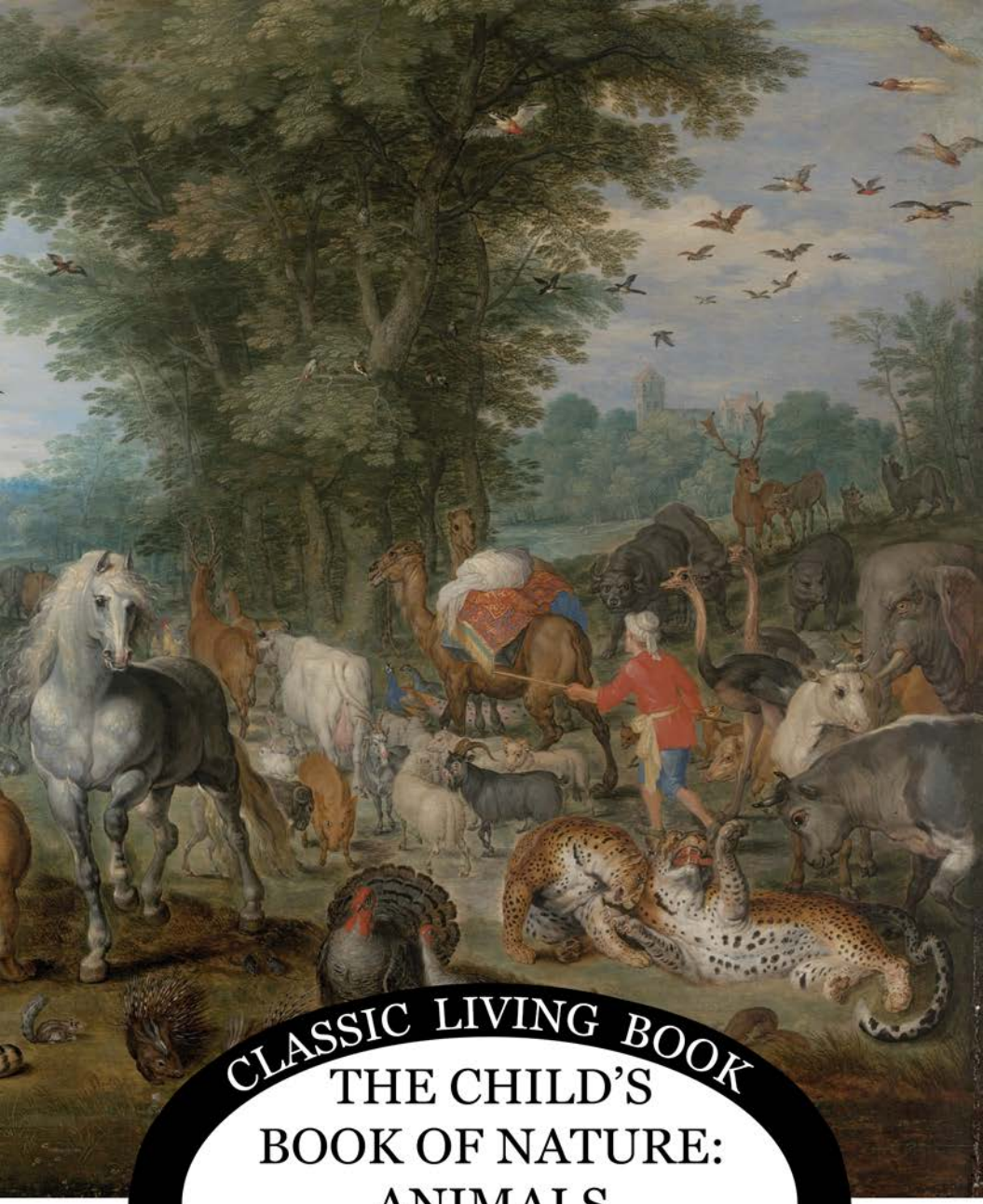

CLASSIC LIVING BOOK

THE CHILD'S BOOK OF NATURE: ANIMALS

Worthington Hooker

COMPLETE AND UNABRIDGED

This edition published 2019
By Living Book Press

First published in 1857.

