils lead to a passage back of my mouth through which I breathe.

The cartilage separates my nose into two parts.

4. *The Mouth*.—My mouth is to speak, eat, and breathe through:

my upper lip,

my lower lip.

In my mouth are:

my tongue,

my lower teeth,

my upper teeth,

my lower teeth,

and my upper and lower jaws, covered with flesh called *gum*.

5. *The Teeth*.—My teeth are used in eating and talking.

My teeth are made of a soft kind of bone, covered with enamel.

I have three kinds of teeth: cutting teeth, tearing teeth, grinding teeth.

A young child has twenty teeth, ten in each jaw.

A grown person has thirty-two teeth, sixteen in each jaw.

6. To preserve my teeth:

I must keep them clean.

I must not scratch the enamel.

I must not eat or drink anything very hot or very cold.

I must not use them for scissors or nut-crackers.

I must not burn them with tobacco or cigars.

7. *About Eating*.—When I eat I move my lower jaw only.

My tongue brings the food between my teeth,

the cutters cut it,

the tearers tear it,

the grinders grind it,

the saliva moistens it,

and my tongue helps me to swallow it.

QUESTIONS FOR THE FORMULAS.

1. Tell about your eyes.

2. Tell about your ears.

3. Tell about your nose.

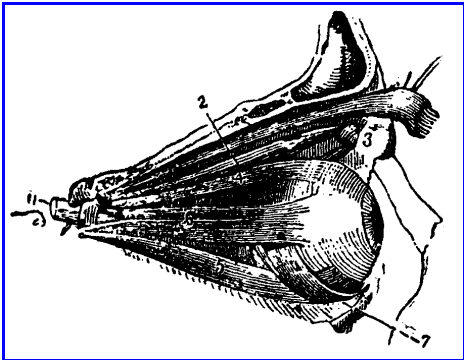
4. Tell about your mouth.

5. Tell about your teeth.

6. What is necessary if you would preserve your teeth?

7. Tell about eating.

[22]



1, the muscle which raises the upper eyelid.

2, the upper oblique muscle.

7, the lower oblique muscle. The oblique muscles roll the eye inward and downward.

4, 5, 6, three of the *four* straight muscles. Two of the straight muscles roll the eye up and down; the other two move it right and left.

3, the pulley through which the upper oblique muscle plays.]

QUESTIONS ON THE DESCRIPTION OF THE EYES.

Of what shape is the eye?—"It is round like a ball."

In what is it placed?—"In a deep, bony socket."

What is a socket?—"A hollow place."

Why is the eye placed in a deep, bony socket?—"To keep it from getting hurt."

Why would not an eye shaped like a cube do for us?—"It would not look well; it could not be rolled about."

Why would not an eye shaped like a cone or cylinder do for us?—"It could not be rolled in every direction."

Why is the ball-shape best for the eye?—"It looks best, and may be rolled in every direction."

What part of the eye do we see through?—"The black spot in the centre."

What is it called?—"The pupil."

[23]

What shape is the pupil?—"Round like a circle."

What color is the pupil?—"Black."

Of what use is the pupil?—"To let light into the eye; to see through."

What is around the pupil?—"A colored ring."

What is the colored ring called?—"The iris."

Of what use is the iris?—"It acts like a curtain to the eye; it lets in and keeps out light from the pupil."

Of what shape is the iris?—"Round like a ring."

Of what color is the iris?—"Sometimes blue, sometimes brown, sometimes gray."

Does the iris always appear the same in size?—"It does not: sometimes it looks large, sometimes small."

When is it the largest?—"When it rolls over the pupil to keep out the strong light."

When is it the smallest?—"When it rolls backward, to let light into the pupil."

When is the pupil the largest?—"When we are in the dark."

When is the pupil the smallest?—"When we are in a bright light."

What color is the eyeball?—"White."

What shape is the eyeball?—"Round like a ball."

How is the eyeball held in its socket?—"By cords made of flesh."

Where are the eyebrows?—"Above the eyelids."

Of what use are the eyebrows?—"To keep the perspiration from rolling into the eyes."

Where are the eyelids?—"Over the eyes."

Of what use are they?—"They cover the eyes and keep them from getting hurt."

Where are the eyelashes?—"On the edges of the eyelids."

Of what use are the tears?—"They keep the eyes clean; they make the eyes move easily in their sockets."

Where are the tears made?—"Back of the eyebrows."

When do the tears wash the eyes?—"Every time we wink our eyelids."

QUESTIONS ON THE EARS.

Name the parts of the ear.

Where are your ears?—"On the sides of my head."

Which is the rim of the ear?—"The edge of the ear."

Which is the flap of the ear?—"The lower part of the ear."

Where is the drum of the ear?—"Inside of the ear."

How is the drum protected?—"By stiff hairs and a bitter wax at its entrance."

QUESTIONS ON THE NOSE.

Where is the nose?—"In the middle of the face."

Name the parts of the nose.

Where is the tip of the nose?—"At the end of the nose."

Where is the bridge of the nose?—"At the top of the nose, between the eyes."

Where is the cartilage?—"In the middle of the inside of the nose."

Of what use is the nose?—"To smell and breathe through."

What are the nostrils?—"The openings inside of the nose."

Of what use are the nostrils?—"To let the air into and out of the opening back of the mouth."

QUESTIONS ON THE MOUTH, ETC.

Where is the mouth?—"In the lower part of the face, between the nose and the chin."

Of what use is the mouth?—"To breathe, speak, and eat through."

What is in the mouth?—"My tongue, my upper teeth, my lower teeth, and my upper and lower jaws."

What covers the jaws?—"Red flesh, called *gum*."

Of what are the jaws composed?—"Of bones."

Of what are the teeth made?—"Of dentine, covered with enamel." [See note](#), p. 19.

[25]

What is enamel?—"A smooth, white substance, harder than bone."

Of what use are the teeth?—"To eat and talk with."

What kinds of teeth have you?—"Cutting teeth, tearing teeth, grinding teeth."

Describe the cutting teeth.—"The cutting teeth have broad and flat edges."

Describe the tearing teeth.—"The tearing teeth are sharp and pointed."

Describe the grinding teeth.—"The grinding teeth are the thick, back teeth."

Which jaw is moved in eating?—"The lower jaw."

What work do the teeth perform?—"They cut, tear, and grind the food."

How many teeth has a child in a full set?—"Twenty teeth: ten in each jaw."

How many teeth has a grown person in a full set?—"Thirty-two: sixteen in each jaw."

What does the tongue do in eating?—"It rolls the food between the teeth, and helps in swallowing."

What is the saliva?—"A kind of liquid, sometimes called *spit*."

Of what use is it in eating?—"It wets and softens the food."

What do you mean by preserve?—"To keep from injury."

What do you mean by injury?—"Hurt."

How do you preserve your teeth? See Formula.

How do very hot or very cold drinks hurt the teeth?—"They crack the enamel."

What happens if the enamel is cracked?—"The teeth decay."

Then what must you do to preserve your teeth?—"I must try to keep the enamel from being cracked or injured in any way."

PART V.

FORMULA FOR DESCRIPTION OF THE BONES.

1. My skull is formed of several bones united, like two saws with their toothed edges hooked into each other.
2. My spine extends from the base of the skull behind, down the middle of my back.

It is composed of twenty-four short bones, piled one upon the other, with cartilage between them.

These bones are fastened together, forming an upright and flexible column, which makes me erect and graceful.

3. My ribs are curved, strong, and light; there are twenty-four of them, twelve on each side; they are fastened at the back to my spine, in front to my breastbone, forming a hollow place for my heart, lungs, and stomach.

