

ELEMENTARY SCIENCE READERS

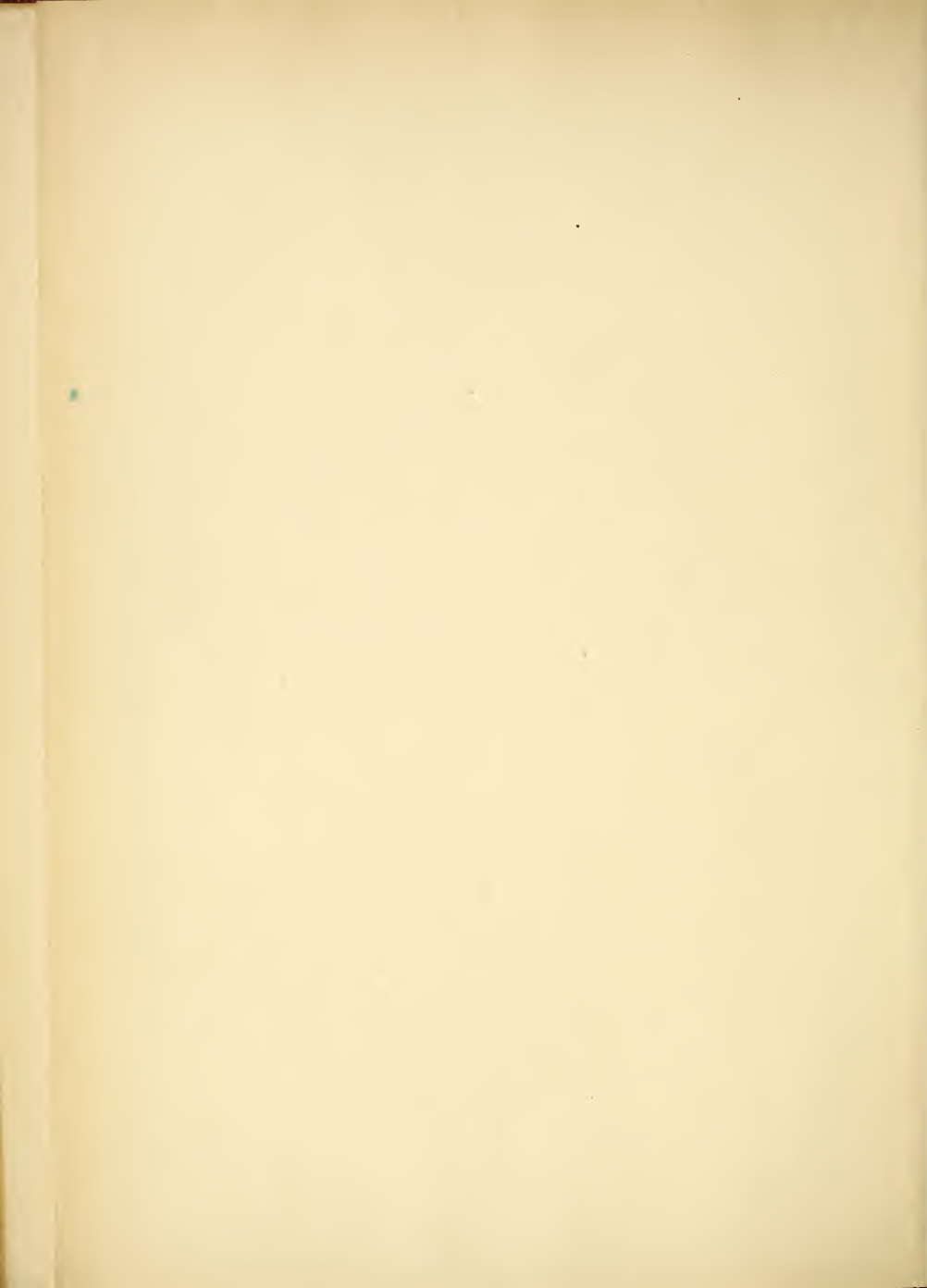
PAYNE · BARROWS · SCHMERBER

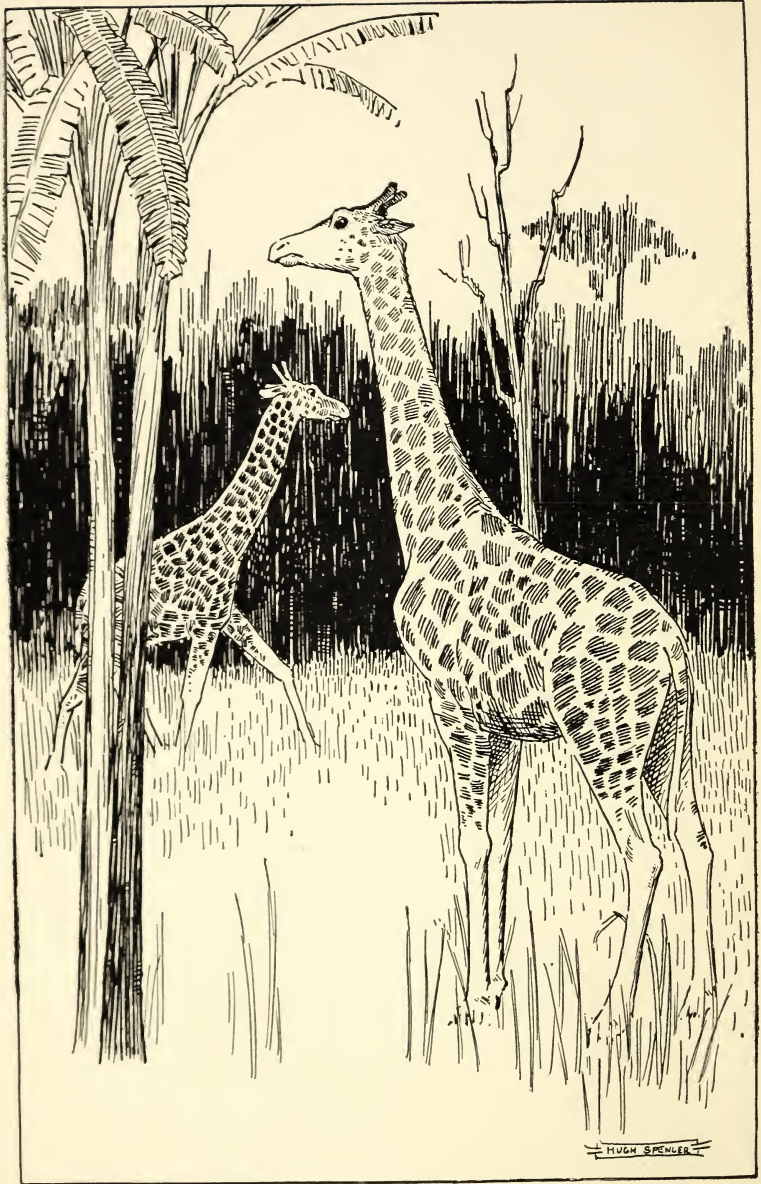
SECOND BOOK



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ELEMENTARY SCIENCE READERS

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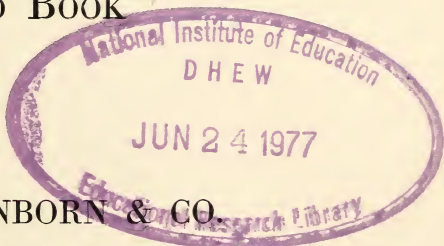
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PREFACE

The Second Book of the series of Elementary Science Readers is a continuation of the subject matter of the First Book and the same principles underlie its construction. Likewise, what is said of the use of the First Book applies to the Second Book. We, therefore, need not repeat here what is said in the Preface to the First Book. It is, however, important to keep in mind at all times that the object of the series is to introduce the child to the rich, varied, and interesting body of scientific knowledge through his reading material. The purpose is to provide a body of reading material that will not only give increased power in reading, but will at the same time allow the child to explore the natural world for the purpose of discovering his interests and of increasing his capacity for social adjustment.

In the Second Book as in the First Book we have departed from the usual method of constructing readers. We have created a body of material appropriate to the reading capacity, ability, interests, and needs of the child in his intellectual and social development. We, therefore, send forth this book in the firm belief that it will meet a long felt need of the school child and the educator, and that the material will introduce the child to a new world of knowledge—knowledge that has become essential in the leisure and occupational life of the individual in the complex life of today.

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Elementary Science Readers

SECOND BOOK

THE LIFE OF A PLANT

"I wonder what takes place inside of plants," said Dolly to her mother one day.

"Yes," chimed in Daisy, "we would like to know what goes on inside of the leaves and flowers and roots."

"I will be very glad to tell you," said her mother, "but before I begin, I wish, Daisy, that you would bring me a geranium plant. Do not break the stem. Pull it up by the roots."

In a few minutes Daisy returned with the geranium. "Here it is," she said.

"You will notice," said her mother, "that this plant, like all green plants, has a stem, roots, and leaves. It also has flowers. Each of these parts has its own work to do."

"What is the work of flowers?" asked Dolly.

"I will tell you about the flowers last," said her mother. "They are the least important of the parts that I have mentioned. A plant can live without flowers,

but it would die immediately if it lost its leaves, its roots, or its stem. Though the flowers are not important to the plants on which they grow, they are necessary for bringing new plants into the world.

“The leaves do most of the work of a plant, so I will tell you about them first. Most leaves are flat and thin, and most of them have stalks that connect them with the stem. They are covered with a skin which gives them strength and also keeps the water that is inside of them from going out into the air. When water goes into the air we say it evaporates.

“Leaves have little openings scattered over them. It is through these openings that gases enter from the air, and other gases go out into the air. It is through them that the plant breathes.”

“Does a plant breathe as an animal breathes?” asked Daisy.

“No,” replied her mother. “An animal takes in oxygen, but a plant gives it off. A plant breathes in the gas that the animal breathes out. This gas is called carbon dioxide.”

“There are several things concerning the roots of plants that I wish to mention. The roots of such plants

as the carrot and the beet store up large quantities of food. The first year of the lives of these plants is spent in making and storing food.

“The next year hardly any leaves are formed. This is the time for making blossoms and seeds. These plants live on the stores in their roots during the second year.

“The roots of trees are very long and strong. This is necessary because the trees are heavy and must be held firmly in the ground. If they did not have strong roots they would be blown over by the wind. Then, too, since trees need a great deal of moisture, they have to have many long roots.”

“Why do leaves sometimes wither on a hot day in the summer?” asked Dolly.

“Frequently,” answered her mother, “the sun suddenly shines after it has been raining. There is so much moisture in the air that water is unable to evaporate from the plant. You see the air will hold only so much moisture. You will learn more about this later. All you need to know now is that the water cannot pass out from the leaves.

“When water leaves anything it makes it cool. That

is, evaporation of water keeps the plant from getting too hot. When evaporation cannot take place and the sun is shining very brightly, the cells of the leaves become so hot that they die. If many of them die, the plant cannot live.”

“Do all green plants give off water?” asked Daisy.

“Yes,” replied her mother. “There is a constant stream of water passing up through a plant all day long. You know how much cooler it is in a wood or grove than it is in open country in summer. This is because the evaporation of water from the leaves cools the air.

“In addition to cooling the air the plants are giving off oxygen. This makes the air purer near trees and plants of all kinds.”

“What is the bark of a tree for?” asked Daisy.

“It has two duties,” said her mother. “It protects the growing part of the trunk and branches of the tree, and it contains the tubes that carry nourishment from the leaves.

“The only part of the trunk and branches of a tree that grows, is that part which is just under the bark. New layers of wood are added to the old wood within. The bark is thus pushed further out by each new layer.”

“What would happen if the bark were taken off?” asked Dolly.

“The tree would live during the year that the bark was removed,” her mother answered, “because the water and other food could pass up through the tubes in the wood. The next year, if all the bark were removed, the tree would die, because no nourishment had been stored up. You see the buds that open in the spring depend upon the food that has been stored up during the year before for their nourishment.”

“You have not told us about the flowers,” said Dolly.

“I will leave that for tomorrow evening,” said her mother.

QUESTIONS

1. What are the three parts of a plant?
2. What purpose do the flowers serve?
3. How does the plant breathe?
4. Can you tell why leaves sometimes wither on a hot day?
5. Why is it cooler in the woods during the summer than in the open country?
6. What work does the stem do?
7. What is the bark of a tree for?

NEW PLANTS

The next evening Daisy and Dolly hurried to their mother to hear more about the life of plants.

“Mother,” said Dolly, “you promised to tell us about the flowers this evening.”

“I told you last evening,” she began, “that a flower is not important to the plant on which it grows, because a plant can live even if its flowers have been removed. Most plants will grow better without flowers than with them, because they do not have to send any food to the flowers. They can, therefore, use all of their nourishment for other purposes.”

“Don’t flowers do any good?” asked Daisy.

“Flowers, in most cases, are necessary for the bringing into the world of new plants. There are some plants though that come into being in another way.

“A flower is made up of several parts. There are the petals—the large colored leaf-like things that make the flower beautiful. Under them are the sepals, which are also leaf-like in shape.

“Are the colored parts of a lilac flower the petals?” asked Dolly.

“Yes,” was the reply, “and the small green leaves under them are the sepals. Neither the petals nor the sepals are necessary to the making of new plants.

“The important parts of the flower are in the central region. They are the ovaries and the stamens. The ovary is in the middle. It contains ovules within which are the eggs. The stamens are smaller, and are around the ovary. There are great numbers of very small, dust-like things on the stamens. These dust-like things are called pollen.”

“Then the important part of a flower is the ovary with its eggs, and the stamens with their pollen?” asked Daisy.

“Yes,” replied her mother. “These are the only parts that are necessary for the making of new plants.”

“Which are the more important—the eggs or the pollen?” asked Dolly.

“They are equally important,” said her mother. “At a certain time, when the pollen and the eggs are ripe, one of the pollen grains becomes attached to an ovary. The pollen grain sends a tube down into it, and part of the pollen grain unites with part of the egg.

“Then certain changes take place within this little

mass made up of egg and pollen. A covering forms around it and we have a seed."

"How do the grains of pollen get to the eggs?" asked Daisy.

"That is a big question," said her mother. "There are many different ways that pollen is carried to the eggs. Some of them are most interesting and show how skillfully Nature has to plan to have her work done.

"In some plants the pollen just drops from the stamens to the ovaries. This is the simplest method. In other plants insects carry the pollen from the stamen to the ovary. In both of these cases, pollen and eggs of the same plant unite to make the seeds.

"There are many plants which have eggs that must have pollen from another flower, and some that need it from another plant. Since pollen grains cannot go in search of eggs, they have to be carried to them."

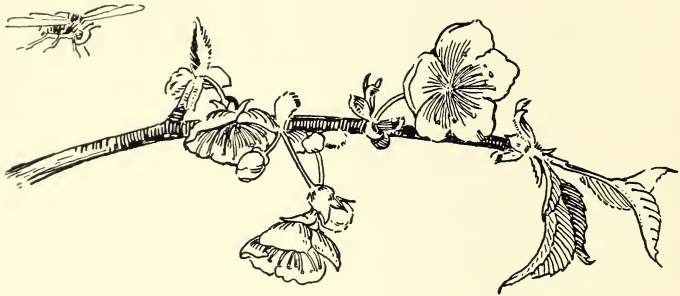
"What carries the pollen grains?" asked Dolly.

"The wind does a great deal of this work," her mother replied. "Since the pollen grains are very light, they can be carried great distances through the air.