ISBN: 978-1-925729-90-0 (softcover)
978-1-922348-82-1 (hardcover)

A catalogue record for this book is available from the National Library of Australia

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WORTHINGTON HOOKER

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PREFACE.

HAVING PRESENTED in Part First such facts or phenomena of Vegetable Physiology as would be interesting to a child, I proceed in this Part to do the same with Animal Physiology.

The teacher and parent will observe, that in doing this I bring out quite prominently the analogies that exist between the animal and the vegetable world in the operations of life. Such analogies are always interesting to the child as well as to the adult, and the consideration of them adds much to the enjoyment of the observer of nature, for it opens to him the simple plans and principles upon which the Creator works out the almost endlessly varied results that life, both animal and vegetable, presents to our view.

What is true of the analogies that exist between the two kingdoms of life is also true of those that we find in each kingdom by itself. I have therefore, in this Part, traced the resemblances which the contrivances in the human system bear to those which we see in animals of different kinds, and also the differences, giving to some extent the reasons for them—that is, I have made it in some measure a book of comparative physiology. The effect of this mode of treating the subject will be to interest the child's mind in the observation of the various animals, great and small, that he sees from day to day. Natural History, which is otherwise rather a dull study, will thus become very attractive to him. And, to further this object, which I deem to be of great importance, I have noticed the habits of some animals in such a manner as to connect distinctly Physiology with Natural History, a

relation which, though an obvious one, has very generally been disregarded.

While I have aimed in this Part at the same kind of simplicity as in the First, there are some points in it which require a greater compass of mind to understand. This is as it should be; for in going through the First Part there will, of course, be acquired by the learner some amount of skill in observation and reasoning. I have taken special care, however, not to presume too much upon the mental advance thus made.

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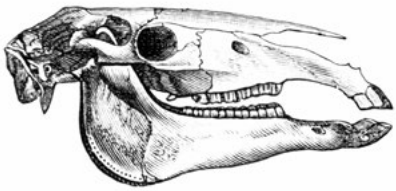
CHAPTER VI.

MORE ABOUT THE TEETH.

NOTICE THAT in the mill in your mouth there are different kinds of teeth. They are for different purposes. The front teeth are for cutting the food; the large back teeth are for grinding it up fine; the pointed teeth, called the stomach and eye teeth, are for tearing the food.

You can see these different kinds of teeth in different animals. Every animal has such teeth as it needs to divide its food. The dog and the cat eat meat, and they want to tear this to pieces; they therefore have long, sharp, tearing teeth; so, too, have the lion and the tiger, for the same reason. Now look at the cow's mouth: she has no tearing teeth. The grass that she eats does not need to be torn; it needs to be bruised and ground up, and for this purpose she has large, broad, grinding teeth. These are her back teeth.

But you notice that the cow has a few different teeth in front; they are made to cut. Now watch a cow as she eats grass, and see how she uses these two kinds of teeth. With the front teeth she bites the grass—that is, she cuts it; then with the end of her tongue she puts it back where the grinding teeth are, to be ground before it goes into the stomach. So the cow has in her mouth both a cutting machine and a mill.



The horse has these two kinds of teeth, as you see represented in this figure, which is the skull of a horse.

Now when you eat an

apple you do very much as the cow or the horse does with the grass; with your front cutting teeth you bite off a piece; then it is pushed back where the grinders are, and they grind it up into a soft pulp before you swallow it.

The cow does not always use her cutting teeth in the way that I have mentioned. See her as she eats hay; she does not cut this as she does the grass. With those front cutting teeth she merely takes up the hay, and it is gradually drawn back into the mouth, the grinders all the while keeping at work on it. If the hay is in a rack, she pulls it out with her cutting teeth. It is the same with the horse.

That beautiful and singular animal, the giraffe, which you see here, has these two kinds of teeth. This animal, when of full size, is three times the height of a tall man; it lives on the leaves of trees, which it crops with its front teeth, grinding them up with its large back teeth, as the cow and horse do their hay and grass.