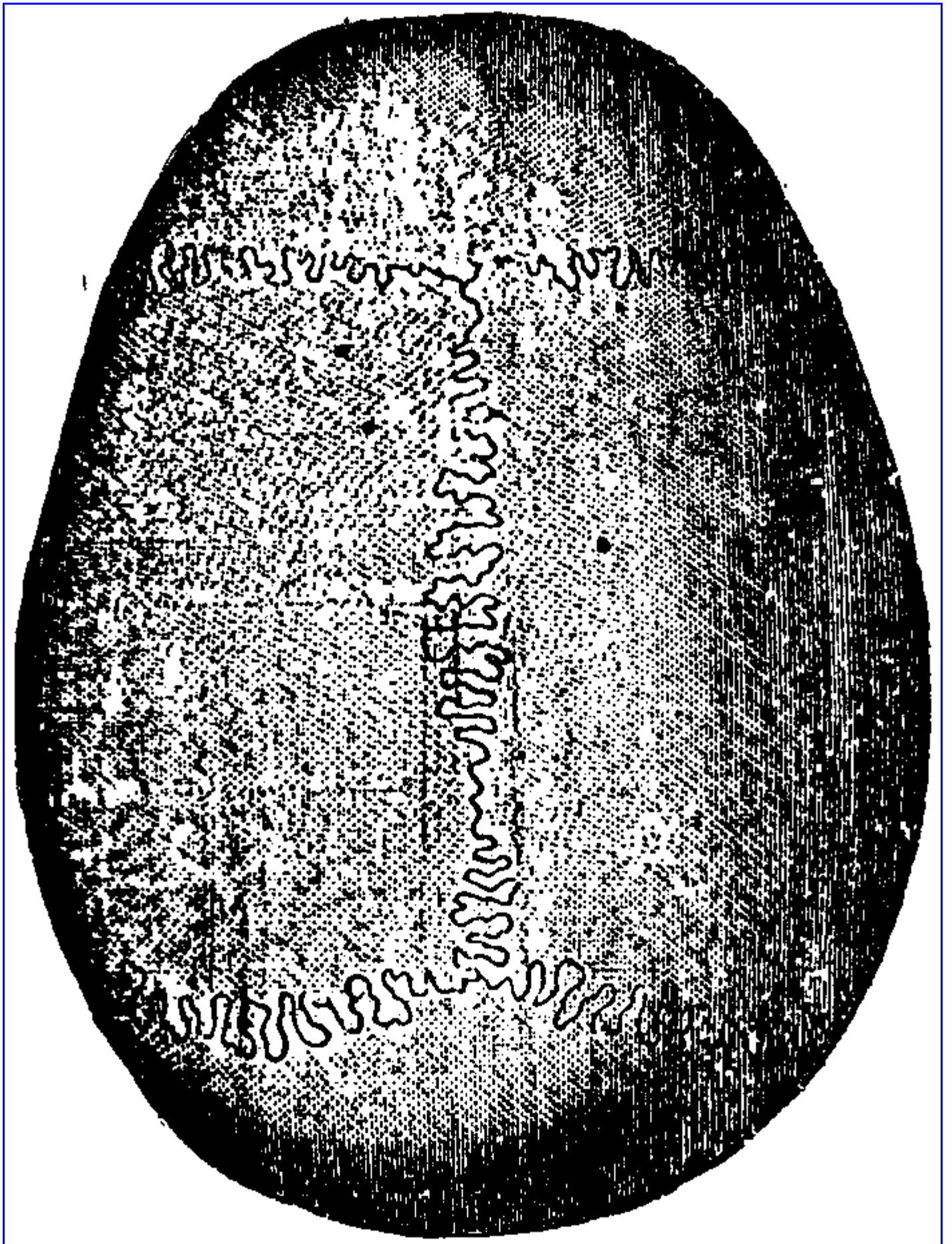
4. My shoulder blades are flat, thin, and like a triangle in shape; they are for my arms to rest upon.
5. My collar bones are fastened to my shoulder blades and my breastbone; they keep my arms from sliding too far forward.
6. The bones of old people are hard and brittle; those of children soft and flexible; so I must sit and stand erect, that mine may not be bent out of shape. I must not wear tight clothing, or do anything that will crowd them out of their places.
7. My bones are made from my food, after it has been changed into blood; so I must be careful to eat good, wholesome food, that they may be strong and healthy.

[27]

8. I must not breathe impure air, because impure air makes bad blood, and bad blood makes poor bones.
9. The body of every person is changing all the time, because the skin, flesh, and bones are always wearing out, and the blood is always repairing and building them again.

QUESTIONS FOR THE FORMULA.

1. Tell about the skull.
 2. Tell about the spine.
 3. Tell about the ribs.
 4. Tell about the shoulder blades.
 5. Tell about the collar bones.
 6. Tell about the difference between the bones of old people and those of children.
 7. Of what are your bones made?
 8. If you wish your bones to be strong, why should you not breathe impure air?
 9. What have you learned about the change which is always taking place in the body?
-



THE JOINTS OF THE SKULL.

A little girl was looking at some pictures of ladies in fashionable dresses. While admiring the beautiful styles and bright colors of the garments, she pointed to the waist of one, and exclaimed, "*That means trouble.*" The waist was too small for a grown person, and could only have been made so by *tight-lacing*. The child had been taught that dresses, corsets, coats, vests, bands, or anything fastened tightly around the waist, press upon the ribs and crowd them out of place, preventing the heart, lungs, and other inside organs from working as they should, causing headache, dyspepsia, shortness of breath, and often ending in some incurable disease, so she knew that *tight clothing means trouble* to the wearer.

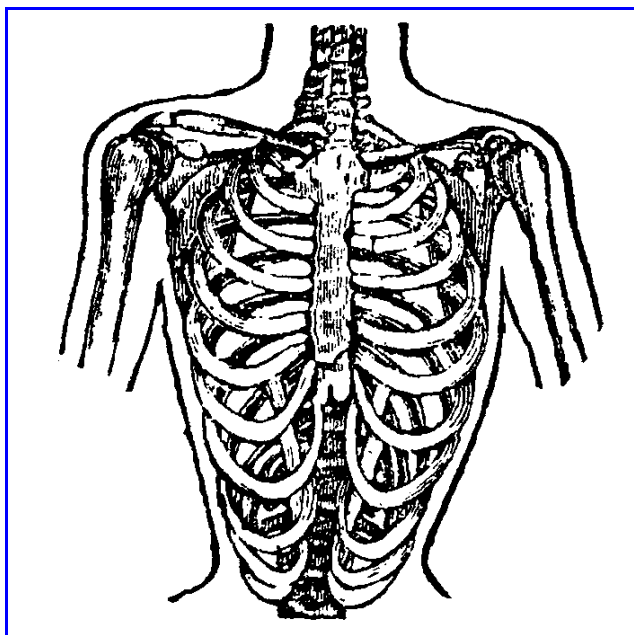


FIG. 1. Deformed by tight-lacing.

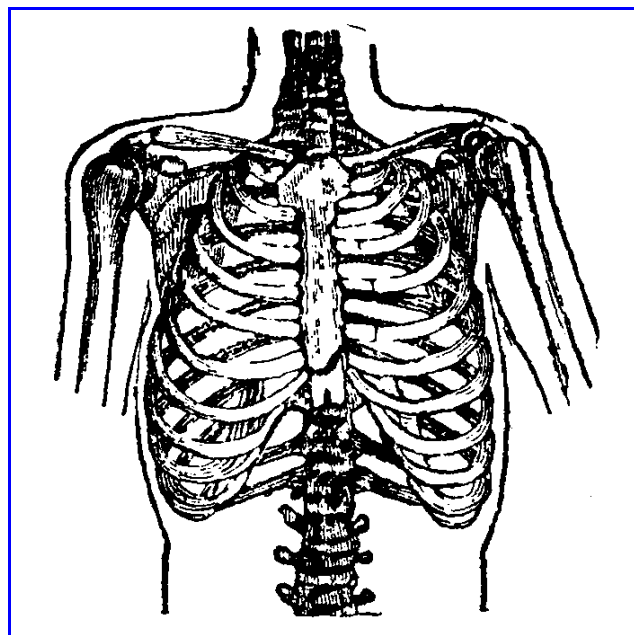


FIG. 2. A natural, well-shaped chest.

QUESTIONS ON THE DESCRIPTION OF THE BONES.

Point to the skull.

Of what is it made?—"Several bones united together."

How are the skull bones united?—"Like two saws with their toothed edges hooked into each other."

What do you mean by *toothed*?—"Having points, like teeth."

What covers the skull?—"Flesh, skin, and hair."

Of what use is the skull?—"It protects the brain."

What is the brain?—"That part of my body in which the thinking is done."

Where is the spine?—"It extends from the base of my skull behind, down the middle of my back."

What do you mean by *extends*?—"Goes from."

What do you mean by *base*?—"The lower part of anything."

Of what is the spine made?—"Of about twenty-four short bones, with cartilage between them."

What is cartilage?—"An elastic substance, harder than flesh, but softer than bone."

How are the bones of the spine placed?—"They are piled one upon the other."

What do you mean by *forming*?—"Making."

What do you mean by *upright*?—"In a vertical position."

What do you mean by *flexible*?—"Easily bent."

What do you mean by *column*?—"A pillar."

What do you mean by *erect*?—"In a vertical position."

Why is cartilage placed between the bones of the spine?—"To make the spine flexible; to keep the brain from injury when we walk or run."

What do you mean by *elastic*?—"Springing back after having been stretched, squeezed, twisted, or bent."

Tell about your ribs.—"My ribs are curved, strong, and light."

Where are your ribs?—"On each side of my trunk."

How many ribs have you?—"Twenty-four; twelve on each side."

How are your ribs fastened?—"At the back to my spine; in front to my breastbone."

What do your ribs form?—"A hollow place for my heart, lungs, and stomach."

Where are your shoulder blades?—"In the upper part of my back."

What shape are they?—"Flat, thin, and like a triangle."

Of what use are your shoulder blades?—"For my arms to rest upon."

Point to your collar bones.

Where are they fastened?—"To my shoulder blades and my breastbone."

[30]

Of what use are your collar bones?—"They keep my arms from sliding too far forward."

Of what are your bones made?—"Of food after it has been changed into blood."

Why should you eat wholesome food?—"That my bones may be strong and healthy."

How does impure air hurt the bones?—"Impure air makes bad blood, and bad blood makes poor bones."

Why should you sit and stand erect?—"Because my bones are easily bent out of shape; if I do not sit and stand erect, they will grow crooked."

Why is it wrong to wear tight clothing?—"Because tight clothing crowds the bones out of shape."

Whose bones are the more brittle, those of a child, or those of an old person?—"Those of an old person."

What do you mean by *brittle*?—"Easily broken."

Whose are the more flexible?—"Those of a child."

What do you mean by *flexible*?—"Easily bent."

What repairs the worn out bones, flesh, and skin of the body?—"The blood."

What do you mean by *repairs*?—"Mends."

What causes the bones, flesh, and skin of your body to change often?—"The bones, flesh, and skin are always wearing out, and the blood is always building and repairing them again."