"Water also does this work, but only the eggs of water plants can get their pollen in this way. The insects

are the most important carriers of pollen. Some plants are so made that only certain kinds of insects can carry pollen to them.

“There is also a kind of humming bird that lives on the nectar of flowers that have petals grouped together in the form of a tube. The slender beak of the bird is



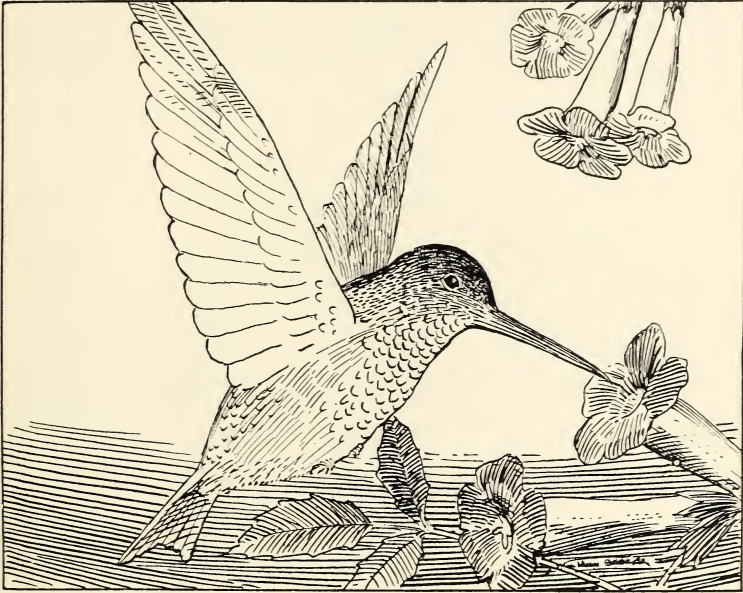
able to reach to the bottom of the long tube made by the petals. Pollen clings to the beak and is thus carried to the eggs. These plants depend upon the humming bird for having this work done.”

“Are there any plants that have to have certain insects carry their pollen?” asked Daisy.

“The eggs of the fig will not develop unless there is a particular kind of wasp to carry its pollen. This little wasp depends in turn upon the fig. Here is a

case where neither the plant nor the insect could exist without the other.

“Men tried to raise the fig in this country, but at first they were not successful, because they did not know



about the wasp. Finally they brought some wasps from the country from which the figs came. After that they had no trouble raising figs.

“The same thing has happened many times when men have tried to raise plants in new countries. They have been successful only when there have been insects

present that could carry the pollen, or when they could bring the insects from the country from which the plants came.

“There are many plants the eggs of which depend upon insects for their pollen. The insects that do most of this work are the butterflies, moths, flies, and bees. They visit the plants to get their nectar or pollen which they use as food. As these insects pass in and out of the flowers, pollen becomes attached to their bodies. Then when they enter another flower the pollen is rubbed off on to the ovaries. From the ovaries it enters the eggs.”

“Why are the petals of flowers colored?” asked Dolly.

“Insects and birds are attracted to the flowers by the brightly colored petals,” was the reply. “There are, though, some plants that have brightly colored petals that do not need the help of insects or birds, because their pollen just drops down onto the ovaries in the same flower. There are also flowers without bright colors, that insects visit.”

“Please tell us about the plants that do not have seed,” said Dolly.

“There are certain kinds, like the strawberry, that have vines,” her mother said. “In places where the vines touch the earth, roots appear. At these places new plants grow.

“If branches of the blackberry are bent down so that they touch the earth and are held there, roots will grow. New plants can be started in this way.”



“Where does the fruit that surrounds the seeds of some plants come from?” asked Daisy.

“After the petals fall off,” said her mother, “great changes take place in the ovaries of plants. In many of them, like the apple, the ovary forms fruit around the seeds.”

“What good does the fruit do the plant?” asked Dolly.

“Animals and birds eat the fruit,” she said. “Since the seeds are inside of the fruit they are carried away by the birds and animals. This is one way that seeds are carried from the parent plant to distant places.”



“I have eaten oranges that did not have seeds in them,” said Daisy.

“The ovaries of some plants will change into fruit even if no pollen is brought to the eggs,” was the reply. “The orange is one of them.”

QUESTIONS

1. Name the parts of a flower.
2. What parts are necessary for making new plants?
3. Name some ways in which pollen gets to the ovaries.
4. How do insects and plants depend upon each other?
5. Why do some flowers have bright colors?
6. Name some plants that do not have seeds.

LAZY PLANTS

“There are people in the world who will not work. They could not live unless other people worked for them. There are plants and animals just like these people. I will tell you this evening about some of the plants that live on the labor of other plants.”

Nancy knew that something interesting was coming. She was all attention in an instant.

“Do you know what the mistletoe is?” asked her mother.

“Oh, yes,” she replied. “It is a pale green plant with white berries. We always have mistletoe at Christmas time.”

“It is an interesting plant,” continued her mother, “but it is a lazy one. As soon as a mistletoe seed starts to grow it begins living on another plant. Little roots from the baby plant find their way into the bark of a tree.”

“Doesn't it grow in the ground?” asked Nancy.

“No,” said her mother. “Its entire life is spent on a tree. As the stem grows, the little roots go deeper and deeper into the tree.”

“Why do they do that?” asked the little girl.

“The roots steal water and food from the tree,” said her mother. “That is the way that the mistletoe gets most of its food. You see, it uses the food that the tree has worked hard to get.”

“Does the mistletoe get all of its food from the tree?” asked the little girl.

“Not all,” replied her mother. “It makes some of it from things that are in the air.”

“What are some of the trees that the mistletoe lives on?” said Nancy.

“The oak, the elm, and the gum tree, but it also lives on many others,” was the reply.

“Does the mistletoe do anything for the trees?” asked the little girl.

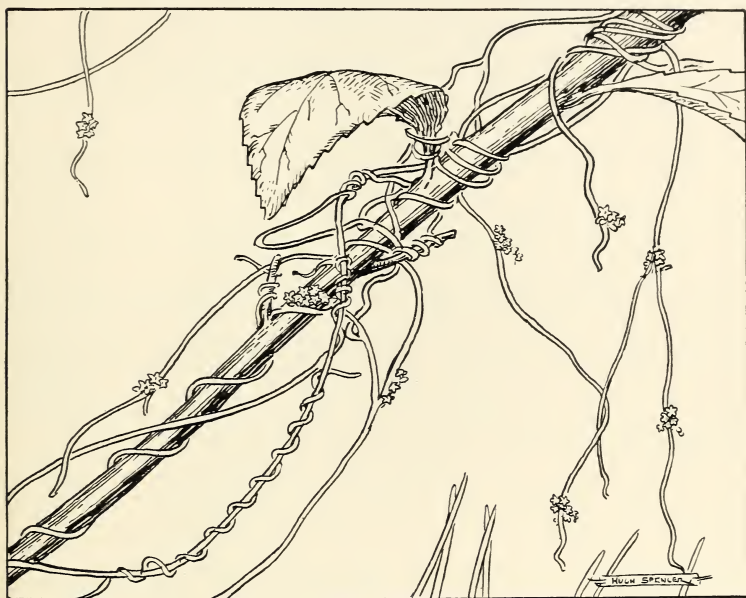
“I am glad to say that it does,” said her mother. “In the winter the mistletoe makes some food and gives part of it to the tree. It also helps birds by giving them berries to eat in the winter.”

“Please tell me about some other plants that steal their food,” said Nancy.

“Another plant that lives in about the same way is the dodder. This plant begins its life in the ground.

As soon as it has come up into the daylight, it hunts around for another plant on which to live.

“As soon as the dodder has found a suitable plant, it clings to the plant. Then the young dodder keeps



growing. It searches around until it finds a tall plant. It climbs the tall one and makes its home there.

“Soon after the little dodder has found a plant from which it can get its food, that part of the dodder’s stem near the ground begins to wither.”

“Why does it wither?” asked Nancy.

“It does not need its roots any more; the plant no longer takes its food from the ground. You see, the plant on which the dodder lives, gives it all the food that it needs. Why do you think the mistletoe has leaves while the dodder has none?”

“You said that the mistletoe makes some of its own food,” said Nancy. “It has to have leaves so that it can do this. The dodder does not make any of its own food, so it does not need any leaves.”

“That is correct,” said her mother. “Plants that live on other plants often lose certain things that they do not need any more. The same thing is true of animals that live on other animals. I will tell you about them some day.

“There is another kind of mistletoe that is almost as lazy as the dodder. Like the dodder it has no leaves. This kind of mistletoe is found on the cactus plant.

“Then there is a plant that kills trees.”

“Do tell me about it,” said Nancy excitedly.

“This plant,” said her mother, “is called the liana. It climbs up a tree trunk, and sends arm-like branches around the trunk. These branches hug the tree very tightly.”

“Why does the liana climb the tree?” asked Nancy.

“That it may reach the sunlight. Since the liana is not strong enough to stand up alone, it clings to the tree for support.”

“I don’t see how that hurts the tree any,” said Nancy.

“The liana’s arms are very strong,” said her mother. “They squeeze the tree so closely that its sap cannot flow. When a tree’s sap stops flowing, the tree dies, because it cannot get any food.

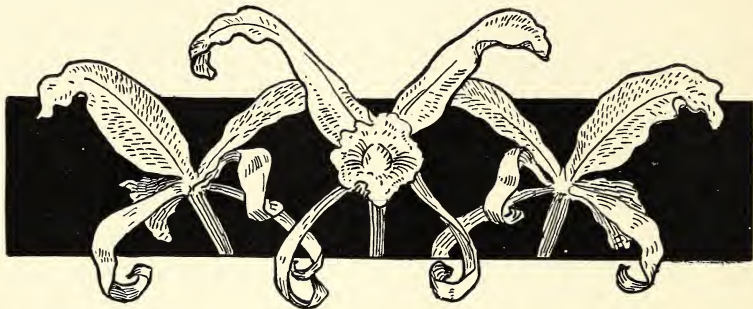
“Besides these large plants that use the food of other plants, there are small ones that live in a similar way. They grow on grain, potatoes, and on many other things.”

“Are they the dark patches that we sometimes see on corn and other plants?” asked Nancy.

“Yes,” said her mother. “These little plants send their roots into the big plants. Then the big plants start to decay.

“There are other very small plants. They are so tiny that you have never seen them. They make many things decay. They are called bacteria. They live on any kind of plant. You will study about them in school before long.

“Before I stop, I must mention the orchids. These are very beautiful plants. They are shaped like air-ships, gorgeous butterflies, and other graceful things. Most of them have very bright colors. The orchids live on other plants.”



“Do they get their food from the other plants?” asked the little girl.

“No,” said her mother. “They make all of their own food. They merely live on the other plants, so that they will be up in the air.

“I have not told you about all of the plants that make use of other plants. You will learn about them as you grow older.”

QUESTIONS

1. Can you explain how the mistletoe gets its food?
2. When do the roots of the dodder wither? Why?
3. Can you tell how some plants kill trees?
4. What are bacteria?
5. What can you tell about orchids?

POISONOUS PLANTS

The people who lived hundreds of years ago knew that the sap of a certain tree, the white hemlock, was poisonous. Whenever they wished to get rid of one of their number, they sent a messenger to him.

The messenger carried nothing but a vessel. But it contained sap from the white hemlock. The unhappy man knew what the hemlock meant, although the messenger said not a word. He knew that the people had decided that he must die. He therefore drank the hemlock, and in a little while was dead.

Tommy had just been reading about the hemlock poison. He wondered if there were any other poisonous plants. One day he asked his father about it.

“There are many poisonous plants,” said his father. “Their poisons are used in many different ways and for various purposes. The Indians knew about them, and used them for capturing their game and killing their enemies.

“Do you remember the stone arrowheads that we saw at the museum? I mean the little ones that the Indians used to fasten to the ends of their arrows.”

“Yes, Father,” answered Tommy, “I remember them well.”

“When the Indians lived in this country many years ago, they used to dip these arrowheads in the juices of poisonous plants. When they went hunting they used one kind of plant. When they fought each other or white men, they used another kind.”

“What kind of poison did they use when they went hunting?” asked Tommy.

“They used a kind that stunned the animal that they shot,” replied his father. “Even a slight injury caused the animal to fall to the ground. The poison that came off from the arrow point made it helpless. This poison was not a kind that would poison a man who ate the animal.”

“What kind of poison did they use for fighting each other?” asked Tommy.

“Some of the poisons that they used for this purpose came from animals, like the rattlesnake. Some of it came from plants. They used more of the plant poison, probably because it was easier to get. Of course, any arrow would kill an enemy, if it entered a place like his

heart. But a poisoned arrow usually killed him, if it only scratched him.

“Sometimes the Indians saved themselves by quickly cutting away the place that had been touched by the arrow point. Sometimes they burned the injured spot. More often, though, they could do nothing to save themselves.”

“Do any people use poisoned arrows now?” asked Tommy.

“Yes,” replied his father. “In Africa and South America there are savage races that still fight as our own Indians did years ago. There are not many of these savages, and they live where white men do not often go. That is the reason why we do not hear more about them.”

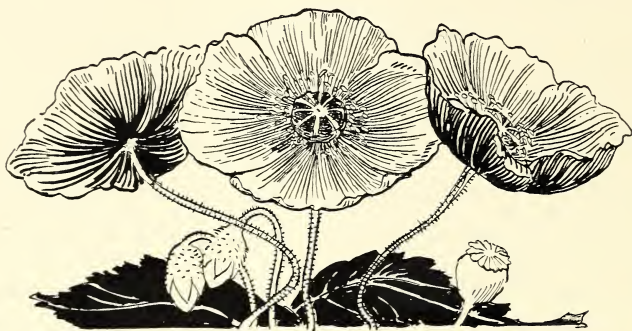
“What else are poisonous plants used for?” asked Tommy.

“Some kinds of deadly plants are used as medicine,” answered his father. “Of course, they are made weak by adding much water to them. If they were used full strength they would kill the sick person instead of curing him. Medicines made from poisonous plants have been

used for so many years that doctors know how much of them can be used without danger of killing their patients.”

“Do people ever die from taking poisonous medicine?” asked the little boy.

“I am sorry to say that they do,” replied his father. “Many medicines that contain poison can be bought at



the drug store. Sometimes people take too much of them, or they take the wrong medicine for their troubles. The only safe way to use medicine is the way that your doctor prescribes.

“One of the deadly plant poisons that is used as medicine is opium. Opium is made from the poppy. In skilful hands, opium and other medicines made from the poppy have prevented much suffering. But opium

has ruined thousands of human beings. These people have taken it without the advice of a doctor.”

“Why do they take opium?” asked Tommy.

“Because they think it will make them feel better,” answered his father. “Some take opium because other people take it. It is very bad to take opium, because the more one takes the more he wants. When one gets in the habit of taking it, he cannot stop.”

“Is tobacco a poison?” asked Tommy. “My teacher told us that it is.”

“Yes, tobacco is very poisonous, especially to children. Children who use it are not nearly so healthy as those who do not. It makes them weak and sickly. Anyone who is weak and sickly catches diseases easily. Tobacco has injured many young children just as opium has hurt grown-ups.

“Boys will tell you that it will not hurt you, because it has not hurt them. Do not believe them. They do not know the harm it is doing them. They will soon begin to feel the bad effects from its use.