You notice that your tearing teeth are not nearly as long and powerful as these teeth are in dogs, cats, tigers, etc. What is the reason of this? It is because, although you eat meat as they do, you can, with your knife and fork, cut up your food. They do not know enough to use such

things, and so God has given them long, sharp teeth to tear their food to pieces.

The cow grinds the grass and hay twice. So do the sheep, the deer, the camel, the giraffe, and many other animals. See the cow cropping grass in the pasture; she grinds it partly in her mouth as she crops it, and then stows it away in a very large stomach that she has for the purpose; after a while she stops eating, and you see her standing or lying in the cool shade chewing her cud, as we say. That large stomach is very full of grass now, and this is all to be chewed over again. How do you think this is done? I will tell you.

After the grass is well soaked in this large stomach, it passes into another, for the cow has more than one stomach—she has four. In this second stomach the grass is all rolled into balls. This is a very curious operation. Now each one of these balls goes up into the mouth to be chewed over again. After it is well chewed, down it goes again, but it goes into still another stomach, and then up comes another ball to take its place; and so the cow goes on till all the balls are chewed. If you look at the cow's neck while she is doing this, you can see when the ball goes up and when it goes down. She seems to have the same quiet enjoyment while thus chewing her cud that the cat has when, with her eyes half open, she lies purring and wagging her tail after a full meal.

Birds, you know, have no teeth. Their mill for grinding food is not in the mouth, it is in the stomach. What we call the gizzard is this mill. See a hen pick up the corn that you throw to her. She swallows it very fast. Where do you think it goes to? It goes into a bag called the crop. Here it is soaked, just as the grass is in the large stomach of the cow. When it becomes soft enough it goes into

the gizzard. Here it is crushed so as to make a soft pulp by being rubbed between two hard surfaces, as corn in a mill is ground between two mill-stones. If you cut open the gizzard of a fowl, you can see how well these surfaces are fitted to grind up the corn. They do it quite as well as teeth would. Birds that live on food that does not need grinding do not have a gizzard, but a common stomach.

Questions.— What are the different kinds of teeth that you have in your mouth, and what are they for? What is said about the teeth of the dog, cat, etc.? What is said about the cow's back teeth? What of her front ones? Tell how the cow uses these two kinds of teeth in eating grass, and how in eating hay. How do you eat an apple? Tell about the giraffe. Tell about the cow's chewing her cud. What is the crop of a bird for? What is the gizzard for? Do all birds have gizzards?

CHAPTER VII.

THE CIRCULATION OF THE BLOOD.

You remember that I told you in Part First how the sap circulates in a plant or a tree. It goes up in one set of pipes, and goes down in another set. Just so it is with the blood in your body; it is always in motion. There are two different sets of pipes for it to go back and forth, as there are in the plant for the sap; these two sets of pipes are called arteries and veins.

The blood in your body is kept in motion by a pump that works all the time, night and day. This pump is in your chest. It is the heart. Put your ear to the chest of some one, and you can hear its working as it pumps out the blood. You can hear it in your own chest sometimes when it works very hard. When you have been running very fast you can hear it.

The heart pumps the blood out at every beat into a large artery. From this great main pipe other pipes or arteries branch out every where, and from these branches other branches go out; dividing in this way, like the branches of a tree, the arteries at last are very small.

At the ends of the arteries there are exceedingly small vessels. They are called capillaries, from the Latin word *capilla*, which means a hair. They are really smaller than the finest hairs, for you can not see them. When you cut your finger you divide a great many of these vessels, and the blood oozes out from them. When any one blushes, these capillaries in the skin of the face are very full of blood, and this causes the redness. It is the blood in these little vessels that makes the lips red. These capillaries are

every where, so that wherever you prick with a pin the blood will ooze out.

The blood goes out from the heart by one set of pipes, and comes back to the heart by another set. It goes out from the heart by the arteries, as I have just told you; it comes back to the heart by the veins.

The veins lie, some of them, very deep, and some just under the skin. You see some of them under the skin in your arm and hand. But you can not see the arteries; they nearly all lie deep. Think of the reason of this. If an artery of any size is wounded, it is not easy to stop its bleeding, for the heart is pumping blood right through it; but it is easy to stop the bleeding of a wounded vein, because the blood is going in it quietly back to the heart. Now it is because it is so dangerous to wound arteries that God has placed them so deep that they can not easily be wounded.