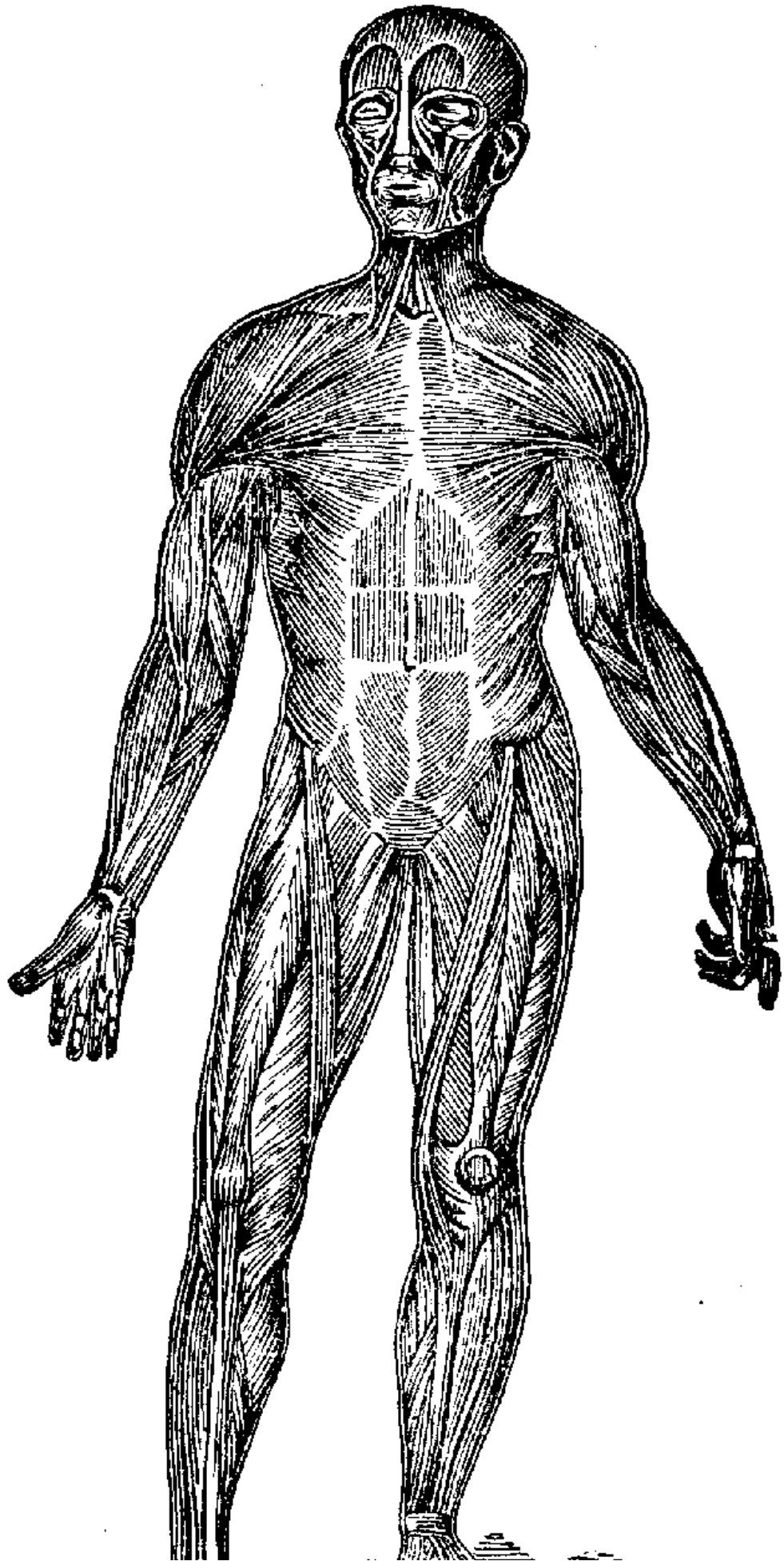
What are alcoholic liquors?—"Liquors which have alcohol in them."

Name some alcoholic liquors.—"Beer, wine, rum, etc."

Whose bones mend the more easily when broken, the bones of those who drink alcoholic liquors, or those of the people who do not use these poisons?—"The bones of those who *do not* use alcoholic liquors."

What other poison hurts the bones?—"Tobacco."

How do alcohol and tobacco hurt the bones?—"They make bad blood, and bad blood makes poor bones."



PART VI.

FORMULA FOR THE LESSON ON THE MUSCLES.

1. Muscles are the red, elastic bands and bundles of thread like substance, called flesh, which cover the bones and make the eyeballs, the eyelids, the tongue, the heart, the lungs, and various other parts of the body.
2. There are about four hundred and fifty muscles in my body.
3. The work of the muscles is to support and move my bones, and different parts of the body.
4. The muscles may be named the muscles of my head, the muscles of my trunk, the muscles of my limbs.
5. The muscles of my head cover and move the parts of my head and face. The muscles of my trunk cover and move the parts of my neck and trunk. The muscles of my limbs cover and move the parts of my arms and legs.
6. Those muscles are the weakest which I use least; those muscles are the strongest which I exercise most in work or play.
7. If I would be strong and healthy,
my muscles must be used,
my muscles must be rested,
my muscles must be supplied with good blood.

I must exercise in work and play to make them strong; I must sleep, or change my kind of work or play, to give them rest, when they are tired; I must breathe pure air, take wholesome food and drink, and live in the sunlight, to supply them [34] with good blood; I must not weaken them by using alcohol or tobacco.

QUESTIONS FOR THE FORMULA.

1. Tell about the muscles.
2. How many muscles have you in your body?
3. Of what use are the muscles?
4. How may the muscles be named?
5. Tell about the muscles of the head, trunk, and limbs.

6. Which muscles are the weakest, and which are the strongest?
7. What is necessary if you would have strong and healthy muscles?

CLASSES AND WORK OF THE MUSCLES.

The muscles are divided into two great classes: those which we may move as we choose, called *voluntary* muscles, and those over which we have no power, called *involuntary* muscles.

Some muscles support and move the various parts of the body, others have different work to do. The heart, the great involuntary muscle, acts like an engine to drive the blood throughout the body; the lungs draw in and throw out the air in breathing; the stomach helps to churn and change food into blood; the tongue is used in speaking and eating.

QUESTIONS ON THE MUSCLES.

What are the muscles?—"The lean flesh of the body; bands and bundles of fleshy threads which cover the body."

Of what use are the muscles to the body?—"They cover the bones; they support and move the bones and different parts of the body."

Name some parts of the body which are made of muscles.—"The eyeballs, the eyelids, the tongue, the heart, the lungs."

What color are the muscles?—"Red."

How do the muscles move the bones?—"By shortening or lengthening themselves according to the way the bones are to be moved."

Tell how the muscles move your arm at the elbow.—"The [35] muscles in the front part of the arm shorten themselves, to draw my fore-arm toward the shoulder; when I wish to stretch out the fore-arm these muscles lengthen, while another set of muscles shorten, to draw the fore-arm away from the upper arm."

What do you say about the muscles because they have the power to shorten and lengthen themselves?—"They are elastic."

About how many muscles are there in your whole body?—"About four hundred and fifty."

How may these be divided as you study about them?—"They may be divided into the muscles of my head, the muscles of my trunk, and the muscles of my limbs."

Of what use are the muscles of your head?—"They cover and move the parts of my head and face."

Of what use are the muscles of your trunk?—"They move the parts of my neck and trunk."

Of what use are the muscles of your limbs?—"They move the parts of my arms and legs."

How can you make your muscles strong?—"By using them."

How can you make your muscles weak?—"By not using them."

What is necessary to make your muscles strong and healthy?—"They must be used; they must be rested when tired; they must be supplied with pure blood."

How should the muscles be used?—"They should be exercised in work or play."

How may they be rested?—"I may rest my muscles by changing position; by changing my kind of work or play; or by going to sleep."

Explain what you mean by changing your position.—"If I am standing, I must sit or lie down to rest them; if they are tired, because I have been sitting too long, I must rest them by standing, walking, or running."

What do you mean by changing the kind of work or play?—"If, in my work or play, my arms become tired, I must do something in which my arms may rest, though other parts of my body may be in exercise."

[36]

How may you help supply your muscles with good blood?—"By breathing pure air; by taking wholesome food and drink; and by living in the sunlight."