“Tea and coffee are also poisonous to young children. Tea and coffee come from plants. They keep a child from growing as he should. Since they help

to make him weak a child should leave them entirely alone.

“Many boys and girls take tea, coffee, and tobacco, because they think it makes them appear like grown-



ups. When they use these things, they are doing the very thing that will keep them from being what they want to be—strong, healthy men and women.”

“Are there any other kinds of plants that poison people?” asked Tommy.

“There are many more,” was the reply. “You surely remember when you played with poison ivy last summer.”

“Yes, indeed, and how it hurt my hands and arms,” said Tommy. “I’ll never go near it again.”

“There are other plants that you must watch out for, like the poisonous sumach and some kinds of nettles,” said his father. “I will point them out to you the next time we go into the woods.”

QUESTIONS

1. What can you tell about the sap of the white hemlock?
2. In what way did the Indians use the sap of poisonous plants?
3. Name some other ways in which poisonous plants are used.
4. From what plant is opium obtained and how is it sometimes used?
5. What can you tell about the poisons that come from the tea, coffee, and tobacco plants?
6. Can you name and tell about any other poisonous plants?

WHERE WILD ANIMALS GO

“Where have all the wild animals gone?” asked Tommy of his father one afternoon. “Of course, we see some of them once in a while, like the rabbit and the woodchuck, but I have never seen a deer or a muskrat or a mink.”

“There are many forces at work against the wild animals,” answered his father. “In the first place, wild animals and man do not get along together.

“When man takes possession of a country most of the wild animals either run away or they are killed by him. He tames a few of them. These continue to live with him.

“He kills such animals as the wildcat, the wolf, and the tiger because they are a source of danger to him. He also uses their hides for different purposes.

“Man destroys animals like the deer, the bison, and wild goat for their hides and their meat. In wild countries men have to do this or they would starve and they would have no clothing. In many regions of the world men kill animals because they can sell their meat and hides and horns.

“Then, besides, men often hunt the wild animals, because they think that while hunting they are having a good time. They call it sport. They do not need the meat of these animals, because they have plenty of better meat every day.”

“Why do they like to hunt them?” asked Tommy.

“One reason is because they see other men doing it,” said his father. “Another is that they have not entirely outgrown some of the habits of the cave men. We do many things that the cave men did just because we are not wise enough to stop doing them.

“Many men go hunting, not so much to kill the animals as to be out of doors. It is natural for people to be out in the open air. When they go on outdoor trips they usually like to have an object to strive for. So they make the hunting of animals this object. Most men would have just as much fun if they were hunting for rare minerals or plants.

“In our country, except in wildernesses and other uninhabited places, only a few wild animals and wild birds remain. Even the fishes are disappearing from our streams.”

“What else kills animals?” asked Tommy.

“Of course you know that they kill each other,” his father said. “But this is not one of the most important reasons for their disappearance. In countries like the wildest parts of Africa there are great numbers of wild animals of many kinds.

“Droughts which occur in some countries cause the death of thousands of animals. A drought means very dry weather. For weeks and sometimes for months no rain falls. Water can be obtained at only a few places. All animals have to go to the same place for their water, or else die of thirst. At these watering places savage animals kill thousands of helpless ones.”

“I see,” said Tommy. “When a drought comes, many animals die of thirst and many others are killed that would not be if they did not have to go for water where the savage ones are.”

“You are right,” said his father. “Very hard winters also result in the death of many animals from a similar cause. When there is unusually heavy snow on the ground, deer are not able to travel rapidly. Wolves can easily catch them then.

“When the winters are very cold many birds freeze to death, because they are not sufficiently protected. It

is probable that large numbers of animals that sleep through the winter are also frozen to death, when the temperature remains far below zero for long periods at a time.

“Another great cause of death among animals is disease. Animals that live together in herds are helpless against a disease that can be carried from one to another. A disease, called rinderpest, killed over half of the animals like the deer and the cow in Africa not very long ago.

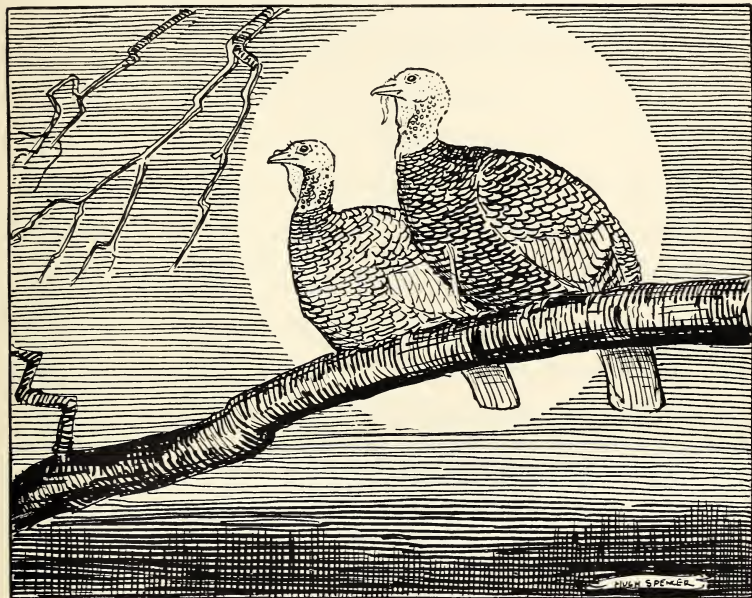
“Animals that lead lonely lives do not suffer so much from such diseases.

“Fishes have entirely disappeared from some of our streams. This is due to the fact that the water has been poisoned by factories which are on their banks.

“In places where most of the trees have been cleared from the hills and mountains, many of the streams dry up in the summer time. The fish that used to be plentiful in these streams have gone.

“Few wild birds live where there are many men, because men kill them and destroy their homes. In New England, when the Pilgrims landed, there were many wild turkeys. Now there are only a few in the whole

country. Years ago there were great flocks of passenger pigeons in this country. They, too, have all been killed. Every year the wild birds are becoming fewer and fewer.”



“Can’t anything be done to save the birds?” asked Tommy.

“A little is being done. Laws have been passed in all the states which forbid the killing of certain kinds, and permitting the killing of others only at certain times of the year. But until the people realize the value

of the birds, not much can be done, because men can kill them in the woods and other wild places without being caught.”

“Can’t the people be taught that it is wrong to kill the birds?” asked Tommy.

“They are being taught, but it takes a long time. By the time they realize that they should preserve the birds, most of them will have been killed.

“Wild animals like the deer are also being protected by law, but the same thing is happening to them that is happening to the birds.”

“It seems to me,” said Tommy, “that man is the worst enemy that the wild animals have.”

“I am sorry to have to say that I agree with you,” said his father. “Yet, even if there were no men, wild animals that live now would sooner or later disappear.”

“Why do you say that?” asked the little boy.

“We know that this has happened to other animals that lived thousands of years ago,” said his father. “We have found the fossils of great groups of animals that lived and died before man appeared on the earth. So man could not have been the cause of their disappearance.”

“What do you think was the cause, Father?” asked Tommy.

“It was probably sudden changes in the climate. Long periods of drought might have killed them, or it might have been unusually cold winters. Disease also may have had something to do with it. Just what the cause was, we shall probably never know.

“I want you to promise me that you will do all in your power to help preserve the desirable birds and animals and fishes. You will find that you will get far more pleasure from protecting them than the man will who kills them.”

“Yes, Father,” said Tommy, “I will do all I can to save them. I will remember my promises when I am grown up.”

QUESTIONS

1. What are some of the reasons why men kill wild animals?
2. What is a drought and how does it affect wild animals?
3. Can you name some of the causes of the disappearance of fish?
4. In what ways can bird life be protected?
5. How do we explain the disappearance of many kinds of animals that lived long ago?

ANIMALS AND THEIR FOOD

“When men go fishing they take fishing tackle with them. When they go hunting they take guns. When an animal has something special to do, it has nothing to use except the things that Nature has given it. All that it has are the different parts of its body.

“Different kinds of animals, as you know, are made differently. There is a reason why they are not all alike. Each one is so formed that it can get the kind of food that its body needs.”

Here Henry interrupted his father with the question, “Is that what makes some animals so queer?”

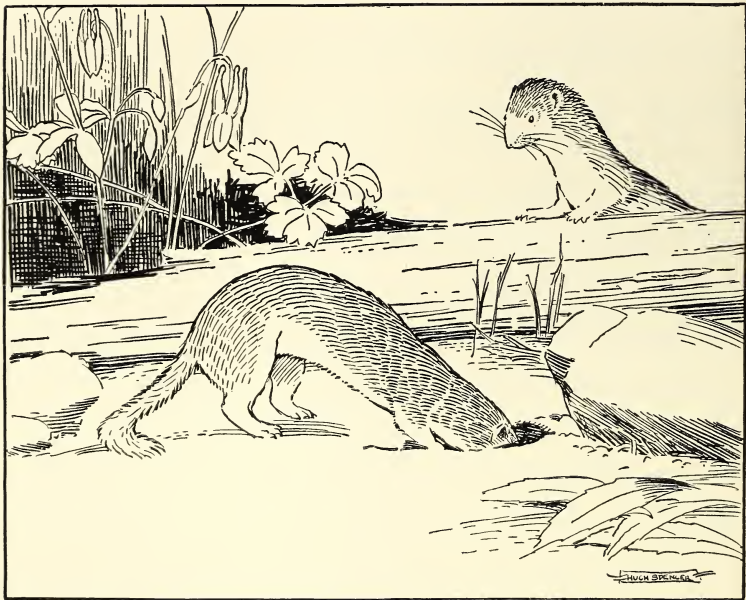
“Yes,” replied his father. “It is the reason why the giraffe has a long neck and the weasel a slender body.”

“Why does the giraffe have such a long neck?” asked Henry.

“His neck makes it possible for him to reach branches that are high up in the air,” answered his father. “You can easily see how this helps him in a country where there are no plants with leaves near the ground.”

“Why does the weasel have a slender body?” asked the little boy.

“His body is slender so that he can crawl through small holes,” was the reply. “His food consists of animals



that live in burrows in the ground and in trees. If he had a fat body he could not go into the burrows of small animals.”

“Is that the reason why ferrets have slender bodies too?” asked Henry.

“Yes,” replied his father. “Their habits are very similar.”

‘What other animals have things that help them to get their food?’ asked Henry.



“Almost all of them,” answered his father. “Even the common ones that you see every day are so made that they can get the food that is best fitted to their needs.

“The dog and the horse are two common animals. You would not think that they would need to have their

bodies specially made. They do though. The horse has to have such things as grass and other plants to eat. He could not live on meat, because his body is built to take care of grass and similar food.

“Grass has to be chewed up fine or it would harm an animal that ate it, instead of doing him good. An animal that eats such food has to have teeth that will grind it. So the horse has teeth like those which are in the back of our own mouths. He also needs teeth that will cut the grass. So those in the front of his jaws are sharp. They are like our front teeth.”

“I see,” said Henry. “He bites the grass off with his front teeth and chews it with his back teeth.”

“You are right,” said his father. “The dog uses a different kind of food. He is a meat-eating animal. The grinding teeth of the horse would not help him tear meat from bones. He needs pointed teeth that will go deep into the meat. The dog, as you know, is really a wild animal that has been tamed. A wild animal that lives on meat must catch and kill his own food. The pointed teeth of the dog are much better for this purpose than grinding ones would be.”

“Are our pointed teeth—I mean the ones that come

next to the front ones—like the teeth of a dog?” asked Henry.

“Yes,” replied his father, “and our back teeth are like the grinders of the horse. The horse and the dog both have sharp cutting teeth in front like ours. Since we have teeth like both of these animals, what kind of food do you think we ought to eat?”

Henry thought for a minute, then replied, “I should think that we ought to eat food that needs to be ground up, because we have grinding teeth. And I think that we ought to eat meat that has to be torn apart, because we have pointed teeth. We also need food that has to be cut, because we have cutting teeth.”

“Good!” said his father, who was well pleased that his boy had been able to answer his question. “Yes, human beings need all kinds of food.

“The next time you see a horse eating, watch him closely. You will notice that he eats slowly. When you are eating the kind of food that a horse eats you must be sure to chew it well. If a horse were to swallow his oats and hay without chewing them, he would get sick. You will get sick if you eat cereals and such things without chewing them thoroughly.

“We must not try to make our bodies do things that they cannot do. Our bodies cannot properly take care of food that is not chewed.”

“What other things do animals have that help them to get the kind of food they need?” asked Henry.

“The lion has a very rough tongue,” answered his father. “The upper side of his tongue is covered with sharp spikes. The spikes are almost like teeth. Perhaps you have noticed that your kitty has a rough tongue too. You know she is a cousin of the lion.

“The lion uses his rough tongue for tearing off the skin from animals that he is eating. He can also tear meat from bones with his tongue.

“The lion also has very long and sharp claws. The lion uses them when he catches the animals that he is going to eat. Of course, his teeth help him catch his prey. They are like those of a dog. They are made for cutting and tearing.

“There is another animal, called the ant-eater. His head is stretched out in front a long distance. This animal has no teeth, because he lives on ants. With his tongue he catches the ants, and then he swallows them. You see his head is made for this one thing.

“The frog has a tongue that is made for catching insects. He does not get them from the ground, as the ant-eater does. The frog catches them when they are in the air.”

“How does he do it?” asked Henry.

“You see,” replied his father, “the frog’s tongue is fastened at the back. When an insect flies near his head,



the frog opens his mouth, and his tongue snaps out. The tip of his tongue curls around the insect. The frog then draws his tongue back into his mouth and swallows the insect.

“I think you know about the whales?”

“Yes, Father.”

“What does a certain kind of whale possess in his mouth that enables him to get his food?” asked his father.

After a moment Henry answered, “The whale-bone

whale has a sieve made of bones that catches small water animals."

"That is correct," said his father.

"Please tell me about the birds," asked the little boy.

"I have told you enough for one evening," his father replied. "Tomorrow I will tell you how birds and some other animals are fitted for getting their food."

QUESTIONS

1. What reasons can you give for differences in animals?
2. Name and tell about some animals that illustrate differences in form.
3. Why do animals have different kinds of teeth? Tell about them.
4. What animals have rough tongues? Why?
5. Can you explain how ant-eaters and frogs catch their food?
6. Name some other animal that gets its food in a strange manner, and explain how it does it.

HOW ANIMALS HUNT

“I told you last evening about some of the things that certain large animals have that help them get their food. The bodies of some of the insects, birds, and fishes are especially made for getting food, too.

“Can you think of anything that any of the insects have that helps them catch or get their food?”

After a short pause Henry answered his father, “I think the beetles have big jaws so that they can catch other insects,” he said.

“Some of them,” replied his father, “use their jaws for that purpose. There is a brightly colored beetle, called the tiger beetle. He has received this name because he is a regular tiger among the insects. He runs and flies very swiftly. His favorite food is the caterpillar.

“The beetles that you see in the water also have huge jaws. Some of these beetles are so large that they can catch small fishes.

“Other beetles use their jaws for eating leaves and other parts of a plant. Perhaps you have seen fat little ones with long legs on the rose bushes. They can do a lot of damage to a plant. I know that you remember

the potato beetles that we had in our garden last summer."

"Oh, yes," said Henry. "Some were black and yellow, with shiny wings. Then there was another kind that did not have any wings. Were they beetles, too?"