The maker of our bodies has guarded the arteries in another way. He has made them much stronger than the veins. If they were not made very strong they would now and then burst. You sometimes see the hose of a fire-engine burst when they are working the engine very hard; but, though your heart pumps away sometimes so fast and hard, as when you have been running, not one of all the arteries gives way; but they would often burst if they were not made stronger than the veins are.

The blood in the arteries is red; but the blood that comes back to the heart in the veins is dark. This is the reason that the veins which you see under the skin look dark. I will tell you more about the dark and the red blood in the next chapter.

You see that the blood is kept in motion in a different way from what the sap is. In a large tree there is a great

deal of sap going up in its trunk all the time, but there are no large pipes there like our arteries and veins. The sap goes up and down in a multitude of very small pipes, and there is no pump in the tree, as there is in our bodies, and in the bodies of other animals. How the sap goes up to the top of the tallest tree without being pumped up we do not know.

The heart is at work, as I have told you, all the time, while you are asleep as well as when you are awake. If it should stop pumping the blood, you would die. How steadily it works, going tick-tack all the while! How much work it does in a lifetime! It takes but a few days for it to beat a million of times; and here I will give you something about this work of the heart that I wrote in another book.1

If the heart could think, and know, and speak, suppose it should count up how many times it has to beat before the days of seventy years are numbered and finished. I think it would feel a little discouraged at the great, long work that was before it, just as some people do when they look forward and think how much they have to do; but remember that the heart has a moment in which it can make every beat. There is time enough to do the work; it is not expected to make two or more beats at once, but only one.

As the heart can not think, it does not faint with discouragement, but goes right on with its work, doing in each moment the duty of that moment; and it would be well if people that can think, whether children or adults, would take a lesson from this little busy worker in their bosoms. If one goes right on, performing cheerfully every duty as it comes along, he will do a great deal in a lifetime, and he will do it easily and pleasantly, if he does not keep

1 Every-day Wonders; or, Facts in Physiology. American Sunday-school Union.

looking ahead and thinking how much he has to do.

There is a pretty story, by Miss Jane Taylor, about a discontented pendulum. The pendulum of a clock in a farmer's kitchen, in thinking over the ticking that it had got to do, became discouraged, and concluded to stop. The hands on the clock-face did not like this, and had a talk with the pendulum about it. The pendulum was, after a while, persuaded to begin its work again, because it saw, as the hands said, that it always had a moment to do every tick in. The pendulum's foolish waste of time in complaining made the farmer's clock an hour too slow in the morning.

Questions.— What is said about the circulation of the sap and the blood? What is said about the heart? What about the arteries? What are the capillaries? By what pipes does the blood come back to the heart? Where can you see some of the veins? Why are the arteries laid deeper than these veins? Why are they made stronger than veins? What is the color of the blood in the arteries? What is its color in the veins? Is the sap kept in motion in the same way that the blood is? What is said about the work that the heart does? Tell about the pendulum.

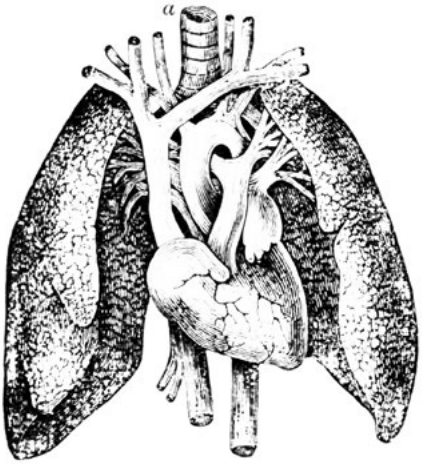
CHAPTER VIII.

BREATHING.

WHAT DO you breathe for? That is plain enough, you will say: I can not live without breathing. But why is it that your life depends on your breathing? This I will explain to you.