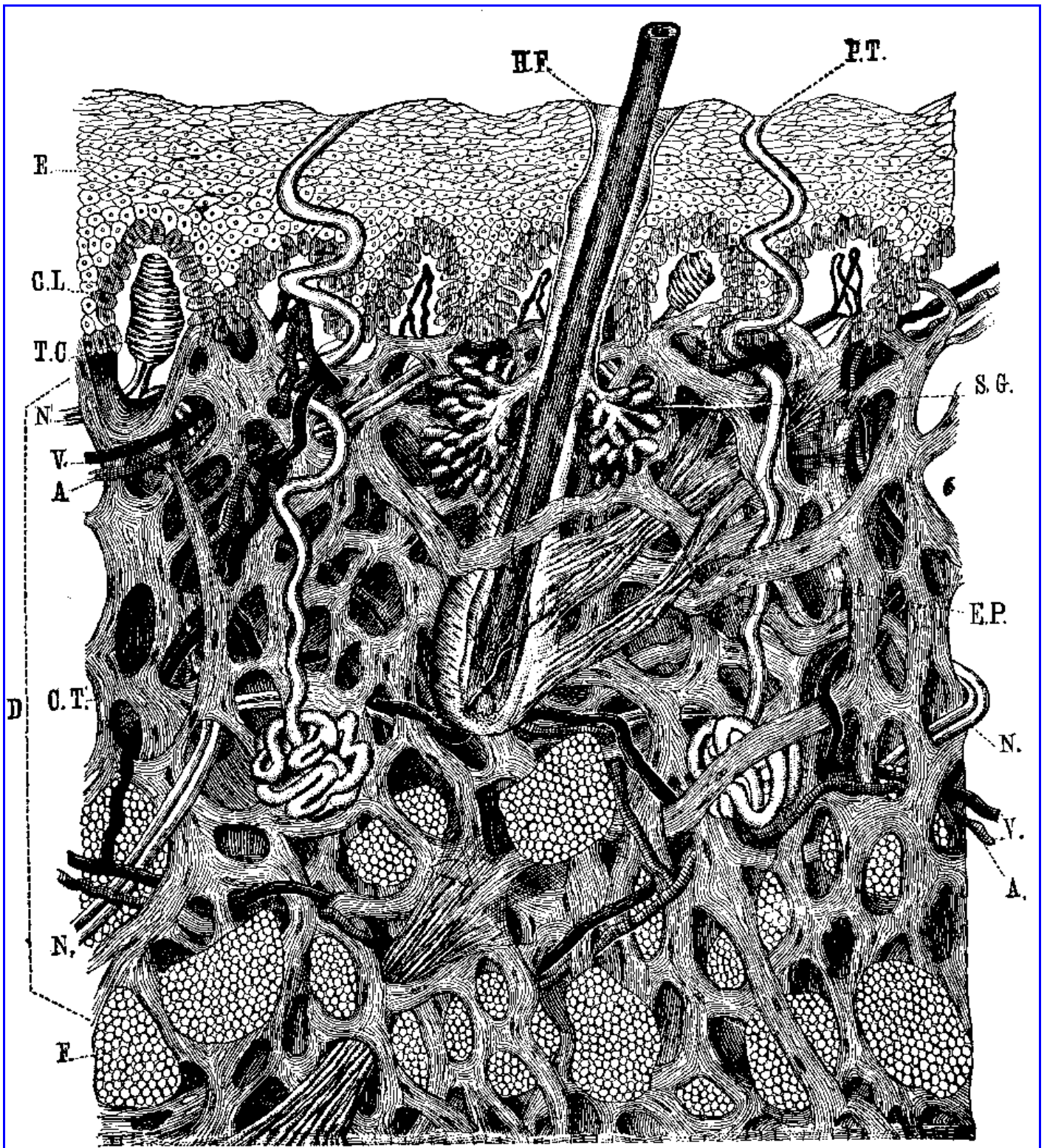
How does drinking alcoholic liquors hurt the muscles?—"It makes them weak, and unfit to move the parts of the body."

What wonderful muscle moves without your will?—"The heart."

How does alcohol hurt the heart?—"It makes it beat too fast."

How does "beating too fast" hurt the heart?—"It makes it tired, and sometimes wears it out." [See Appendices on Alcohol and Tobacco.](#)

[38]



THE SKIN (very highly magnified).—(From Walker's *Physiology*, 1884.)

A, arteries; V, veins; N, nerves; F, fat cells; E, the outer skin; CL, the color layer; D, the true skin; PT, a perspiratory tube; HF, a hair and hair sac; EP, muscles; SG, oil glands; TC, tactile corpuscles; CT, connective tissue.

PART VII.

FORMULA FOR THE LESSON ON THE SKIN.

1. My skin covers my body.
 2. It is thin, elastic, flexible, porous, and absorbent.
 3. I have two skins; the inner skin is the true skin.
 4. My true skin is elastic, and like a net-work of blood-vessels and nerves. My true skin is covered with a jelly-like substance which gives color to my skin.
 5. My outside skin is not the same thickness over my whole body. In some parts, as on the palms of my hands and the soles of my feet, it is very thick and tough.
 6. If my outside skin be destroyed, it will grow again; if the jelly-like substance be destroyed, it will re-appear; but if my true skin be destroyed, it will never be perfectly renewed.
 7. More than half of the waste substance of my body passes from it through the pores of the skin, in the form of perspiration.
 8. If I would have a healthy skin,
I must perspire freely all the time,
I must keep my body clean,
I must wear clean clothing,
I must breathe pure air,
and live in the sunlight.
-

QUESTIONS FOR THE FORMULA.

1. Where is your skin?
2. Tell about the skin.
3. How many skins have you?
4. Tell about the true skin.
5. What difference is there in the thickness of your outside skin?
6. What happens if the different skins be destroyed?

7. What passes through the pores of the skin?
8. What is necessary if you would have a healthy skin?

DIRECTIONS FOR BATHING.

Bathe the whole body at least twice every week. Do not bathe when tired or after a hearty meal. After bathing *rub well* with a coarse towel.

QUESTIONS ON THE SKIN.

Of what use is the skin?—"It covers the muscles of the body."

What can you tell about it?—"It is flexible, elastic, porous, and absorbent."

Why do you say it is flexible?—"Because it is easily bent."

Why do you say it is porous?—"Because it is full of little holes, or pores."

Why do you say it is elastic?—"Because it will spring back after it is stretched, squeezed, twisted, or bent."

Why do you say it is absorbent?—"Because it will soak up liquids."

How many skins have you?—"Two; an outside skin, and an inner skin."

Which is the true skin?—"The inner skin."

Of what is the inner skin composed?—"Of blood-vessels and nerves."

How do you know that the outer skin has no blood-vessels?—"Because if I put a pin through the outer skin the blood does not flow out, as it would if I had cut a blood-vessel."

How do you know the outer skin has no nerves?—"Because [41] if I put a pin through my outer skin it does not make me suffer pain, as it would if I had touched a nerve."

What gives color to the skin?—"A jelly-like substance between the inner and the outer skin."

What have you learned about the true skin?—"That it is of the same color in people of every nation."

What difference is there in the thickness of the outer skin? [See Formula.]

What passes through the pores of the skin? [See Formula.]

What is this waste called when it comes from the surface of the skin?—"Perspiration."

When does the perspiration flow through the pores of the skin?—"All the time, if the skin is healthy."

Why do we not always see the perspiration which passes through the pores?—"Because it does not always form drops on the surface of the skin; it generally passes off in very fine particles."

What becomes of the fine or minute portions of perspiration which pass from the body?—"Some of these portions are absorbed by the clothing; some pass into and mix with the air around us."

What effect does the perspiration produce on the air and the clothing?—"It soon makes the air unfit to be breathed, and the clothing unfit to be worn."

What is necessary if you would have a healthy skin? [See Formula.]

Why must you wear clean clothing?—"That there may be nothing impure in the clothing for the pores of the skin to absorb."

Why should you breathe pure air?—"Because air purifies the blood, and pure blood is necessary to make a healthy skin."

How does drinking alcoholic liquors hurt the skin?—"It makes the blood impure, and impure blood makes unhealthy skin."

In what other way does drinking these liquors hurt the skin?—"It gives the skin too much work to do."

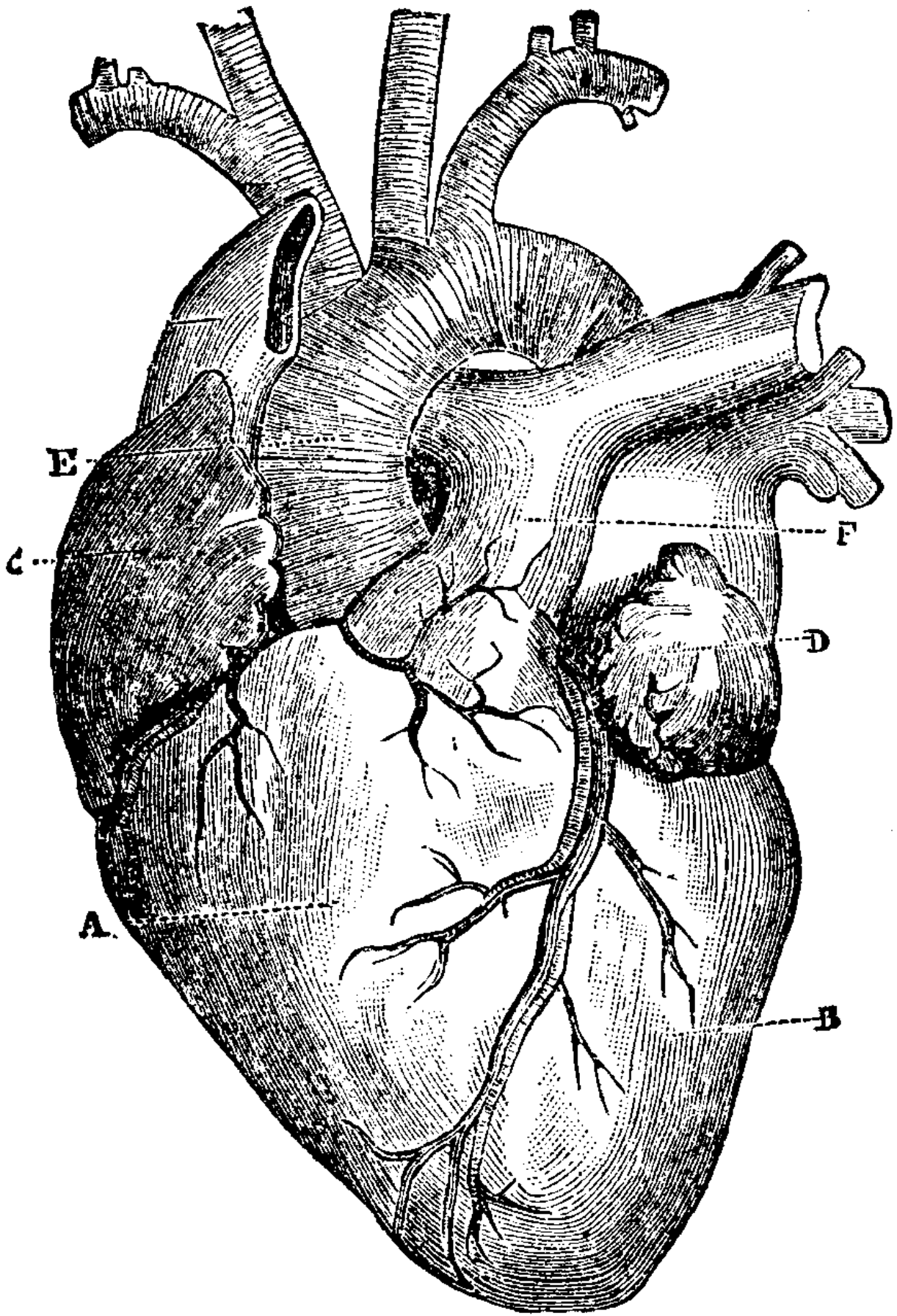
[42]

How does it give it too much work to do?—"It makes more waste substance to pass from it through the pores, in the form of perspiration."