"Those wormlike things that you saw were not beetles. But they would have become beetles if we had let them grow up," his father replied. "Potato beetles are like short fat worms when they are young. Before they are grown up one of these insects is called a larva. More than one of them are called larvae. The babies of other insects that are like worms are also called larvae."

"Did the larvae of the potato beetles also eat the potato plants?" asked Henry.

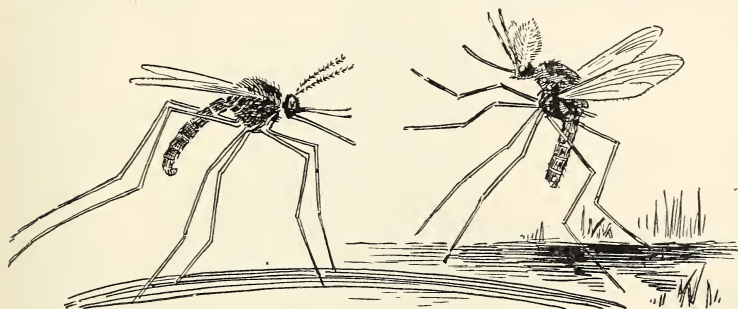
"Yes," replied his father. "That is the reason the leaves of the potato plant disappeared so rapidly. The whole family of potato bugs was at work eating them."

"I think that some flies also get their food by biting," said Henry.

"The horsefly does," said his father. "After he has pierced a hole in the horse's skin, he sucks the horse's blood. The mosquito is another kind of fly that lives in the same way. A strange thing about the horsefly and

the mosquito is that it is only the lady members of the family that bite animals and people. The men-folk live on the nectar of flowers.

“The butterflies and moths have long tongues. By means of them they can reach down into deep flowers and get the nectar that is there. The bees have many



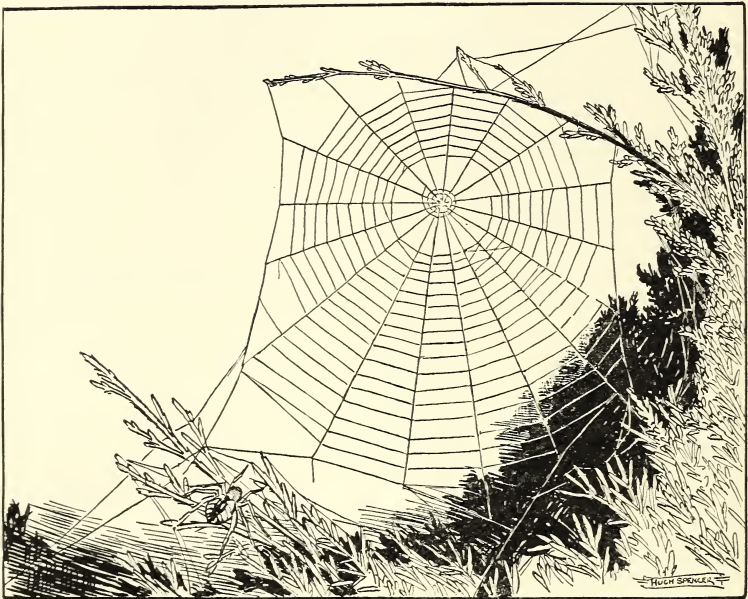
different parts of their bodies made for doing different things. Some parts are for gathering nectar and pollen, with which they make their honey and other food. Other parts are used for carrying the pollen and nectar. I will tell you more about the bee's body some other time.”

“What else do insects have that help them get their food?” asked Henry.

“The wings of the dragon fly are very powerful. This insect can fly faster than any other insect. For this reason he has no trouble catching his food. Some

beetles, like the tiger beetle, that I just told you about, have long legs that they can move very rapidly. They also can catch almost any kind of insect.

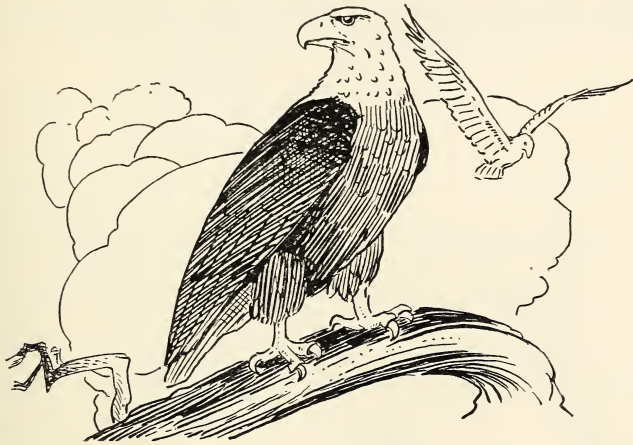
“Many different kinds of insects are colored like the things among which they live. Since they cannot be



seen easily, they simply wait until their prey comes along. Then they grab it.

“The spider is not an insect, because he has eight legs. An insect has six legs. But the spider is almost

like an insect. He is able to spin silk thread. With this thread he makes a large net. An insect that touches this net gets caught in it. The spider then runs out from the place in which he has been hiding and winds

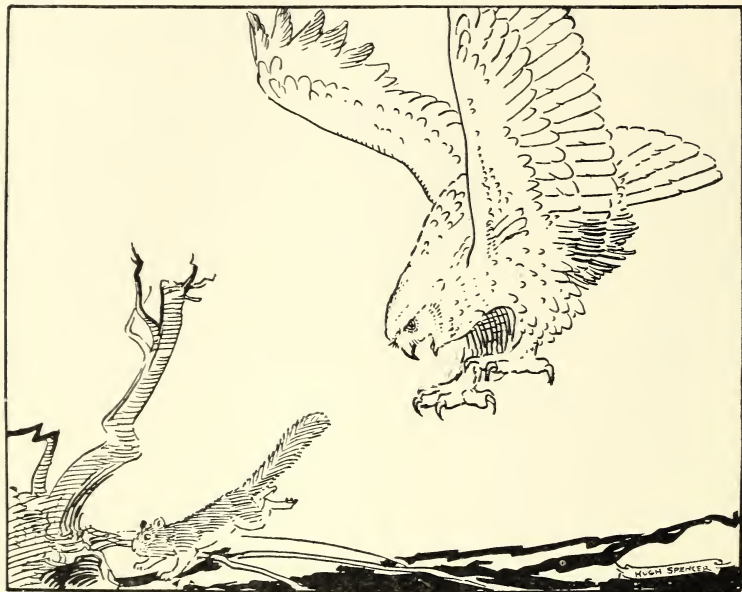


more thread around his prey until the insect is helpless. Then the spider kills and eats the insect.”

“Tell me about the birds that catch their food,” said Henry.

“Birds rely entirely upon their beaks, their claws, and their wings for getting their food. The eagles are very large birds. They live on other birds and animals. Their strong wings make it possible for them to swoop down upon birds of every other kind. They use their

heavy claws, which are often called talons, for grasping the birds that they have caught. A large eagle, like the American eagle, is able to carry an animal as large as a half-grown antelope a long distance. There are stories



that eagles have carried little children to their nests. They are strong enough to carry small children, but we are not sure that these stories are true.

“Hawks are a great deal like eagles. They have powerful beaks, strong claws, and they are great fliers.

They capture smaller birds and animals in the same way the eagles do.

“Birds like the hawk and the eagle are helped by wonderfully sharp eyes. Even though they are high in the air they can see a small animal on the ground. Unless the animal is near a hole that he can crawl into, the eagle or hawk gets him every time.

“The shape of a bird’s bill is fitted to the kind of food that he eats. Those that live on insects have long pointed bills. The bills of seed-eating birds are short, but they have to be very strong so that they can crack the seeds.

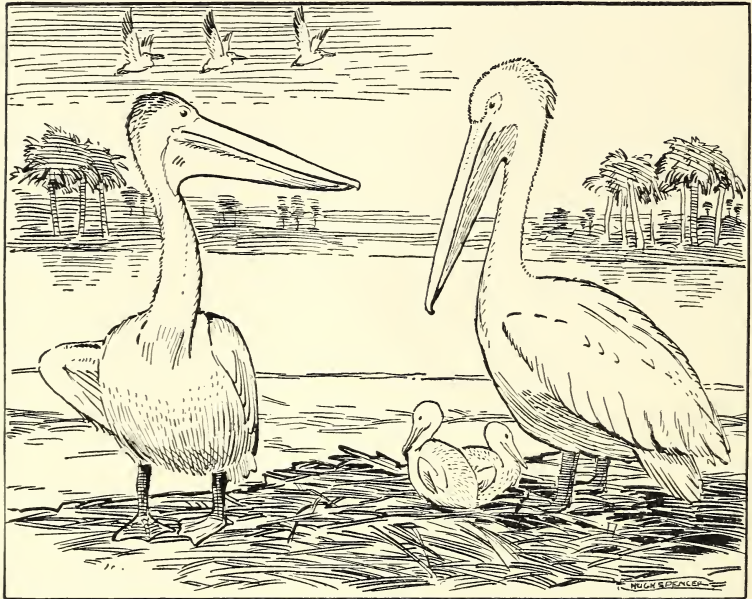
“Most birds that live on other birds and animals have curved beaks like the eagle’s. These beaks have to be strong, because they are used for tearing flesh. The woodpecker’s bill is strong and sharp. He uses it for digging holes in trees, when he is hunting for the larvae of insects.

“Some birds, like the pelican, have great scoops, which they use for catching fish.”

“Have the fishes any special things for catching their food?” asked Henry.

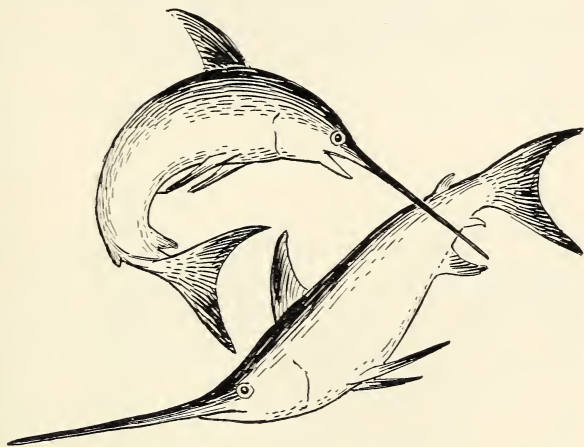
“Yes,” replied his father. “Some of them are very

strange. The swordfish has a long pointed snout. When he sees his prey, he swims as fast as he can straight at it. He sticks his sword deep into the fish or other animal that he is attacking. Swordfish sometimes kill whales.



“There is another kind of fish that also attacks whales and other sea animals and fish. This is the sawfish. He has a long beak-like saw that has teeth on both sides. He drives this saw into his prey, and then pulls it back and forth. This of course kills the animal or fish.

“Sometimes swordfish, sawfish, and grampus whales all unite and attack a great whale. The whale has no chance. They tire him out after wounding him many times, and then kill him. Of course, after that they eat



him. Even a whale, which is the largest living thing, is not free from enemies.

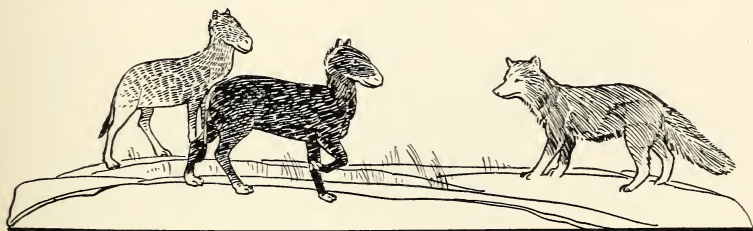
“Some of the common fishes have strong jaws and sharp teeth. These are all they need for catching other fishes and animals.”

QUESTIONS

1. How did the tiger beetle receive its name?
2. What is a larva? Name some kinds.
3. Can you tell how the horsefly gets its food?
4. Why do moths and butterflies have long tongues?
5. Why is the spider not an insect?
6. Name some other animals that catch their food, and tell how they do it.

THE HORSE, MAN'S SERVANT

“There were horses on the earth long before there were human beings. The first horses were very small. They were about the size of a fox. But these little horses kept growing larger. By the time that man came on the earth, the horse was as large as some that we have today.”



“Please tell me more about the little horses,” asked Henry of his father who had just begun one of his evening talks.

“We do not know very much about them,” said his father. “We are pretty sure, though, that the feet of the first horses had five toes. Men have found traces of little horses that had four toes and a little bone where the fifth would have been if it had been present.”

“How could men find traces of horses that lived so many thousands of years ago?” asked the little boy.

“Sometimes the bones of animals that have lain in certain kinds of earth have been replaced by stone. Such things are called fossils. Fossils tell us what kinds of animals lived thousands of years ago. It is through fossils that we know how many toes some of the little horses had.

“The foot of the modern horse possesses but one large toe. What we call the hoof is really the nail of the middle toe. The bones of two of the other toes are still present, but they are only splinters. Nothing remains of the other two toes.”

“Where are the little splinters?” asked Henry.

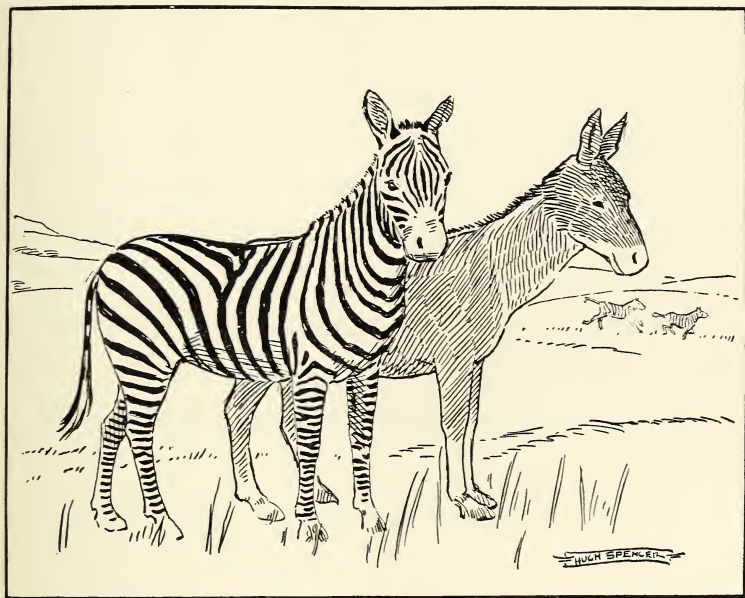
“The little splinters that remain are covered by the skin,” he replied. “That is the reason you cannot see them.”

“But I do not see why horses’ feet do not have five toes now, if they once did,” said Henry.

“When the little horses lived, the land was swampy and soft,” said his father. “Toes are better than hoofs for walking on soft earth. Slowly the ground became harder. The horses did not need their toes. Gradually the toes on the sides of their feet disappeared. At last when the land became hard and firm, only one toe

remained on each foot. This toe, as I have told you, is the middle one.

“Horses were wild when the first men came. For a long time men hunted them for food. Finally they



tamed the colts of these wild horses. Then began a friendship that has lasted ever since.”

“Are there any wild horses now?” asked Henry.

“Oh, yes,” answered his father. “In certain parts of the earth there are wild asses and zebras.”

"Are wild asses and zebras horses?" asked Henry.

"They belong to the horse family," was the reply. "Of course, you know that they are considerably different from our horses, but they are horses nevertheless."

"I've seen pictures of wild horses that looked like our horses," said Henry.

"There are many horses running wild in different parts of the world," said his father. "These horses were once tame, but they escaped from their masters and became wild. They travel in herds, as do all wild horses. They are safer together than they would be if they were alone."