You remember that I told you that the blood that comes back to the heart in the veins is dark; it is not good blood. It has been used while it was in the capillaries in building and repairing bone, and skin, and muscle, and nerve, etc. It is not fit to be used again so long as it is dark blood. What shall be done with it? It must be made in some way into good red blood again. Now the factory where this is done is the lungs.

Just as fast as the dark blood comes to the heart, it sends it to the lungs to be made into red blood, then it goes back to the heart to be sent all over the body. But how, you will ask, is the dark blood changed into good red blood in the lungs? It is done by the air that you breathe in; every time that you draw a breath, air goes down into the lungs and changes the blood that it finds there.



And now you see why it is that you have to breathe to keep alive. If the air does not go down into the

lungs, the dark blood that is there is not changed into red blood: it goes back to the heart dark blood, and is sent all over the body; but this dark blood can not keep you alive: it is the red blood that does this.

You see, then, how death is caused in drowning; the air is shut out by the water, and the blood is not changed in the lungs; so the blood goes back to the heart dark instead of red, and is sent all over the body.

The heart and the lungs fill up your chest. The lungs cover up the heart, except a little part of it on the left side: this is where you can feel its beating so plainly. Here is a figure of the heart and lungs; the lungs are drawn apart, so that you can see the heart, and its large arteries and veins. You see, marked *a*, the windpipe by which the air goes down into the lungs. The lungs are light, spongy bodies. They are light because they are full of little cells for the air to go into. It is in these cells that the blood is changed by the air.

And now I will tell you about the lungs of fishes. But perhaps you will say that fishes do not breathe, and it can not be that they have lungs, for they would be of no use to them. It is true that they do not have such lungs as we have; but they have lungs, and they really do breathe air. How is this, you will ask, when they live in the water? There is a good deal of air always mixed up with water, and the lungs of a fish are so made that the air in the water can change the blood in them. The gills of a fish are its lungs, and the way that they are used is this. The fish takes water into its mouth, and lets it run out through the gills, and so the air that is mixed with the water changes the blood in them. Our lungs are fitted to breathe air alone, but the fish may be said to breathe air and water together. Air alone does the fish no good; he

can not live in it; he must have his air mixed with water, or it is of no use to him.

Here is a picture of the lamprey eel. You see that it has a row of holes on its neck: these are openings that lead to its lungs; there are seven on each side. It is from this that it is sometimes called seven-eyes. Insects have such openings into their lungs. The grasshopper has twenty-four of them, in four rows. So you see that there are different ways of breathing in different animals. They do not all breathe through their mouths and noses, as we do.

You see that the chief use of breathing is to air the blood; but it is of use to us in another way. It makes the voice. We could not speak if we did not breathe. The sound of the voice is made in the top of the neck, in what we call Adam's apple. This is a sort of musical box at the top of the windpipe: in this box there are two flat cords stretching right across it. Now when we speak or sing, the sound is made in this way: the air, coming up out of the lungs, strikes on these cords, and makes them shake or vibrate. It is just as the vibration of the fiddle-string makes a sound when the bow is drawn over it. If you look at an Æolian harp fixed in a window, you can see that the strings are made to quiver by the wind, and this causes the sound. In the same way, the wind that is blown up from your lungs makes the cords in the Adam's apple vibrate; and the chest may be said to be the bellows of that little musical box or organ that you have in the throat.

Many animals have a musical box in the throat similar

to ours. The lowing of the cow, the barking of the dog, and the mewing and squalling of the cat are all done in such a box. You perhaps have wondered how the cat purrs. This noise is made in the same box where she does her mewing and squalling; for if you put your finger on her Adam's apple while she is so quietly purring, you can feel a quivering motion there.

Fishes, you know, have no voice. They have no musical box. If they had they could not use it, for the only way in which it can be used is to blow air through it. The frog can not use his so long as he is under water; he has to stick his head up out of water when he wants to croak.

Questions.— What do you breathe for? How is the blood in the lungs changed? What would it do if it were not changed? How is death, caused in drowning? How are the heart and lungs situated? Why are the lungs so light? What is said about the lungs of fishes? What is said about the breathing of the lamprey eel? What about the breathing of the grasshopper? How is the breathing of use besides changing the blood? Tell how the voice is made. What is said about the voices of animals? Where is the cat's purring done? Why do fishes have no musical box? What is said about the croaking of frogs?