In what other way does drinking alcoholic liquors hurt the skin?—"It makes it a bad color."

How does it make the skin a bad color?—"It stretches the little blood-vessels of the skin, and makes them too full of blood." [See Appendix.](#)

[44]



THE HEART.

A, the right ventricle; B, the left ventricle; C, the right auricle D, the left auricle; E, the aorta; F, the pulmonary artery.

[45]

PART VIII.

FORMULA FOR THE LESSON ON THE HEART AND THE CIRCULATION OF THE BLOOD.

1. My heart is shaped like a cone, and placed in my chest near my breastbone, with its apex pointing downward to my left side. It beats about seventy times a minute, sending out about two ounces of blood at every beat.

2. The blood when pure is of a bright red color; it is a liquid made from food and drink.

3. It passes from my heart to all parts of my body, through pipes called arteries; these arteries spread out through the body like branches from a tree.

4. As the blood flows from the heart, through the arteries, it gives nourishment to every part of the body, and carries away the impurities it meets, which makes it black and thick; when it comes through the veins, back to the heart, it is not fit to be used, so it goes to the lungs to be purified by the fresh air; then it returns to the heart to be sent again throughout the body; this happens once in from three to eight minutes, and is called the circulation of the blood.

7. If I would be healthy,

my blood must be pure and circulate freely all the time.

8. It will not circulate freely,

if I wear tight clothing,

if I do not exercise in work or play,

if I do not keep my body warm.

[46]

9. It will be impure,

if I breathe bad air,

if I eat unwholesome food,

if I drink alcoholic liquors,

if I snuff, smoke, or chew tobacco.

QUESTIONS FOR THE FORMULA.

1. Tell about the heart and where it is placed.
2. Tell about the blood and of what it is made.
3. Where does the good blood pass after it is sent out from the heart?
4. Tell what the blood does as it flows through the body.
5. What is this flowing of the blood to and from the heart called?
6. How often does it happen?
7. What is necessary if you would have pure blood?
8. When will the blood not circulate freely?
9. When will the blood be impure?

HOW TO TREAT A WOUND.

If it is only a flesh-wound or slight cut, wash it with cold water and bandage it with a clean, white rag. The edges of a deep cut should be drawn together and held in place by narrow strips of adhesive plaster, fastened across the wound from side to side.

If the cut is very deep, and the blood flows very freely, send for a doctor. While you wait for him, knot a handkerchief, or suspender, or towel, in the middle, and twist it very tightly *over the cut artery, above the wound*. If a vein has been severed, twist the knotted handkerchief *below the wound*. If the blood continues to flow, tie a bandage both above and below the hurt part.

[47]

QUESTIONS ON THE HEART AND THE CIRCULATION OF THE BLOOD.

Of what shape is your heart?—"My heart is shaped like a cone."

Where is it placed?—"In the chest, pointing toward my left side."

What bone is it near?—"It is near my breastbone."

Of what use is the heart?—"It contains the blood and sends it to the different parts of the body."

How much blood is sent from the heart at each beat?—"About two ounces."

What is the blood?—"A liquid made from food and drink."

Of what color is the blood?—"Bright red, when pure; dark red, when impure."

How does the heart send the blood through the body?—"Through pipes called arteries."

What do the arteries resemble in the way they are arranged?—"The branches of a tree."

What makes the blood impure?—"As the blood flows, it gives nourishment to every part of the body; this makes it poor. It also takes up the old worn-out particles; this makes it impure."

Where do the arteries carry the impure blood?—"To the veins."

Where do the veins carry the impure blood?—"To the heart."

Where does the heart carry the impure blood?—"To the lungs."

What happens to the impure blood in the lungs?—"It is made pure."

What makes it pure?—"Pure air."

Where do the lungs send the blood after it is made pure?—"Back to the heart."

Where does the heart send the pure blood?—"Throughout the body."

[48]

What is the journey of the blood to and from the heart to the different parts of the body called?—"The circulation of the blood."

What is the circulation of the blood?—"The circulation of the blood is its journey from the heart to the different parts of the body, and from the different parts of the body back to the heart."

How often does this circulation take place?—"Once in from three to eight minutes, according as the heart beats fast or slowly."

What kind of blood is necessary to health?—"Pure blood."

How should the blood circulate?—"Freely, all the time."

What do you mean by freely?—"Without anything to hinder."

What is necessary for the free circulation of the blood?—"I must wear clean clothing; I must exercise in work or play; I must keep my body warm."

How does tight clothing hinder the free circulation of the blood?—"By pressing upon the arteries and veins; and when about the waist, causing the ribs and other parts of the body to press upon the heart."

How does exercise help the free circulation of the blood?—"Exercise makes the heart beat faster, which causes the blood to move faster through the arteries and veins."

Why does keeping the body warm help the circulation of the blood?—"Because the blood moves faster when

it is warmest; cold chills the blood, and makes it move slowly."

What harm do alcoholic liquors do to the heart?—"They make it tired, and sometimes wear it out."

In what way do they make it tired?—"They make it beat too fast."

Why does it beat too fast?—"Because it is hurrying to drive the alcohol out of the body."

In what other way do alcoholic liquors hurt the heart?—"They produce disease in it."

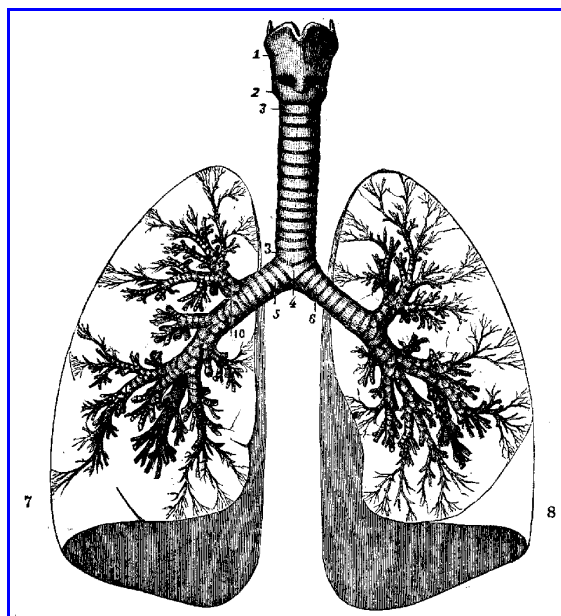
Tell one way by which the heart becomes diseased through [49] alcoholic liquors?—"Alcohol softens the fibres of the muscles of the heart, and fills them with fat."

What harm does this do to the heart?—"It makes it too weak to do its work, which is to pump the blood through the body."

What sometimes happens when the heart is thus weakened?—"It stops beating, which causes sudden death."

What harm does alcohol do to the blood?—"It uses up the water of the blood; it destroys the goodness of the red part; it makes the blood thin, impure, and unfit to do its work." See [Appendices](#) on Alcohol and Tobacco.

[50]



THE LUNGS.

- 1, 2, the larynx, the upper part of the windpipe.
- 3, the windpipe, or trachea.
- 4, where the windpipe divides to right and left lungs.
- 5, the right bronchial tube.
- 6, the left bronchial tube.
- 7, outline of the right lung.
- 8, outline of the left lung.
- 9, the left lung.
- 10, the right lung.

[51]

PART IX.

FORMULA FOR THE LESSON ON THE LUNGS AND RESPIRATION.

1. My lungs are the bellows or breathing machines of my body.
2. They are composed of a soft, fleshy substance, full of small air-cells and tubes. They are porous and spongy when healthy, but in some diseases become an almost solid mass, through which the air cannot pass.
3. I breathe by drawing the air through my windpipe, along the tubes into the cells of my lungs, swelling them out, and causing my chest to expand; then the chest contracts, and the impure vapor in my lungs is pressed out through the same tubes, windpipe, nose, and mouth, into the atmosphere.
4. I cannot live without breathing, because if the air does not go down into my lungs, the dark blood in them is not changed into pure red blood, and goes back through my body dark blood, which cannot keep me alive.
5. If I would have healthy lungs,
I must breathe pure air,
I must live in the sunlight,
I must keep my body clean,
I must wear loose clothing,
I must wear clean clothing,
I must sit and stand erect,
I must keep all parts of my body warm,
I must not change my winter clothing too early in the spring,
I must avoid draughts of cool air,

[52]

- I must not rush into the cold when I am in a perspiration,
I must not poison my lungs with alcohol or tobacco.

QUESTIONS FOR THE FORMULA.

1. What are the lungs?
2. Describe the lungs.
3. How do you breathe?
4. Why can you not live without breathing?
5. What is necessary if you would have healthy lungs?

THE AIR AND THE LUNGS.

The air which enters through the nose and mouth passes into a tube of muscles and ring-like pieces of cartilage. The upper part of this tube is the voice-box or *larynx*, covered by a spoon-shaped lid which closes when we swallow; the lower part is the *trachea*, and the two parts are the windpipe. The trachea divides into two branches, *the bronchial tubes*, one for each lung. These tubes divide again and again like the branches of a tree, and end in exceedingly small sacs or bags. The air in these sacs, or air-cells, gives *oxygen* to the blood in the tiny blood-vessels of the lungs and takes from them the poison, *carbonic-acid gas*, water, and impurities, which it carries back through the windpipe into the outside air.