"Were the mustang ponies once tame?" asked Henry.

"The mustang ponies that run wild over some of our western states were once tame horses. They were brought into this country by people from Europe hundreds of years ago. They escaped from their masters and became wild."

"Are the Shetland ponies anything like the little horses that lived so long ago?" asked the little boy.

"There is not a very strong resemblance between them," replied his father.

"In the first place, the Shetland ponies have hoofs. The little horses had several toes. The Shetland ponies are a great deal larger than the little horses were. Besides, the bodies of the little horses were shaped more like those of foxes."

"What is a wild ass like?" asked Henry.

"The wild ass is very much like the donkey," said his father. "You know that donkey is another name for the ass. The donkey was once wild too.

"There are many different kinds of asses. In some countries, like Egypt, the ass is as valuable as a horse.

"People who live in mountainous countries depend upon donkeys for carrying their burdens over the mountains. The donkey and his relative, the mule, can travel where horses cannot."

"What is a mule?" asked Henry.

"A mule," said his father, "is an animal whose father is a donkey and whose mother is a horse. A mule is as patient as the donkey and as strong as the horse. He looks a great deal like a horse, but his ears are longer."

"Is a donkey as stupid as people say he is?" asked Henry.

"No," replied his father. "A donkey is as bright as a horse. The mule is also an intelligent animal.

Both of these animals get stubborn once in a while. That has made people think that they are stupid.”

“What is the zebra like?” asked Henry.

“The shape of the zebra’s body is a great deal like that of an ass. The most peculiar thing about a zebra is its coloring. Its body is white or yellowish brown with stripes of brown or black.”

“Are there any tame zebras?” asked Henry.

“People have tamed them,” said his father, “but they are naturally very wild, and it is difficult work to tame them. Sometimes the people in Africa, where the zebras live, eat them, because their meat is very good.”

“Please tell me about the horses that we see every day,” said Henry.

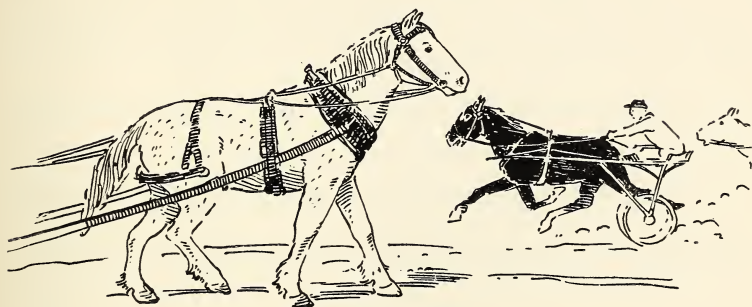
“Horses are not all alike,” said his father. “Their bodies are different, and they are used for different purposes. You have seen horses that haul trucks, and do heavy work. They have huge thick legs and their bodies are heavy. They are very powerful animals.

“There is another kind that hauls light wagons. They are strong too, but they are not nearly as strong as the truck horses. Their bodies and legs are much lighter.”

"I've seen pictures of race horses," said Henry.

"Yes," replied his father. "They are of another kind. Their bodies are slender and graceful.

"Besides these, there are others that are used for driving, and still others for riding."



"I have read about war horses," said Henry. "Please tell me about them."

"Ever since men have been on the earth they have fought with each other. From the time that they first tamed horses, men have trained horses to help them fight one another.

"Sometimes they rode the horses into battle and sometimes they had the horses draw their two-wheeled carts, called chariots.

"Horses are not afraid of danger. They are as brave as men."

"Yes," said Henry. "I read a story about a horse that ran toward the enemy even though his rider had been killed."

"That has happened many times," said his father. "Other horses have remained with their wounded masters until help came. Sometimes the horses have gone for help and have saved their masters' lives."

"I should think that people would be kind to horses, because they are so faithful," said Henry.

"They should be kind to them," agreed his father. "Horses are loyal to man and they work hard for him."

QUESTIONS

1. How many toes did the first horses have?
2. What do we mean by fossils?
3. Why don't our horses have five toes?
4. What other animals belong to the horse family?
5. What can you tell about the mule and donkey?
6. Name some of the different kinds of horses and tell for what purpose each is used.

THINGS MADE FROM ANIMALS

“The men that lived thousands of years ago ate the meat of animals and clothed themselves in their skins. They also made weapons and tools from the antlers, bones, and horns of animals. Men still make use of animals for the same purposes. Since man is now much wiser than the first men were, he makes many more things from animals than the first men did. The things that he now makes are much better made too.”

Henry's father was about to continue, when the little boy interrupted him with, “What do we use antlers, bones, and horns for, Father?”

His father replied, “The knife that you gave me for Christmas had a stag-horn handle. Stag-horn is another name for antler. Stag-horn is used for many other purposes.

“Men used to make trumpets from the horns of certain kinds of sheep and other animals. They used to make powder flasks to hold their gun powder, but they do not use them now.

“Another substance that comes from animals is ivory. Two of the teeth of some animals grow very

large and long. They are called tusks. These tusks are made of ivory. Many different animals are hunted for their ivory tusks, but the elephant and the walrus are the most important.”

“What is ivory used for?” asked Henry.



“Piano keys, knife handles, and similar things,” said his father. “My set of chess men is made of ivory. Ivory is used for making ornaments of many kinds.

“There is another kind of ivory that is called vegetable ivory. It comes from a plant. It is not as good as that which comes from animals, but it is used for many things.

“There is a little sea animal that makes a substance called coral. This is used for making different kinds of ornaments. Millions of these tiny animals live

together. Each one builds a little hard cup under him. Then as he dies another animal builds another cup on this. These cups are so closely packed that they form a very hard mass. It is almost as hard as stone.

“Sometimes there are so many of these little animals working together in the ocean that they make islands. The Bermuda Islands were made by them. The coral made by them is different from that which is used for making ornaments. Ornaments are made from pink coral.”

“Pearls come from animals, don't they, Father?” asked Henry.

“Yes,” replied his father, “pearls come from oysters.”

“Do oysters make the pearls?” asked the little boy.

“Yes,” answered his father, “a pearl is made by an oyster, but it is not part of the oyster. The inside of an oyster shell is covered by a hard layer. This layer is very beautiful. Your mother's paper cutter is made of it.”

“Is that pearl?” asked Henry.

“It is called mother of pearl. It is from the same kind of material that the pearls are formed. There is a

certain part of the oyster that lies next to the shell that makes this mother of pearl.

“Sometimes a very tiny animal or piece of dirt happens to be near the place where the mother of pearl is being made. When this happens, the mother of pearl forms around the little animal or piece of dirt. Layer after layer of mother of pearl is added. That is the way in which a pearl is formed.”

“How do men get the oysters with the pearls in them?” asked Henry.

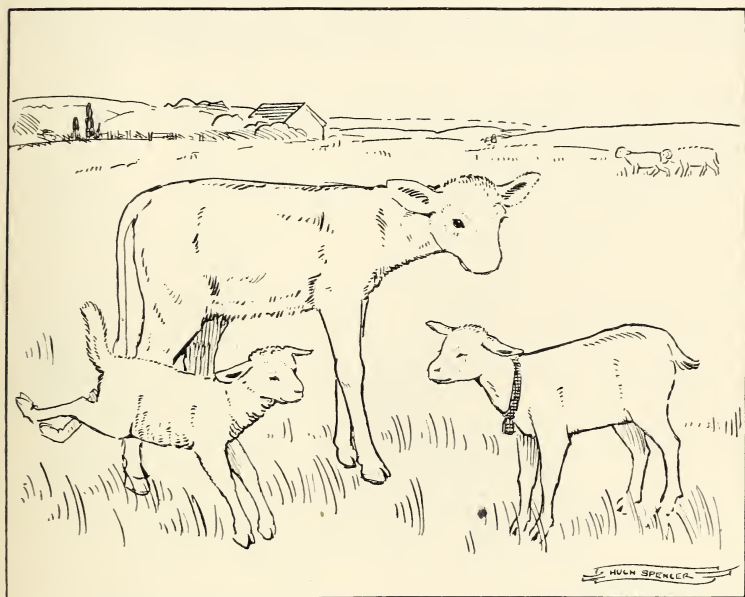
“They dive to the bottom of the sea and bring them up. Then they break the shells open and hunt for the pearls. Only a few of the oysters have any pearls in them,” replied his father.

“Mother of pearl also comes from animals other than the pearl oyster. Many of our buttons are made from this substance. It is also used for making ornamental and useful things.”

“Are sponges animals?” asked Henry.

“Yes,” replied his father. “They, like the pearls, come from animals that live on the bottom of the sea. The sponges are brought to the surface and are then laid out on the beach. Since they are made up of little

animals, certain parts of the sponges are soft. After the soft parts have decayed, the sponges are cleaned. They are then ready for use. There are many kinds of sponges that cannot be used, because they are too hard.



“Let us go back to the land animals. One of the most important articles that we use comes from animals. This is leather. Leather is the skin of an animal after the hair and some of the outer portion have been removed. Leather can be made from many kinds of

animals. That made from different animals is used for different purposes.

“The calf supplies us with most of our shoes, the kid and the lamb with many of our gloves. The skins of the cow, pig, and horse, are used for such things as soles of shoes, traveling bags, and many other purposes.



“The wool that we wear comes from sheep, and other kinds of cloth are made from the hair of the camel, the goat, and from many other animals.”

“Do people kill the animals to get their hair?” asked Henry.

“No,” replied his father. “We clip them with shears. It does not hurt them, but they must get pretty cold sometimes.”

“How do people get fur from animals?” asked the little boy.

“They have to kill them first,” was the reply. “Thousands and thousands of animals are killed every year for their fur.

“It takes many squirrel skins to make a squirrel coat, and a great many moles to make one of mole skins.”

“It is too bad to kill so many animals,” said Henry.

“Yes, it is,” said his father, “but many of the animals whose fur is used are man’s enemies, like the tiger. No one would feel bad if all tigers and animals like them were killed.

“Most of the brushes that we use are made from the hair of animals. Stiff brushes are made from the bristles of the pig and similar animals. The hair of the cow and camel and many others gives us our soft brushes.

“Glue is made from the hoofs, and soap from the fat of animals that are killed to be eaten. There is no

part of these animals that is not now used for something.”

QUESTIONS

1. For what purposes did man use the horns of animals in years past?
2. Where does ivory come from and how is it used?
3. Can you describe the formation of a coral island?
4. How are pearls formed?
5. Explain how leather is obtained and used.
6. Tell about some other things that are made from animals.

THE SQUIRREL FAMILY

Molly and Bob were watching several red squirrels that were playing in the trees in front of the hermit's cabin. The little animals were chattering at the top of their voices and jumping from limb to limb. They seemed to be having the best kind of a time.

Noticing that the children were interested in the squirrels, the hermit asked them if they would like to hear something about these and other kinds of squirrels.

"Oh, yes, please tell us about them," the children replied with one voice.

The hermit began, "The members of the family that live in this part of the country are the red squirrel and the chipmunk.

"The red squirrel, as you have noticed, is a very playful fellow. He delights to romp among the branches with his mate for hours at a time. If children were to play as long and as hard as he does in the open air their bodies would become as strong and wiry as his. The squirrel has nothing to gain by his playing among the branches, except the exercise that he gets and knowledge of the trees in which he lives."

“What do you mean by knowledge of the trees?” asked Molly.

“The squirrels in their play are constantly jumping from branch to branch. Since they play day after day among the same trees they get so that they know without thinking just how far the different branches are from each other.”

“What good does that do them?” asked Bob.

“If an enemy tries to catch them, by knowing the trees thoroughly in which they live, they can often escape. This knowledge makes it possible for them to travel with the greatest speed from limb to limb, because they do not have to measure the distance for each leap. A strange animal, even if he is as fast as the squirrel, cannot keep up with him, because he is not familiar with the distances between the branches.”

“Do squirrels for this reason stay pretty close to the same place?” asked Molly.

“Probably that is the reason that they do not wander far away,” answered the hermit. “They are much easier prey to their enemies when they are in strange trees.”

“What enemies has the red squirrel?” asked Bob.

“In wild parts of the country his greatest foes are the mink and the weasel. The mink is almost as swift as the red squirrel and very often catches him. The



weasel can follow him into his nest, although the entrance to the nest is very small.

“He also is pursued by the hawks and owls. But his worst enemy is man.”

“Why do men want to kill the squirrels?” asked Bob.

“Some red squirrels are killed for their fur and some

to be eaten. But most of them are hunted by men because red squirrels do so much damage. Red squirrels kill many young birds and they eat much fruit and grain.”

“What do they eat in the winter time?” asked Molly.

“They depend mostly upon stores of nuts and seeds that they collected during the fall. They also eat the bark of poplar and other trees. Some squirrels sleep through the winter, but the red squirrel probably does not. He can be seen, unless it is very cold, almost any day.”

“I would like to know something about the chipmunk,” said Bob.

“The chipmunk is much smaller than the red squirrel, and his tail is not so bushy. He has two light stripes that run down his back, one on each side. Many of his habits are like those of the red squirrel, but others are very different.

“The chipmunk, unlike the red squirrel, prefers to live near the ground. Piles of stones, stumps of trees, fences, and old buildings are his favorite haunts. He often makes his home in a bank, into which he digs a long burrow.

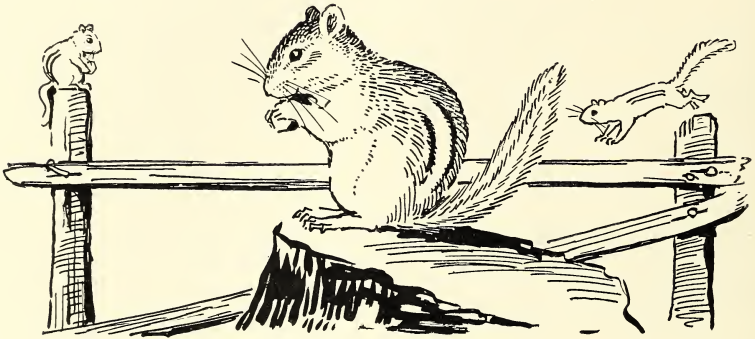
“There is one important lesson that you can learn from the chipmunk. He loves the sunshine. You will not find him in dark and gloomy places. His body



needs the sunshine just as yours does. He seems to know that the sun gives him something that makes him strong. The chipmunk is one of the happiest animals in the world. The sunshine that he bathes in probably has a great deal to do with it.”

“What does the chipmunk live on?” asked Molly.

“His principal food is nuts, grain, and acorns. He has one very bad habit though. He steals the eggs of birds and kills little ones that are still in their nests. I am sorry to say that this little animal does much damage.”



“Do any other animals kill the chipmunks?” asked Bob.

“He has more enemies than the red squirrel has, because he lives near the ground. Besides the animals that pursue the red squirrel, he has to avoid snakes, foxes, and cats. But in spite of his enemies he manages to exist.”

“What does the chipmunk do in the winter?” asked Molly.

“He sleeps most of the time,” the hermit said.

“But when warm days come, he awakens and eats some of the food that he has stored away. He goes to sleep again when the weather turns cold.”

“What other kinds of squirrels are there?” asked Bob.

“The gray squirrel is one that you have often seen when you have been in the city. He is a friendly little creature.”

“Oh, yes, I remember how we used to feed them almost every day in the park,” said Molly.