CHAPTER IX.

BRAIN AND NERVES.

I HAVE told you some things in the previous chapters about how the body is built and kept in repair. I have told you that the blood is the building material from which all the parts of the body are made. The use of food, you have seen, is to make the blood, and the chief use of the breathing is to keep the blood in good order. The heart, with its arteries and veins, keeps the blood moving all about the body, so that it may be used in building and repairing. But what is the body built and kept in repair for? It is a house for the mind or soul. The soul—the thinking part of you—so long as it remains in this world, dwells in the body.

The body is something more than a house for the soul. The head, where the soul dwells, is but a small part of the body. But it uses all parts of it. When the hand is moved, the soul uses the hand; when you walk, it uses the legs and the feet; when you see, it uses the eyes; it uses the ears as its instruments to hear with, and the nose is its smelling instrument; and so of other parts.

You can think, then, of the body as having in it many different kinds of machinery that the mind or soul uses. And the object of eating, and drinking, and breathing, and having the blood circulate, is to make all this machinery for the mind to use.

Let us see, now, how it is that the mind uses the machinery of the body. Raise your hand. What makes it go up? It is what we call the muscles. They pull upon it and raise it. But what makes them do it? They do it because

you think to have them do it. It is your thinking mind, then, that makes them raise the arm.

But the mind is not there among the muscles; it is in your head. Now how does the mind get at the muscles to make them work? It does not go out of the brain to them, just as a man goes out of his house among his workmen to tell them what to do. The mind stays in the brain all the time; but there are white cords, called nerves, that go from the brain to all parts of the body, and the mind sends messages by these to the muscles, and they do what the mind tells them to do.

These nerves act like the wires of a telegraph. The brain is the mind's office, as we may call it; here the mind is, and it sends out messages by the nerves as messages are sent from a telegraphic office by its wires. This is done by electricity in the telegraphic office, but how the mind does it we do not know. When you move your arm, something goes from the brain along the nerves to the muscles, and makes them act, but what that something is we do not know.

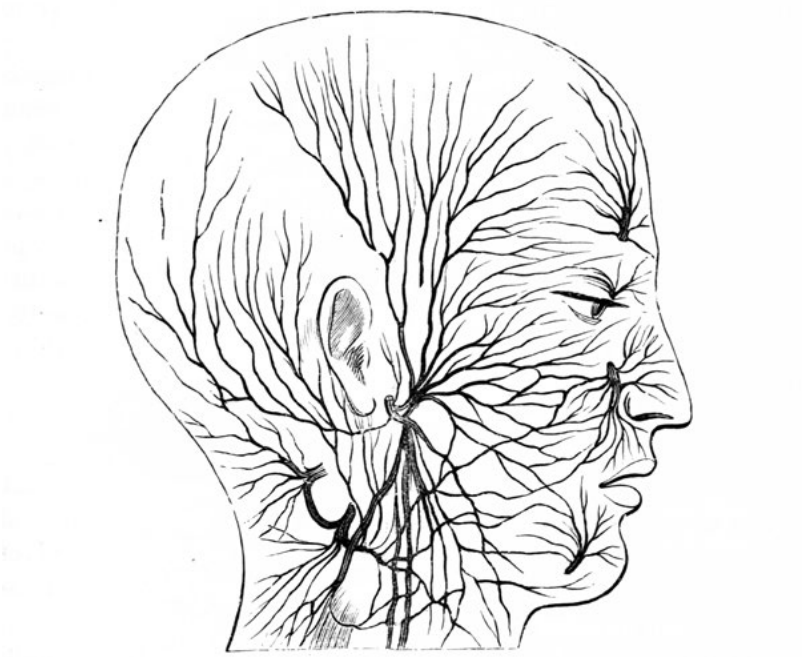
If the wires that go out from a telegraphic office are broken off in any way, the man in the office may send out messages, but they will not go to the place he wishes. He may work his machine, and send the electricity along the wire, but it will stop where the break is. Just so, if the nerves that go to the muscles of your arm were cut, the muscles could not receive any message from the mind. You might think very hard about raising the arm, but the message that your mind sends to the muscles is stopped where the nerves are cut, just as the electricity stops where the break is in the wire.