QUESTIONS ON THE LUNGS AND RESPIRATION.

Of what are the lungs composed?—"Of a soft, fleshy substance, full of small air-cells and tubes."

Of what use are the lungs?—"They are the breathing machines of the body."

How do the lungs appear when healthy?—"Porous and spongy."

How does the air get into the lungs?—"The air flows through the nose and mouth, into the windpipe and along the air-tubes, into the air-cells of the lungs."

[53]

What does the air do in the lungs?—"It swells the lungs and causes the chest to expand."

What do you mean by expand?—"To increase in size."

How is the air expelled from the lungs?—"The chest contracts and sends the impure air through the tubes and windpipe, the nose and mouth, into the atmosphere."

What do you mean by contracts?—"Becomes smaller."

What do you mean by atmosphere?—"The air."

Of what use is the air when it is in the lungs?—"It makes the blood pure."

Why can you not live without breathing?—"Because, if I do not breathe, pure air cannot get into the lungs to make the bad blood pure, and I cannot live if the dark, impure blood is sent back again through my body."

Why must you live in the sunlight?—"Because the sunlight helps to purify the blood and strengthen the body."

Why must you wear loose clothing?—"Because tight clothing stops the circulation of the blood."

Why must you avoid tight-lacing?—"Because tight-lacing crowds the ribs against the lungs, so that the lungs cannot move freely."

Why should you wear clean clothing?—"That nothing impure may pass into the body through the pores of the skin."

Why should you keep the body clean?—"That the pores of the skin may not be closed, but remain open to let the perspiration pass through."

What has the cleanliness of the body to do with the health of the lungs?—"If the body is not kept clean, the perspiratory pores become clogged."

What happens when the perspiratory pores are clogged?—"The impure particles which should pass through them stay in the body, and cause disease in the lungs or other parts."

Why should you sit and stand erect?—"Because, if I am in the habit of stooping, my lungs will be crowded, and will not have enough room to move freely."

Why should you keep all parts of the body warm?—"Because [54] chilling any part of the body causes the blood to chill in that part, and thus hinders its circulation."

Why should you not change your winter clothing too early in the spring of the year?—"I may take cold if not warmly clothed during the cool days of early spring."

Why should you avoid draughts of cool air?—"Because the cool air blows upon some parts of the body and closes the pores of the skin, checking the perspiration, and hindering the circulation of the blood."

Why should you not rush suddenly from a warm to a cool place?—"Because when warm the pores of the skin are open; if I rush suddenly into the cool air, these pores are closed too quickly."

Why does stopping the perspiration hurt the lungs more or less?—"The impurities it ought to carry away remain in the body, make the blood impure, and produce disease in some part; very often that part is the lungs."

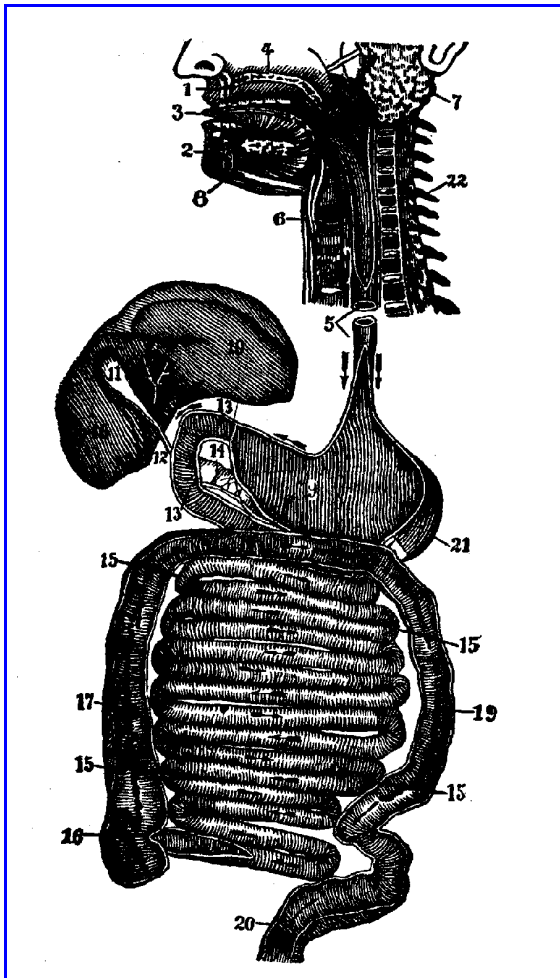
What harm does alcohol do in the lungs?—"It fills the lungs with impure blood."

What harm does it do to the air-cells?—"It hardens the walls of the air-cells of the lungs."

What harm is done by the hardening of these air-cells?—"1. The lungs cannot take in enough of the gas called oxygen to purify the blood perfectly. 2. The gases or vapors in the lungs cannot pass freely through the hardened air-cells."

What happens from this?—"The lungs become diseased."

From what disease do some hard drinkers suffer?—"Alcoholic consumption, for which there is no cure." [See Appendices](#) on Alcohol and Tobacco.



THE DIGESTIVE ORGANS.

2. The lower jaw.
3. The tongue.
4. The roof of the mouth.
5. The food-pipe.
6. The windpipe.
- 7, 8. Where the saliva is made.
9. The stomach.
10. The liver.
11. Where the bile is made.
12. The duct through which the bile passes to the small intestine.
13. The upper part of the small intestine.
14. Where the pancreatic juice is made.
15. The small intestine.
16. The opening of the small into the large intestine.

17-20. The large intestine.

21. The spleen.

22. The spinal column.

PART X.

FORMULA FOR THE DIGESTIVE ORGANS AND DIGESTION.

1. When my food is chewed, it is rolled by my tongue into the oesophagus, or food-pipe, which is back of my windpipe, and leads from my mouth down along the side of my spine, to the left and upper end of my stomach.

2. My stomach is an oblong, soft, and fleshy bag, extending from my left to my right side, below my lungs and heart.

3. It is composed of three coats or membranes, and resembles tripe.

4. The *outer coat* is smooth, thick, and tough. It supports and strengthens the stomach.

5. The *middle coat* is fibrous. Its fibres have the power of contracting, sometimes pressing upon the food, and sometimes pushing it along toward the opening which leads out of the stomach.

6. The *inner coat* is soft, thick, spongy, and wrinkled. It prepares a slimy substance and a fluid. The slimy substance prevents the stomach from being irritated by the food. The fluid dissolves the food.

7. Food passes through several changes after it enters the mouth.

8. It is changed into pulp in the *mouth*, by the action of the teeth and the saliva. This is called *mastication*. It is changed in the *stomach*, by the action of the stomach and the gastric juice, into another kind of pulp called *chyme*. The chyme is changed by the bile and another kind of juice, called *pancreatic* [58] *juice*; these separate the nourishing from the waste substance. The nourishing, milk-like substance is called *chyle*. The waste substance passes from the body. The chyle is poured into a vein behind the collar bone, and passes through the heart to the lungs, where it is changed into blood.

9. If I would have a healthy stomach,

I must be careful what kind of food I eat,

I must be careful how much I eat,

I must be careful how I eat,

I must be careful when I eat.

10. I must eat wholesome food, good bread, ripe fruits, rather than rich pies or jellies.

11. I must eat enough food, but not too much.

12. I must eat slowly,

I must masticate my food thoroughly,

I must masticate and swallow ray food without drinking

13. I must take my food regularly but not too often,

I must rest before and after eating, if possible,

I must not eat just before bedtime.

14. I must breathe pure air,

I must sit, stand, and walk erect,

I must not drink alcoholic liquors,

I must not snuff, smoke, or chew tobacco.

QUESTIONS FOR THE FORMULA.

1. Describe the process of eating.^[2] See page 21.
2. Where does the food go after it is chewed?
3. Describe the stomach.
4. Of what is the stomach composed?
5. Describe the outer coat of the stomach, and tell its use.
6. Describe the middle coat of the stomach, and tell its use.
7. Describe the inner coat of the stomach, and tell its use.
8. What happens to the food after it enters the mouth?
9. Tell about these changes.
10. What is necessary if you would have a healthy stomach?
11. What kind of food must you eat?
12. How much food must you eat?
13. How must you eat?
14. When must you eat?
15. What other rules must you obey?

^[2] See Formula 7 on the Organs of Sense.

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"EAT TO LIVE, NOT LIVE TO EAT."

There is pleasure in eating, because God has given us the sense of taste, that we may enjoy our food. But not everything which pleases this sense is good for the body, so we should learn what things are wholesome and choose them for our food and drink, refusing everything which is unwholesome. Those who obey these rules "*eat to live*" and never become drunkards or gluttons.

QUESTIONS ON THE DIGESTIVE ORGANS AND DIGESTION.

What happens to the food after it is chewed?—"It is rolled by my tongue into the oesophagus or food-pipe."

Where is the oesophagus or food-pipe?—"It passes from the mouth down the left side of the spine."

What is the stomach?—"A fleshy bag which receives and changes the food we eat."

Where is the stomach?—"In the front part of the chest, below the heart and lungs."

Of what is the stomach composed?—"Of three coats or membranes."

What do you mean by composed?—"Made of."

What do you mean by membrane?—"A thin skin."

What are the coats of the stomach called?—"The outer coat, the middle coat, the inner coat."

Describe the outer coat of the stomach.—"The outer coat is smooth, thick, and tough."