“Gray squirrels,” continued the hermit, “love company. Six or eight of them sometimes occupy the same nest which they have made in a hole in a tree.”

“The lives they lead are similar in many ways to those of the other squirrels, and they have the same enemies to avoid. They have been entirely destroyed in many parts of the country by men who hunt them for their meat and fur.”

“What are the flying squirrels like?” asked Bob.

“These squirrels,” said the hermit, “have flaps of skin between their legs on each side. By spreading their legs out they are able to skim through the air for long distances. They often climb as high as a hundred

feet and then glide down like a bird to another tree.”

“What part of the world do they live in?” asked Bob.

“Some of them live in our country and in Canada,” was the reply. “We do not often see them, because



they are more active during the night than they are during the day.

“These little animals are not afraid of the cold; they do not go to sleep during the winter. They live in about the same way that other squirrels do.”

QUESTIONS

1. What is the purpose of so much activity on the part of squirrels?
2. Name some of the animals that are enemies of the squirrel.
3. What lessons are to be learned from chipmunks?
4. Can you explain why some squirrels are called flying squirrels?
5. Why are the gray squirrels killed by man?



THE CAT FAMILY

Jack and his sister were playing with the cat that their father had brought home. As Jack drew a string slowly across the floor, the cat began to crouch as if he were going to spring.

“Look out,” cried Sister.

Just then the cat sprang and with his sharp claws caught and held the string very tightly.

“How quick he is!” said Sister. “A mouse would have to be very careful with our cat around.”

“Yes, indeed,” said Father. “Nature has given the cat just the tools he needs for getting food. Notice the strong legs, the slender body, and the sharp claws.”

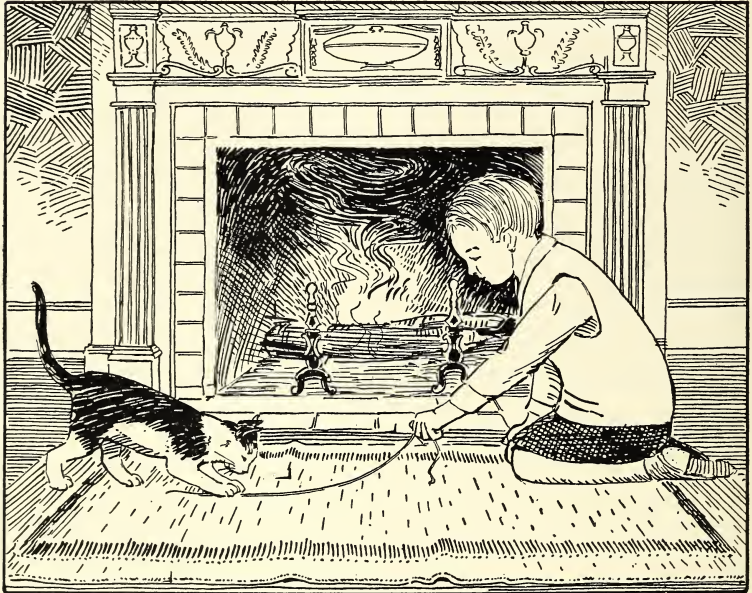
“Look at these little pads on his feet,” Father continued, as he turned pussy over playfully. “Do you know why the cat has them?”

“Oh, that is to make it possible for him to walk quietly,” said Jack. “He can steal up very close to a mouse without frightening it.”

“You will also see that the claws are drawn back into little sheaths when he walks,” replied Father. “These sheaths keep the claws out of the way until needed.”

“I have often wondered why cats have whiskers,” said Sister. “Will you tell us, Father?”

“I am glad you asked,” he replied. “Many people believe that a cat can see in real darkness. This is not



true. He can see better than we can in the darkness, but he cannot see when there is no light at all. The cat does most of his hunting at night when the light is very poor, so he needs feelers.”

“Are the whiskers the same as feelers?” asked Jack.

“That is the real reason for them,” said Father. “They tell the cat when things are in his way so that he will make no noise by bumping into them.”

Father held the cat facing the light, and continued. “You will see that the eyes are not round but shaped like



a football. As I hold him toward the light, the pupil of the eye closes until it is a tiny slit up and down. Now watch as I turn him away from the light.”

“The slits are opening wide,” cried Jack.

“That is to let more light in, I suppose,” said Sister.

“Yes,” Father replied. “In poorly lighted places, the cat’s pupils open very wide. This helps him to see better in dim light than we can.”

“Do all cats hunt at night?” asked Sister.

“Yes. They also hunt at other times,” answered



Father, “but they like to hunt at night best of all. They do a great deal of good by killing rats, mice, and other harmful animals.”

“But they also do harm at times by killing birds,” said Sister. “They are not always as tame as they seem to be.”

“You must expect that,” said Father, “because they really come from a fierce family. They are relatives of

the wildcat. I am sure you have heard of them. Wildcats have habits very much like our little house cat, but of course they are wilder. They hunt their prey and catch it by creeping upon it or waiting and suddenly springing upon it."

"Do they always hunt alone?" asked Jack.

"Almost always," said Father, "but they have been known to hunt in pairs."



"I have heard that the lion and tiger are of the same family," said Sister.

Father told the children that there were many other animals in the same family. Then, placing the cat on the floor, he took a book from the shelf and handed it to Jack, and said, "Read about the leopard, the panther, and the lynx to your sister when you have time. They are very interesting animals. The mothers of these

animals often carry their little ones in their mouths, one by one, to save them from danger.”

“I have seen tame cats do that,” said Sister. “They are alike in that habit.”

“Do all members of the cat family climb,” asked Jack.

“The lion and the tiger do not climb trees as easily as our tame cat and some others of the same family do, but they can climb when it is necessary.”

QUESTIONS

1. What tools has Nature given the cat to help it in hunting?
2. Why do cats have whiskers?
3. Can you name some harmful things cats do?
4. Name several wild animals that belong to the cat family.
5. How does the cat catch its prey?
6. What can you tell about the climbing habits of the cat family?

THE SNAKE FAMILY

“Run, run! A snake!” screamed Molly.

“Stop!” said the hermit. “It is harmless. It is only a garter snake. You have nothing to fear from one of them.”

“I was so frightened,” said Molly. “I thought that all snakes were dangerous.”

“No,” he said. “There are only a few kinds of snakes in our country that can harm human beings. But there are many kinds that are perfectly harmless. In some other countries thousands of people are killed each year by snakes.”

“How do snakes kill people and animals?” asked Bob.

“There are three ways,” was the reply. “Some seize their prey with their jaws and then swallow it alive, some kill it with poison, and others squeeze it to death. The only snakes that are very dangerous to man are those that kill with poison.”

“Do snakes ever eat human beings?” asked Molly.

“I never heard of one doing it,” was the reply. “But one of the large ones, like the python, could very

easily eat a child. There are none of the large snakes in this country.

“A snake has a strange way of eating. One of these little garters can swallow a frog or other small animal that is three or four times as wide as its own throat. He can do this because he can separate his jaws where they join each other. After he has seized an animal, he holds it firmly with one side of his mouth. Then by moving his jaws on the other side he forces the animal backward. He keeps changing from side to side, and finally is able to swallow the animal.

“The teeth of most snakes point backward. This makes it easy for such a snake to draw his prey into his throat. An animal that is once caught by one of these snakes cannot go forward, because the teeth prevent it. It can go backward though.

“If one of these snakes has once firmly seized an animal, he must swallow it, no matter how long it is. Sometimes snakes swallow other snakes that are almost as long as their own bodies. Some snakes in other countries can swallow animals as large as young deer and goats. After such a meal one of these snakes does not have to eat for many days.”

“How does a snake move without legs?” asked Molly.

“A snake,” he said, “has many ribs. Fastened to each rib is a large scale on the under-side of his body.



A snake really walks on his ribs. The scales catch on to the earth or whatever he is moving over and help him along. They work a great deal like the oars of a boat. A snake cannot move when he is on a smooth surface, like glass, because there is nothing for him to catch his scales on to.

“There are many snakes that live almost entirely in the water. They are great swimmers. Most snakes feel at home in the water.”

“I have seen pictures of snakes shooting their forked tongues out at animals,” said Bob. “Can their tongues hurt the animals?”

“A snake can do no harm with his tongue,” said the hermit. “They probably do this to frighten their prey.

“Another strange thing about a snake is that all the skin from his body comes off at once. This happens several times a year. Even the skin that covers his eyes comes off with the rest. Under the old skin is new skin.

“Snakes sometimes protect themselves by pretending that they are dead. The hog-nosed snake has a habit of turning on his back and lying as limp as a rag when he thinks he is in danger. One can then lift him up and carry him around without his showing any signs of life. But if the snake is laid on his stomach, he immediately rolls over on his back again.”

“That shows that snakes do not know very much,” said Molly, “because anyone would know that they were not really dead, if they moved at all.”

“What are some of the dangerous kinds of snakes in our part of the world?” asked Bob.

“The three that are the most dangerous to human beings are the rattlesnake, the copperhead, and the



water moccasin. The ‘rattler’ is the commonest of the three. These snakes all have sacks of poison in their cheeks. This poison passes through two great teeth, called fangs, into an animal that has been bitten.”

“I have heard that a rattlesnake can make a noise with his tail,” said Molly. “Is it true?”

“Yes,” said the hermit. “The rattlesnake can make a rattling sound by shaking the end of his tail. There are hard pieces made of skin that hit together and make the noise.”

“Why does he make a noise?” asked Molly.

“We do not know why he does it,” was the reply. “It may be that he calls other snakes in this way. It may be that by doing this he can frighten some animals so badly that they cannot move away.

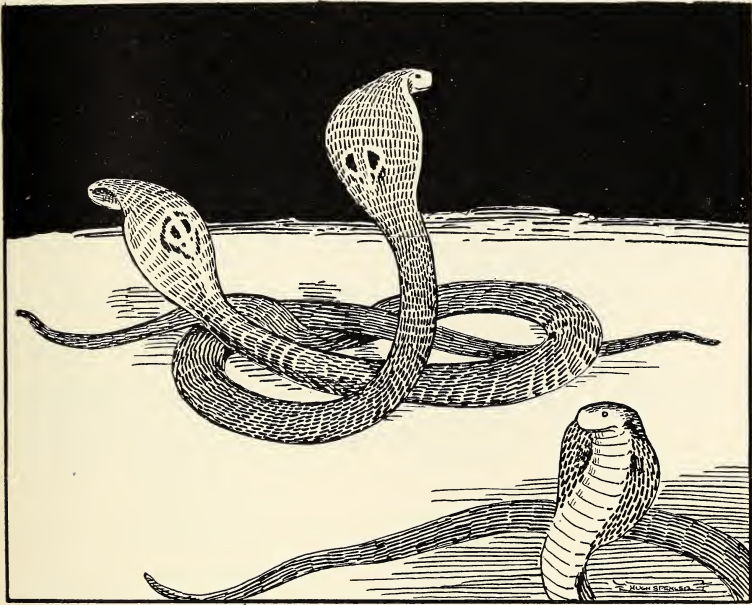
“Some people think he tries to frighten enemies that he is afraid of. This does not seem to be likely, because there are hardly any animals that dare attack the rattlesnake. The pig is the only one that I know of. The rattlesnake’s poison does not hurt a pig.

“Very often in places where there are many rattlesnakes pigs are turned loose. It does not take them very long to clear such places of these snakes.”

“Tell us about the snakes that squeeze their prey.”

“They are called constrictors,” said the hermit. “They wind coils of their body around their prey and squeeze them to death. Some of them are very powerful, as they are over thirty feet long. The python is one of the largest of the constrictors.

“Constrictors are not very dangerous to man, because they do not attack unless they are hungry. The snakes with poisonous fangs attack whenever they are disturbed.”



“What is the most dangerous kind of snake in the world?” asked Molly.

“The cobra,” was the reply. “The cobra has a great swelling just back of his head. Most people think that this is his head. It is usually so decorated that it looks somewhat like a face. When a cobra is angry

he puffs out this swelling, which is called a hood, hisses, and then strikes with his poisonous fangs.”

“Where does the cobra live,” asked Bob.

“In certain parts of Asia, the East Indies, and in Africa,” said the hermit. “The cobra that is found in India is the most terrible of all. Less than fifty years ago about six hundred thousand people lost their lives through snake bites in India in one year. But even now many thousands of people die each year in India from this cause. Other snakes besides the cobra kill people there, but the cobras kill most of them.

“You see, the natives go around barefooted and barelegged. For this reason they have no protection from snake bites, and they do not know what to do when they are bitten.

“In some parts of India and other parts of the world the natives worship snakes. They think that the snakes are gods. Since they believe that the snakes are gods, they think that it is wrong to kill them. This is one reason why there are so many dangerous snakes in some countries.”

“How many people are killed a year in our country by snakes?” asked Molly.

“Very few,” was the reply. “Probably not more than three or four. The rattlesnake, which is the commonest of the dangerous snakes, warns people away by making a noise. Besides, the dangerous snakes of all kinds are being killed off rapidly. And then, too, we are learning more and more about the care of snake bites. This saves many lives.”

QUESTIONS

1. Are all snakes harmful?
2. Can you name some ways in which snakes kill animals?
3. Why do the teeth of some snakes point backward?
4. Can you explain how a snake moves without legs?
5. Name some of the dangerous snakes.
6. Describe the manner in which a cobra attacks.

THE WHALE FAMILY

“Why isn’t a whale a fish?” asked Mary of her mother one day.

“There are several reasons,” was the reply, “but the principal one is the way in which the whale takes care of her babies. You know that baby fishes hatch from eggs, and have to get their own food without any help from their mother. It is different with a baby whale. He lives on his mother’s milk, just as kittens and puppies do.

“A mother whale closely watches over her babies, and guards them against fishes and other whales that would eat them.

“You would never guess that a whale breathes as we do. He cannot stay under water all the time as a fish does. A fish can breathe while under water. But a whale, after he has been under water for a certain length of time, has to come to the surface for air.

“Whales have oily skins. Under this skin is a very thick layer of fat. This fat is called blubber.”

“What is the blubber for?” asked Mary.

Her mother continued, “The blubber keeps the

whale warm. The whale is a warm-blooded animal like a human being. The temperature of our bodies is always about the same. So is the blood of the whale. The blubber prevents the cold water from chilling his blood."

"In what other ways is a whale different from a fish?" asked Mary.

"Most fish have scales over their bodies, but whales have smooth skin. A whale's tail sticks out on each side. A fish's tail points up and down."

"Why does a whale's tail point sideways?" asked the little girl.

"The whale often goes down very deep in the water," answered her mother. "He uses his tail to help bring him up to the surface quickly.

"There are other differences between a whale and a fish. I will not tell you about any more of them now because, if I do, you may not remember any of them.

"Men who study about the lives and history of animals believe that the whale was once a land animal. They think that he once had legs. If they are right he must have looked like a giant frog. These men think that something happened to the earth, so that the whale

could not get enough food. So he left the land and began living in the water. But we do not know much about it.”

“Do whales ever kill each other?” asked Mary.

“Some of them do,” was the reply. “There are several different kinds of whales. Some are savage and some are peaceful. I will tell you about the peaceful ones first.

“The whalebone whale is one of the largest. Some of them grow to be nearly a hundred feet long. They have great mouths, which are sixteen or seventeen feet long and seven or eight feet across.”

“It must take a lot of food to feed a whale,” remarked Mary.