While the mind sends out messages by one set of nerves, it receives messages by another set; it receives them from

the senses. Just see how this is. If you put your finger upon any thing, how does the mind in your brain know how it feels? How does it know whether it is hard or soft, rough or smooth? The mind does not go from the head down into the finger to find out this; it knows it by the nervous cords that stretch from the brain to the finger. When you touch any thing, something goes, as quick as a flash, from the finger along these nerves to the brain where the mind lives, and lets it know what kind of a thing it is that your finger has touched. So, when you smell any thing, it is the nerves which connect your nose with the brain that tell the mind what kind of a smell it is. And when you taste any thing, it is the nerves of the mouth that tell the mind in the brain whether it is bitter, or sweet, or sour, etc. So, too, when you see any thing, it is the nerve which connects the eye with the brain that tells the mind what it is that you see.

The brain, in which the mind lives and with which it thinks, is the softest part of the body. You can see what sort of a thing your own brain is by looking at the brain of some animal at the meat-market. You can see it very well in the calf's head when it is prepared for cooking by being sawed in two. I have compared the nerves to the wires that stretch out from the telegraphic office; but there are only a few wires, while the nerves that branch out from the brain, all over your body, can not be counted. Here is a figure showing how the nerves branch out over the face and head; there are a great many of them, and so there are in all other parts of the body.

The nerves, by dividing, spread out, so that there are little nerves every where. If you prick yourself with a pin any where, there is a little nerve there that connects that spot with the brain, and that tells the mind about



it. Now all the nerves in all parts of the body have their beginnings in the brain. In this soft organ are bundled together, as we may say, all the ends of the nerves, so that the mind can use them. There the mind is at its post, just like the man in the telegraph office; and from that great bundle of the ends of nerves it is constantly learning what is going on at the other ends of them in all parts of the body.

A great business the mind has to do in attending to all these ends of nerves in the brain; and how strange it is that it does not get confused, when so many messages are coming to it over its wires from every quarter! It always knows where a message comes from. It never mistakes a message from a finger for one from a toe, nor even a message from one finger for one from another.

And so, too, in sending out messages to the muscles,

there is no confusion. When you want to move a finger, your mind sends messages by the nerves to the muscles that do it. The message always goes to the right muscles. It does not go sometimes to the muscles of another finger by mistake, but you always move the finger which you wish to move. And so of all other parts. Messages go from your busy mind in the brain to any part that you move. You can see how wonderful this is, if you watch any one that is dancing or playing on an instrument, and think how the messages are all the time going by the nerves so quickly from the brain to the different parts of the body. I shall tell you more about this in another chapter.

The man in the telegraph office receives messages by the same wires by which he sends them out. It is not so, as I have told you before, with the mind's wires, the nerves; the mind receives messages from the senses by one set of nerves, and sends messages to the muscles by another set. If you burn your finger, you pull it away from the fire. Now in this case the mind gets a message from the finger by the nerves, and so knows of the hurt. The message goes from the finger along some nerves to their ends in that bundle of them in the brain; and the mind, being there on the watch, receives it. Now what does the mind do? Does it leave the finger to burn? No; it sends a message at once along some other nerves to the muscles that can pull the finger out of harm's way.

Questions.— What are some of the things that I have told you in the chapters before this? What is the body built and kept in repair for? In what part of the body does the soul live? Tell how it uses different parts of the body. When your arm is raised, how is it done? In what way does the mind make the muscles act? What are the nerves? How are they like telegraph wires? What is it that goes along the wires? Do we know what it is that goes along the

nerves? Give the comparison between cut nerves and broken wires. From what does the mind receive messages? Tell about touching, smelling, tasting, and seeing. What is said about the brain? What is said about the number of nerves? What is said about the mind's attending to all its nerves? What is said about its making no mistakes in its messages? Give what is said about the burning of a finger.