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Of what use is the outer coat of the stomach?—"It strengthens and supports the stomach."

What do you mean by supports?—"Holds."

Describe the middle coat of the stomach.—"The middle coat is composed of fleshy fibres, which have the power of making themselves long or short."

What do you mean by fibrous?—"Composed of threads."

What do you mean by fibres?—"Threads."

Of what are the fibres of the stomach composed?—"Of flesh."

Of what use are the fibres of the stomach?—"They press upon the food, and push it toward the opening which leads out of the stomach."

Describe the inner coat of the stomach.—"The inner coat is soft, thick, spongy, and wrinkled."

Of what use is the inner coat of the stomach?—"It prepares a slimy substance and a fluid."

Of what use is the slimy substance?—"It prevents the stomach from being irritated by the food."

Of what use is the fluid?—"It dissolves the food."

What do you mean by slimy?—"Soft, moist, and sticky."

What do you mean by irritate?—"To produce unhealthy action."

What do you mean by dissolves?—"Melts."

Where is the food changed after it is taken into the mouth?—"First it is changed in the mouth; second, it is changed in the stomach; third, it is changed after leaving the stomach; fourth, it is changed in the lungs."

By what is it changed in the mouth?—"By the action of the teeth and the saliva."

By what is it changed in the stomach?—"By the action of the stomach and a kind of fluid called gastric juice."

By what is it changed after leaving the stomach?—"By the action of the bile and the pancreatic juice."

By what is it changed in the lungs?—"Nobody knows."

Into what is it changed in the mouth?—"Into pulp." [61]

Into what is it changed after leaving the stomach?—"Into chyle and waste substance."

Into what is it changed in the lungs?—"Into blood."

What is the change in the mouth called?—"Mastication, or chewing."

What is the change in the stomach called?—"Chymification, or chyme-making."

What is the change after leaving the stomach called?—"Chylification, or chyle-making."

What is necessary, if you would have a healthy stomach?—"I must be careful what kind of food I eat; how much I eat; and when I eat."

What kind of food must you eat?—"Wholesome food, etc." See Formula.

How much must you eat?—"Enough, but not too much."

How must you eat?—"Slowly."

How should your food be masticated?—"Thoroughly."

When must you eat?—"Regularly, but not too often."

When should you avoid eating?—"Just before bedtime."

What kind of air should you breathe?—"Pure air."

How should you sit, stand, and walk?—"Erect."

Why should you not eat too much food?—"Because, if I eat too much food, my stomach will have too much work to do in changing it into chyme."

Why should you eat slowly?—"That I may have time to masticate the food thoroughly."

Why should you masticate your food thoroughly?—"That it may be well prepared to enter the stomach."

Why should the food be well prepared to enter the stomach?—"Because, if it is not well prepared in the mouth, the stomach will have too much work to change it into chyme."

Why should you eat regularly, but not too often?—"Because the stomach needs rest, which it cannot have, if I eat too often."

Why should you avoid eating just before bedtime?—"Because, while I am asleep, the stomach cannot do the

work of [62] changing the food as it ought to be changed; because the stomach should rest with the other parts of the body."

Why should you breathe pure air?—"Because pure air helps to make pure blood, which the stomach needs to make it strong and healthy."

Why should you sit, stand, and walk erect?—"That the stomach may not be crowded out of its place, or pressed upon by other parts of the body."

In what way does tobacco hurt the stomach?—"It poisons the saliva and prevents it from preparing the food to enter the stomach."

What harm does tobacco do inside the stomach?—"It weakens the stomach and makes it unfit to change the food into chyme."

How will wise children treat tobacco?—"Let it alone. They will not chew, snuff, or smoke the vile weed."

Is alcohol food or poison?—"It is poison."

How do we know it is not food?—"Because it cannot be changed into blood."

How has this been proved?—"Alcohol has been found in the brain, and other parts of drunkards, with the same smell and the same power to burn easily which it had when it was taken into the mouth."

How do you know it is a poison?—"Because it does harm to every part of the body, beginning in the stomach."

What harm does alcohol do in the stomach?—"It hinders the stomach from doing its work; it burns the coats of the stomach; it destroys the gastric juice; it hardens the food, so that it cannot be dissolved by the gastric juice."

What does the stomach do with alcohol?—"Drives it out as soon as possible."

Where does the stomach send it?—"Into the liver."

Where does the liver send it?—"To the heart; and the heart sends it to the lungs."

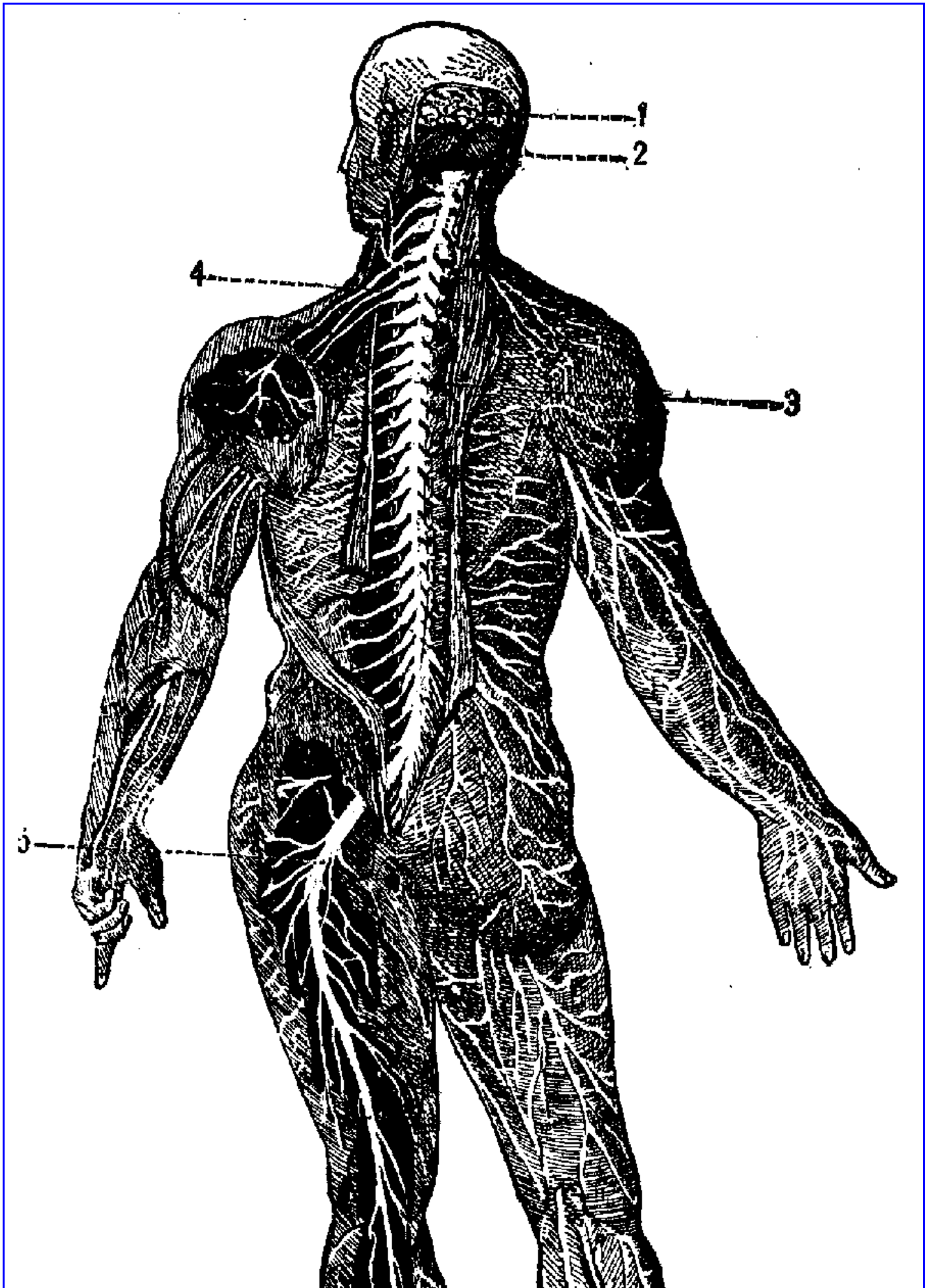
What do the lungs do with the alcohol?—"They drive it out as soon as they can."

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Where do the lungs send some of it?—"Through the nose and mouth, into the air."

What harm does the alcohol do in the breath?—"It poisons the air; it tells that some kind of alcoholic liquor has been taken into the stomach."

From what you have learned about alcohol, what do you think is the only safe rule to obey concerning cider, beer, wine, and all alcoholic liquors?—"I must not drink them, if I wish to have a strong and healthy stomach."



THE NERVOUS SYSTEM.—(From Walker's *Physiology*.)

1. The large brain.
 2. The small brain.
 3. The spinal cord.
 4. 5. Nerves.
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PART XI.

FORMULA FOR THE LESSON ON THE NERVOUS SYSTEM.