“It does,” was the reply, “but you will be surprised to learn that these whales eat only small animals. They have no teeth. They have great strainers instead.”

“What do you mean by strainers?” asked Mary.

“The strainer is a mass of long narrow bones that hang down from the roof of the whale’s mouth. These bones are side by side and act like a sieve.

“When the whale wants to eat, he opens his mouth and fills it with water.

“Little animals that are in the water that he has taken into his mouth cannot get out because the strainer holds them back. The whale then lets the water go out of his mouth, and swallows the little animals.”

“Are there many little animals in the water?” asked Mary.

“Oh, yes, there are many different kinds. The principal food of the whale is jelly fish. These animals travel in great numbers near the surface. When a whale runs into them he has no trouble getting all he wants to eat.

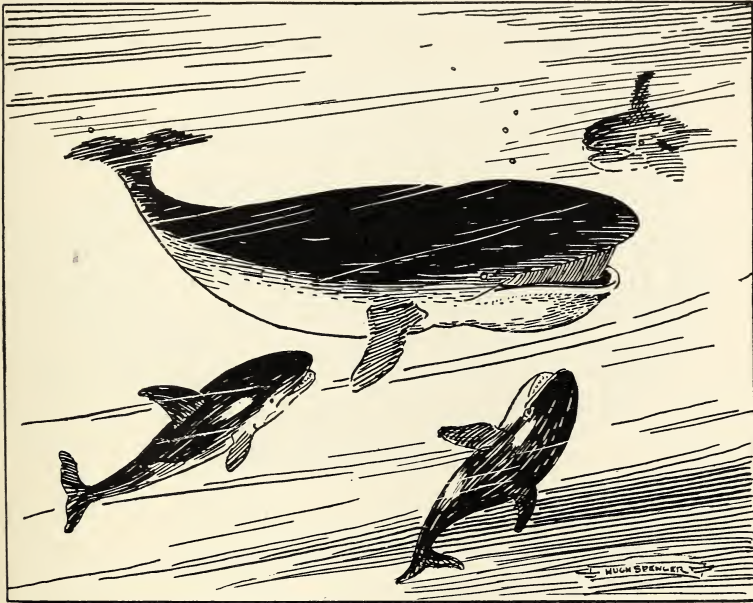
“Another kind of whale is the sperm whale. Instead of having a big strainer in his mouth he has teeth, but only on his lower jaw.”

“Does the sperm whale eat other whales?” asked Mary.

“No,” replied her mother, “the sperm whales do not eat other whales, but they do fight with each other sometimes. Once in a while the jaws of two of these whales get locked together so tightly that the whales are not able to get them apart. When this happens, both whales drown.

“There is a little whale called the grampus. He

has teeth on both jaws and is a very savage animal. He is about twenty feet long when grown. Several of these 'killers,' as these whales are sometimes called, attack



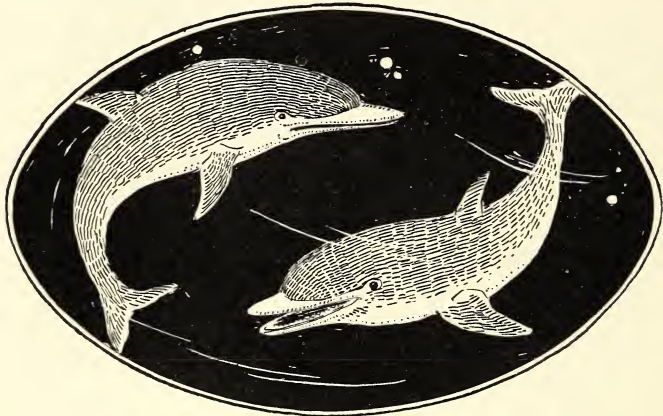
one of the large whales. They usually succeed in killing him, after they have tired him out."

"Why do they kill him?" asked Mary.

"The grampus lives on other animals," answered her mother. "They kill the large whale that they may eat him."

“Why do men kill whales?” asked the little girl. “I have seen pictures of men hunting whales.”

“There are many things that men get from whales,” explained her mother. “The whalebone is very useful for different purposes. Oil is obtained from the blubber.



Within the head of the sperm whale there is a kind of oil called spermacetti. This is used for making candles and other things. The sperm whale also sometimes has a substance in his body called ambergris. This is very fragrant and is put into perfumery to retain the odor. The things that can be obtained from a single whale are worth a good many thousands of dollars.”

“Are there any other animals like the whales?” asked Mary.

“The dolphins are cousins of the whales. They are about seven or eight feet long when grown. They have very long bill-like mouths that have over a hundred teeth in them.

“The porpoise is another cousin of the whales. He is a little smaller than the dolphin. He has not such a long mouth, and he has fewer teeth.

“Both of these animals take care of their babies in the same way that the whale takes care of hers. They breathe in the same way and they have smooth skins in place of scales. There are still other members of the whale family, but I must stop now as it is getting late, and you must go to bed.”

QUESTIONS

1. Why do we say that the whale is not a fish?
2. How does the whale differ from a fish?
3. Describe the ways in which some whales get their food.
4. What are some of the things men get from whales?
5. Tell about some other members of the whale family.

BIRDS AND THEIR HOMES

“What a wonderful day for a hike,” said Jack. “Do you think Father will take us?”

“We can ask him,” Sister replied.

The two children disappeared into the library. Father was willing, so they soon started for the open country.

Many little sparrows were busy hunting for food in the street as they passed, and Jack talked to his father about their home habits.

“They build their nests almost anywhere,” said Jack, “but they like the spaces behind shutters, and under the eaves of the roof best.”

“That is because there is protection from the wind and the rain in such places,” said Father. “All birds do not build their homes in the same kinds of places. The night hawk likes flat open spaces.”

“Do night hawks come near the city?” asked Sister.

“Yes, indeed,” said Father. “If you will watch late in the afternoon, you may find one flying high over the city. Perhaps she is looking for a place to lay her eggs. The eggs are often laid upon a flat roof.

“Although they are called night hawks, they also fly a great deal in the daytime. Their call is more often heard at night than in the daytime. For that reason they are called night hawks.”

“I thought all birds built nests,” said Brother.

“No,” said Father. “There are many birds that do not build nests. The prairie hen and some of the owls lay their eggs in small hollows in the ground.”

“We know that there are many birds that have their nests on the ground,” said Sister. “While we were on the farm last summer we found many old nests in the open fields.”

“It was great fun looking for them,” said Brother. “We found five different kinds of nests in one day.”

“What kinds were they?” asked Father.

“There was an old quail nest,” said Brother. “Cousin called it a bobwhite’s nest. It was loosely constructed of grasses, weeds, and straw. There were no eggs in it, but Cousin told us that the quail’s eggs are white, and that sometimes as many as twenty-five eggs are found in a nest.

“We found another under an old log. It was made of sticks and short grass. Some feathers from the mother

bird were in it also. I guess they were there to make a soft place for the eggs. Uncle told us that these nests are seldom found in the eastern section of the country, although at one time there were many of them there."

"What kind of bird made it?" asked Father.

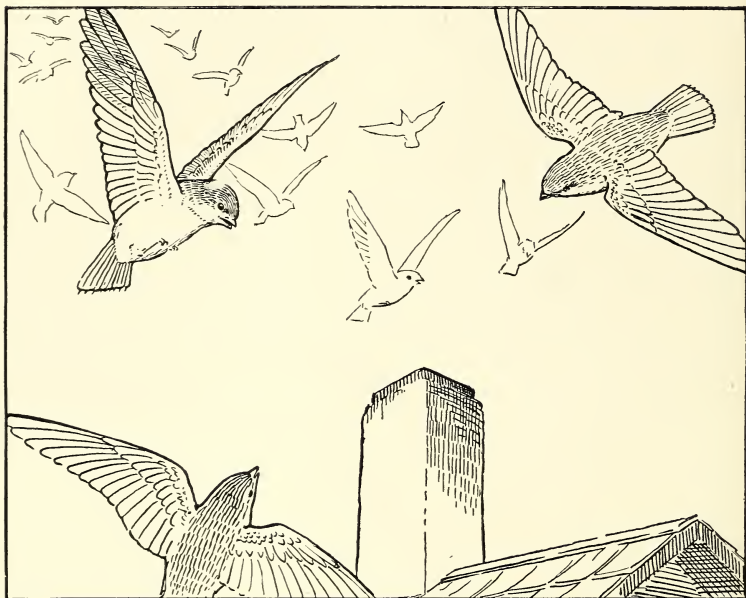
"It was the nest of a short-eared owl," replied Brother. "I took it to school and the teacher showed it to all the pupils.

"But the nest which I thought the nicest was found in a little hollow in the ground. This nest had an old egg in it. Corn leaves and dry grass were used to make the nest. Uncle told us that it was the nest of a bobolink. He also told us that the bobolink sometimes makes two or three nests in a season, and that the first is usually the best. I'm sorry the little gray egg with chocolate patches did not hatch. Perhaps the mother left the nest too long and the egg grew cold."

Sister said she had seen the home of a song sparrow in the park, which was very much like that of the bobolink.

"I must show you the nest of a chimney swift," said Father. "There is one in the chimney of the old house near ours. It is made of short sticks fastened together

with a kind of glue. This glue comes from the bird's mouth during the nest-building season. It is said that the bird breaks the sticks from trees for his nest while he is flying."



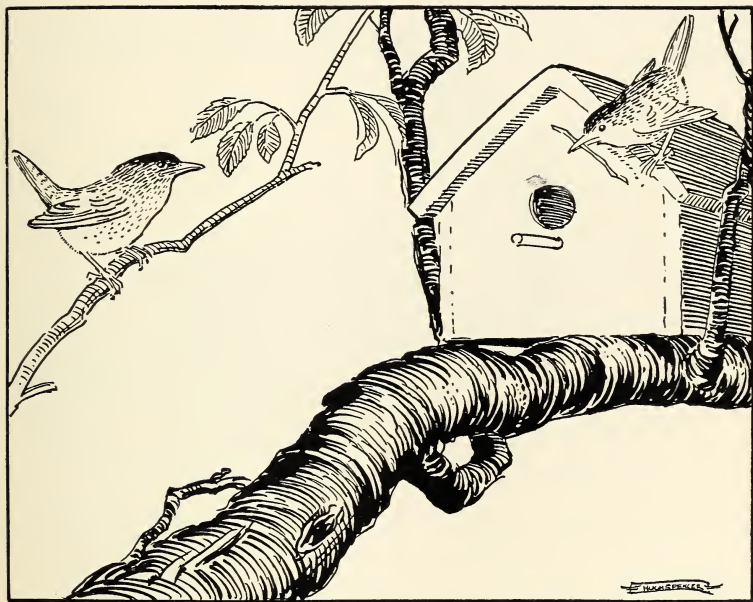
"Does the chimney swift always build his nest in a chimney?" asked Sister.

"Almost always," said Father.

"What did they do before there were any chimneys?" said Sister.

“I suppose they used hollow trees,” was the reply.

“I have often watched them,” said Sister. “They are of a dusky color and have short square tails. They did not fly with both wings going up and down at the

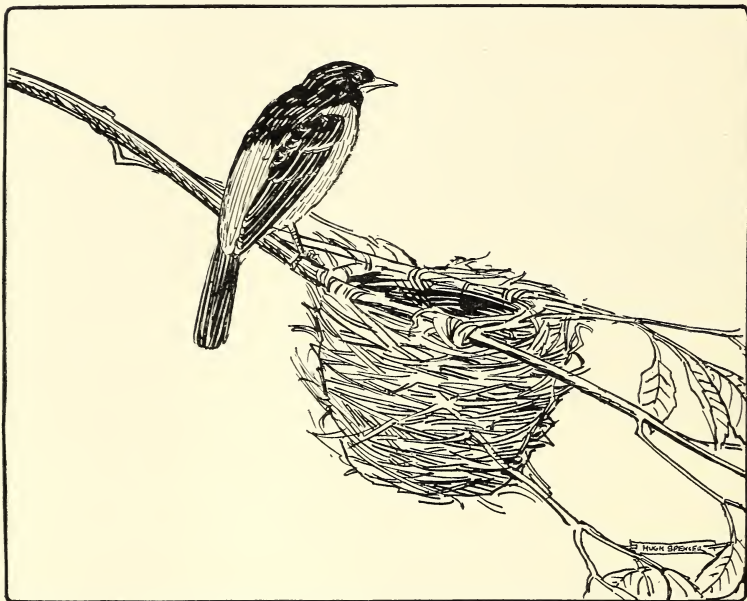


same time. They seemed to move their wings, in flying, as we move our legs in walking, first one, then the other.”

“A little house wren built a nest in a birdhouse which we made in our class at school,” said Brother. “The house had only one little round hole for the wren to go

in and out through. The nest was made of hay and feathers.

“We looked at it one day when the mother had gone



for food. There were seven little white eggs with brown spots on them.”

“One day we found an old bluebird’s nest in an apple tree on the farm,” said Sister. “It was in a hollow in the tree. Some birds like to have their homes well protected.”

“That orchard had some wonderful nests,” said Jack.

“I remember the orchard oriole’s nest. It was very hard to see because it was made of fresh grass. It matched the leaves very well. It was woven like a basket and the rim was laced to the branches and to the leaf stems.”

“It was nicely done,” said Sister, “but the hanging nest which Cousin showed us was really wonderful. It was made of grass strings and even had two or three strips of cloth woven in. It hung just at the end of a branch, and I thought what a fine swing the young orioles would have. It did not look strong enough to stand a good storm, but it is still hanging there.”

“It was very easy to see the nest,” said Jack, “but we could not see the eggs. Do you know anything about the eggs of the oriole, Father?”

“I think,” said Father, “that the oriole lays eggs that are colored a light gray with light purple lines. You can see some of them in the collection at the Museum.”

“Perhaps I could have seen the eggs with the help of a ladder,” said Jack. “I would rather see them that way.”

“Many nests can be found in the bushes and vines,” said Father as they prepared to go home. “The purple grackle, the red-winged blackbird, the little peewee, and many of the sparrows prefer such places.

“Next Saturday, we will roam through the park and look for nests,” he continued.

“That will be fine,” shouted Sister and Jack, as they started for home.

QUESTIONS

1. Where does the sparrow like to build its nest? Why?
2. What can you tell about ground nests?
3. Name some birds that build their nests on the ground.
4. Describe some nest that you have seen in trees.
5. Why do some birds prefer to build nests inside of trees?
6. What birds build nests in bushes and vines?

BIRDS OF PREY

"Hawk! Hawk!" shouted Cousin as he ran for his gun.

The chickens scattered in all directions as they looked for shelter.

"Where is it?" asked Jack, shading his eyes with his hand.

"I see it now, circling just above the barn. Quick, Cousin, or it will be gone."

Just then there was a swift flight downward, and in a moment the hawk had a small squawking chicken in its talons. Very rapidly it mounted higher and higher.

"You are too late," said Jack, as his cousin appeared in the doorway. "He is almost out of sight."

"That is the third chicken taken by the hawks this week," sighed Cousin. "They are certainly swift birds of prey."

"Are there many birds of prey?" asked Sister.

"Not in this neighborhood," answered Cousin, "but there are many that belong to this class."

"I know the eagles are birds of prey," said Jack. "They are much larger than hawks and much stronger."

“Father told us that they often carry off young pigs and sheep,” said Sister. “They must be very large.”

“I have seen an eagle that was three feet high and nine feet across its wings when spread,” said Cousin. “They are very hard to get, because they live in places that are hard to reach.”