1. My brain is a soft gray-and-white mass resembling marrow.
2. It is placed in a bony box called the skull; it is covered and held together by three coats or membranes.
3. The outer membrane is thick and firm; it strengthens and supports the brain.
4. The middle membrane is thick, and somewhat like a spider's web in appearance.
5. The inner membrane is a network of blood-vessels.
6. From the brain, white or reddish gray pulpy cords, called nerves, pass to all parts of the body. These nerves are of two kinds: nerves of feeling, and nerves of motion.
7. If I prick my finger, a nerve of feeling carries the message to my brain; if I wish to move my finger, a nerve of motion causes my finger to obey my will.
8. Twelve pairs of nerves pass from the base of the brain: the first pair, called the nerves of smell, to my nose; the fourth pair, called the nerves of sight, to my eyes; the fifth pair, called the nerves of taste, to my mouth, tongue, and teeth. One pair pass to my face; another to my ears. The ninth, tenth, eleventh, and twelfth pairs to my tongue and parts of my throat and neck.^[3]

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9. The spinal cord is a bundle of nerves extending from the base of my brain, down through the whole length of my spine, or backbone. It is the largest nerve in my body.
10. From the spine, thirty-one pairs of nerves, called *spinal nerves*, pass to different parts of my body; some to the lungs, some to the heart, some to the stomach, some to the bones, and some to the muscles and skin.
11. If a nerve be destroyed it cannot carry messages to and from the brain. Before filling a tooth, the dentist sometimes destroys its nerve.
12. If a nerve be pressed upon too long it cannot perform its duty. If I press upon the nerve passing to my foot, I stop it from communicating with the brain; the foot loses its feeling, or, as I say, "is asleep."
13. If I drink alcoholic liquors, or snuff, smoke, or chew tobacco, my brain and nerves cannot do their work well; because alcohol and nicotine are very poisonous to the brain and nerves.

14. The brain must be supplied with good blood;

The brain must be used;

The brain must be rested;

I must drink wholesome drink, eat wholesome food, take enough exercise, and breathe pure air, that my brain may be supplied with pure blood;

I must study and think, that my brain may grow and be strong for work;

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I must rest my brain when it is tired, either by changing my employment, or by going to sleep;

I must not poison my brain with alcohol or tobacco.

[3] NOTE.—*A fuller description of the Nerves of the Brain:* Twelve pairs of nerves pass from the base of the brain; the first pair, called the nerves of smell, to my nose; the second pair, called the nerves of sight, to my eyes; the third, fourth, and sixth pairs to the muscles of my eyes; the fifth pair to my forehead, eyes, nose, ears, tongue, teeth, and different parts of my face; the seventh pair to different parts of my face; the eighth pair, called the nerves of hearing, to the inner part of my ear; the ninth pair to my mouth, tongue, and throat; the twelfth pair to my tongue; the eleventh pair to my neck; the tenth pair to my neck, throat, lungs, stomach, and different parts of my body.

QUESTIONS ON THE FORMULA.

1. Describe the brain.
2. Where is the brain placed?
3. Describe the outer membrane of the brain.
4. Describe the middle membrane of the brain.
5. Describe the inner membrane of the brain.
6. Tell about the nerves.
7. Tell about the use of the two kinds of nerves.
8. Tell about the nerves which pass from the brain.
9. Tell about the spinal cord.
10. Tell about the nerves which pass from the spinal cord.
11. What happens if a nerve be destroyed?
12. What happens if a nerve be pressed upon too long?

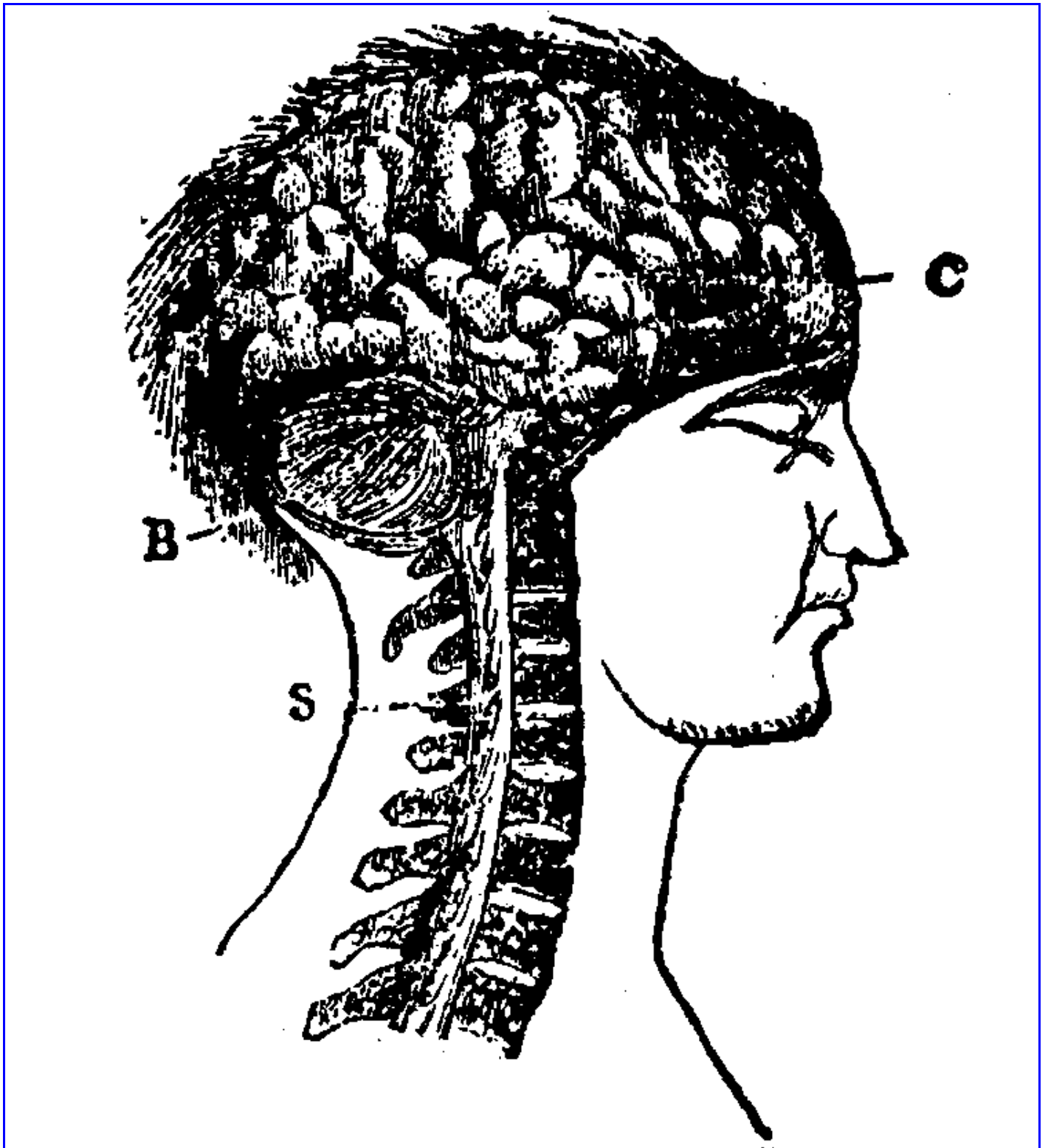
13. What happens if you drink alcoholic liquors, or snuff, smoke, or chew tobacco?

14. What is necessary if you would have a healthy brain?

THE BRAIN AND ITS WORK.

The brain is egg-shaped, and of two parts, the large brain (*cerebrum*), and the little brain (*cerebellum*). These are composed of a white and gray substance, which in the large brain is so folded and wrinkled that it looks like the meat of an English walnut; in the little brain it is so arranged that it resembles a tree, and is called *arbor vitæ*, tree of life. The mind does its thinking through the large brain, and controls its muscles through the little brain.

A drunken man can not walk straight because alcohol has hurt the little brain; he can not think straight because it has poisoned the large brain.



THE BRAIN AND THE SPINAL CORD.

C, the large brain (*cerebrum*). B, the small brain (*cerebellum*). S, a portion of the spinal cord.

QUESTIONS ON THE NERVOUS SYSTEM.

Where is your brain?—"In my skull."

What color is the brain?—"Gray and white."

What does the brain resemble?—"Marrow."

How is the brain protected?—"By three coats or membranes."

What may you name these membranes?—"The outer membrane, the middle membrane, and the inner membrane."

Describe the outer membrane. See Formula.

Describe the middle membrane. See Formula.

What are the nerves?—"White ashen-gray pulpy cords, which are found in the brain."

Where do they go from the brain?—"To every part of the body."

How many kinds of nerves have you?—"Two."

What names are given to the two kinds of nerves?—"Nerves of motion and nerves of feeling."

Which is the largest nerve in the body?—"The spinal cord."

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Where is the spinal cord?—"It extends from the brain throughout the whole length of the backbone."

How may you describe the spinal cord?—"It is a bundle of nerves, etc." See Formula.

Where are the spinal nerves?—"They pass from the spinal cord to different parts of the trunk and limbs."

How many pairs of nerves pass from the base of the brain?—"Twelve."

Where do the first pair go?—"To the nose."

What are they called?—"The nerves of smell."

Where do the second pair go?—"To the eyes."

What are the second pair called?—"The nerves of sight."

Which move the muscles of the eyes?—"The third, fourth, and sixth pairs."

Where do the fifth pair go?—"To the forehead, eyes, nose, ears, tongue, teeth, and different parts of the face."

The seventh pair?—"To the different parts of the face."

The eighth pair?—"To the inner ear."

What are the eighth pair called?—"The nerves of hearing."

Where do the ninth pair go?—"To the mouth, tongue, and throat."

Where do the twelfth pair go?—"To the tongue."

Where do the eleventh pair go?—"To the neck."

Where do the tenth pair go?—"To the neck, throat, lungs, stomach, and different parts of the body."

What happens if a nerve be destroyed?—"It cannot carry messages to the brain."

What happens if a nerve be pressed upon too long?—"It cannot carry messages to the brain."

What is necessary if you would have a strong, healthy brain?—"My brain must be used; my brain must be rested; my brain must be supplied with pure blood."

How must you use your brain?—"In thinking and studying."

How may the brain be rested?—"By sleep."

In what other way may the brain be rested?—"By thinking of something different from that which made it tired."