“I suppose they have powerful beaks to tear the flesh,” said Jack. “I would like to see one.”

“All birds of prey,” replied Cousin, “have some things in common. They nearly always have strong talons like hooks, strong beaks, and powerful wings.”

“Would you call the owl a bird of prey?” asked Sister.

“Yes, indeed,” said Cousin. “The owl is one of the birds that hunt at night. There are others of this kind. They feed on smaller animals, such as mice, rats, and young rabbits.”

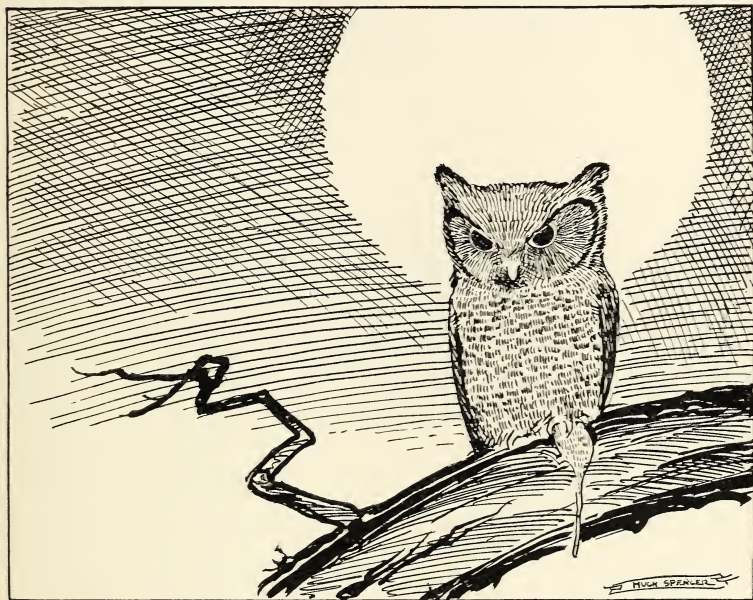
“In our geography there is a picture of a condor,” said Jack. “The condor is somewhat like the eagle, but its talons are not as strong.”

“It differs also in the fact that it does not kill its food,” added Father, who had just arrived.

“The condor will circle for hours above an animal

that is dying. As soon as life passes, the condor will swoop down and devour it."

"I have heard," said Cousin, "that the ranchmen in some places have great sport lassoing these birds."

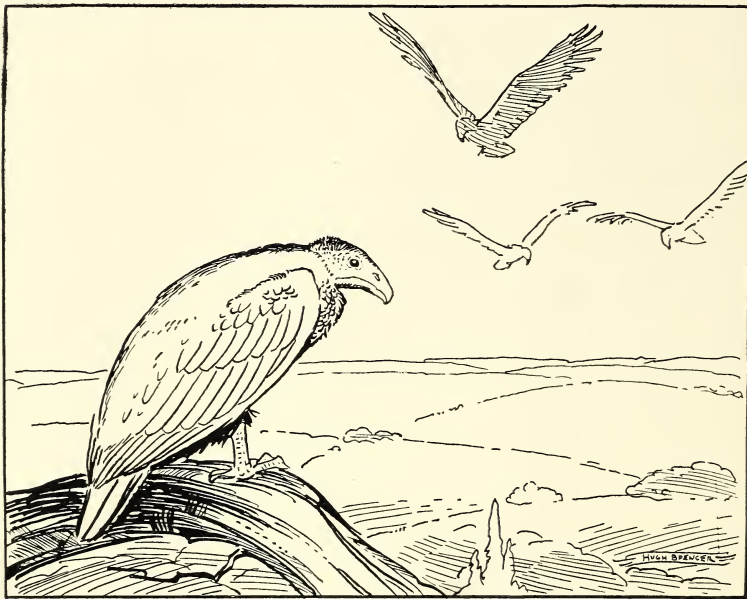


"I do not understand how that can be possible," said Sister.

"It is because the condors are so greedy," said Father. "They eat and eat until they become heavy and inactive. The condor usually runs a short distance

before it begins its flight. But after a heavy meal these birds do not move so swiftly."

"Do the vultures belong to the same group?" asked Sister.



"They do," Father continued, "but the vulture feeds on carrion."

"What is that?" asked Sister.

"Carrion is meat that is partly decayed," said Cousin.

"Some of the eagles do not live on meat," said

Father. "The bald-headed eagle is a fish-eater. It does not always hunt its own fish, but likes to steal from others."

"How does it do that?" asked Jack.

"Well," said Father, "the bald-headed eagle will dart after an osprey, another kind of bird, when it has caught a fish. The osprey gets frightened and drops the fish in order to get away quickly. But the bald-headed eagle, with a rapid swoop, catches the fish before it lands in the water."

"Why are they called bald-headed?" asked Sister.

"It is because the head and upper part of the neck are covered with white feathers," said Cousin. "From a distance the eagle looks bald. If you will look at the picture in this book, you will see why that name was given these birds."

Jack took the book and started to turn the pages.

"There are many pictures of falcons here," he said.

"Are they also birds of prey?"

"Oh, yes," said Father. "Have you never heard of hunting with falcons? In olden days these birds were trained to catch other birds. They wore hoods over their heads and went after the first bird they saw when the hood was taken off."

“It is the nature of falcons to hunt,” remarked Cousin. “So man took advantage of that and trained them to hunt for him.”

“Look, everybody! Here is the picture of a sparrow hawk! We have seen many of them here on the farm,” cried Jack in excitement.

“But I have never seen one actually catch a sparrow,” said Sister. “Now tell me, Father, do they really eat sparrows?”

“They do indeed!” said Father. “They eat little snakes also.”

“They eat thousands of insects that are harmful to the crops,” said Cousin. “I have asked my neighbors not to shoot them. We really could not get along as well without the sparrow hawks as with them. They are indeed very useful to man.”

“Well,” said Jack, “I guess that there will be no more chickens stolen today, so let’s go into the house and read this book on birds of prey that Cousin has given us.”

QUESTIONS

1. What is a bird of prey?
2. Name some of the characteristics of birds of prey.
3. What are talons and how are they used?
4. Explain what is meant by carrion.
5. What birds feed upon carrion?
6. Name some of the other birds of prey.
7. How has man used the falcon?



INSECTS THAT CARRY DISEASE

A little fly had come through the screen and Father was chasing it with a swatter.

“It seems a shame to kill a little fly,” said Sister. “Do they do so much harm?”

Bang! went the swatter. As Father turned after killing the fly, he told about insects that carry diseases.

“It has been proved,” said Father, “that the house-fly is one of the worst insects for carrying diseases. Perhaps you do not know that typhoid fever and tuberculosis are spread by this insect.”

“But how do they carry disease?” asked Sister.

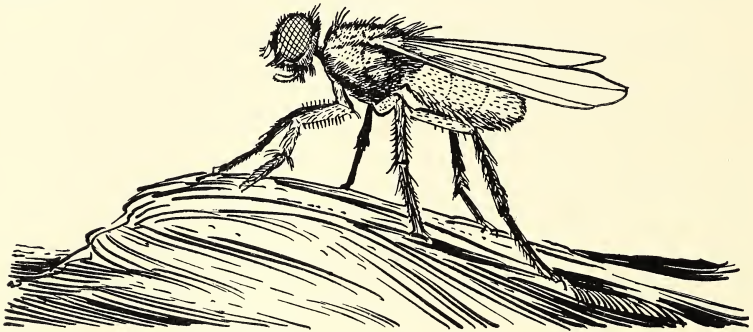
“The fly breeds in filthy places,” said Father. “Its little hairy feet are covered with hundreds of germs. These germs are gathered as it walks through refuse of all kinds. It then comes through open windows or doors and alights on our food. Many of these disease germs are then left on the food which we eat.”

“Yes,” said Jack, “that is the reason it is necessary to screen our windows.”

“The fly not only carries germs among these hairs,” said Father, “but its little tongue has many ridges in

which germs are carried. This is one of the ways that tuberculosis is spread.”

“I have read,” said Brother, “that there is much less typhoid fever now than there used to be. I guess this is because we have learned to protect ourselves from flies.”



“But flies are only one of the many kinds of insects that carry disease,” said Father. “For many years people believed that malaria came from breathing the damp night air. Science has proved that if there were no mosquitoes, there would be no malaria.”

“Will you tell us how malaria is carried by mosquitoes?” asked Sister.

“The mosquito does not carry these germs in the same way that the fly does,” said Father. “The mosquito must first bite a person who has malaria. It sucks

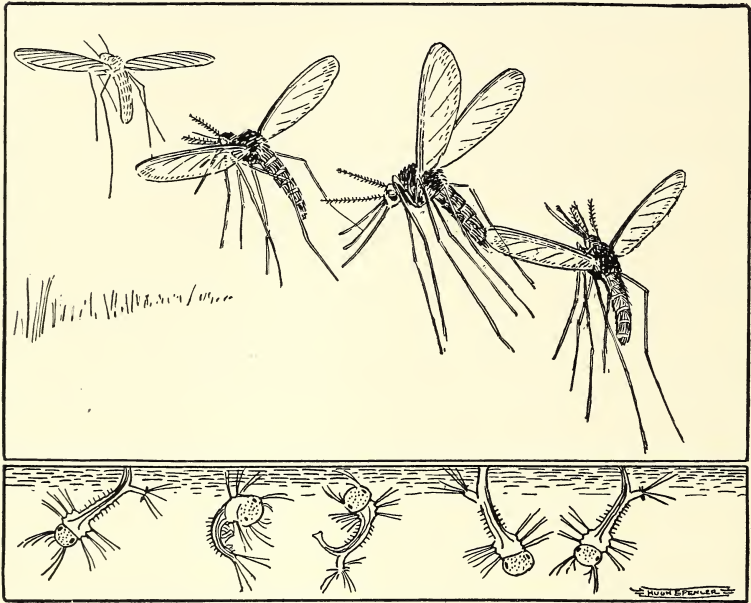
the blood from the body of the malaria patient. When the mosquito bites another person, it gives these malaria germs to the one who is bitten. This germ multiplies in large numbers in the blood, and soon the person bitten has chills and fever. We can prevent the spread of malaria by properly taking care of persons that have the disease and by destroying the insects that carry it."

"It would take a great many fly-swatters to kill all the disease-carrying insects," said Sister. "I don't see how it could be done."

"Men have tried many ways of ridding us of the mosquitoes, which are producing good results," said Father. "You know that mosquito eggs are laid in water. When they hatch, they become wrigglers. These must have air in order to live, just as you and I must have air. Kerosene is put on top of the water in swamps and other places where mosquito eggs are to be found. When the little wriggler comes up to breathe, the kerosene makes a coating over the tubes that he breathes through. The wrigglers die, because they are not able to get air."

"That seems to be a good way to get rid of mosquitoes," said Jack. "Why is it that there still are mosquitoes?"

“Because,” said Father, “there are thousands of swamps that have not been treated with oil, and besides there are many careless people in the world.”



“What have careless people to do with it?” asked Sister.

“They often throw cans and other things on the ground. Water collects in them when it rains. This makes the finest kind of place for breeding mosquitoes.”

“Our teacher told us,” said Jack, “that many people

died from yellow fever before it was found out that mosquitoes were the carriers of this disease.”

“Yes,” said Father, “there are many other diseases carried by insects. In some parts of the world, many people die from a disease called the bubonic plague. This disease is carried by fleas. When people learn to protect themselves from fleas, there will be less of this disease.

“These fleas are carried by rats. When ships come from the Orient they often carry rats infested with plague-bearing fleas. The tsetse fly, which lives in South Africa, spreads sleeping sickness. There is not much known about this disease as yet, but science has done a great deal in discovering one of the main ways in which it is spread. The Texas fever, which kills thousands of cattle and causes much loss of money, is carried by a tick. The government is spending a great deal of money to destroy this tick.”

“Do we know all the insects that carry disease?” asked Sister.

“No, indeed,” answered Father. “There is a great deal of work to be done in finding out what other diseases are carried by insects, and which insects carry

them. In some of our western states, the spotted fever is carried by ticks. Probably many other diseases could be prevented if we knew more about insect life."

"I am very glad you killed the fly," said Sister. "I am sure I shall do all I can to help the cause of health."

"I also," said Brother, as he picked up a fly-swatter. "It does not seem bad to kill these insects now."

QUESTIONS

1. What are some of the diseases spread by the house-fly?
2. Can you explain how the fly spreads disease?
3. What are some of the methods used for getting rid of mosquitoes?
4. What disease is spread by the flea?
5. How is progress being made in the control of disease?

FRESH-WATER FISH

Jack, Father, and Sister had been out on a picnic, and they had started home early.

They had plenty of time to play along the brook and they found many interesting things.



“I wish I had brought a fishpole,” said Jack. “Look at the shiners here! Notice how they flash in the sunlight.”

“Perhaps that is why they are called shiners,” Sister replied. “The scales are almost silver in color. I would not want to see you catch any. They are too small to be used for food.”

“I would not catch them for eating,” said Jack. “They would be fine bait to go fishing with in the lake.”

Bass and pickerel eat many of these shiners. They feed upon frogs and insects also, but Father says the shiner is the food they like best."

"They have very little chance of getting away," said Sister. "It would be hard for such shiny fishes to hide from a hungry bass."

"They protect themselves by swimming close to the shore where the water is very shallow," said Jack.

"Yes," replied Father, joining in the conversation. "They also like to feed near the lily pads and other water plants that grow in the shallow water. If you will look carefully the next time we go out on the lake, you will find them in groups swimming around these plants. Such groups of fishes are called schools."

"There is a sunfish," whispered Jack all excited. "Do you think we could get him with a pin hook?"

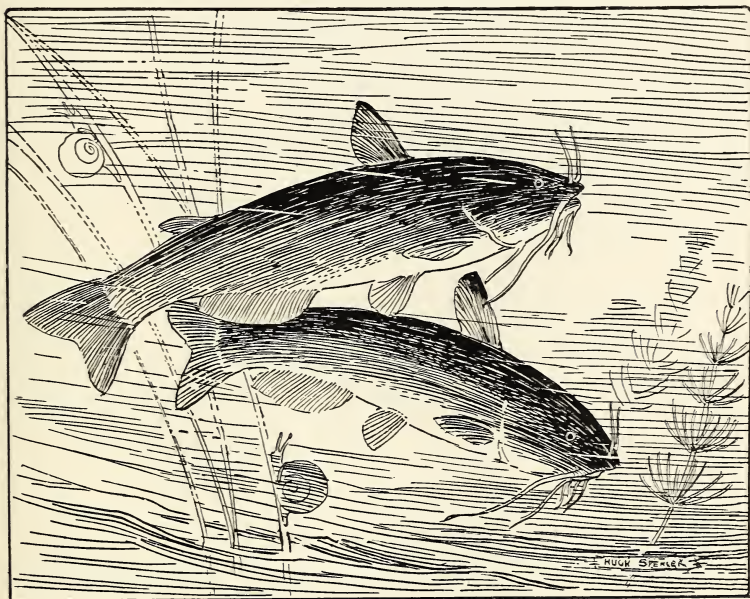
"I think it would be better to go down to the lake and fish," said Father. "We can hire a boat and fishing tackle."

The children were glad to go. After a short walk they came to the boathouse, where Father hired a boat, three fishpoles, and bought some worms for bait.

"We will keep away from the end of the old dock,"

said Father. "The bottom of the lake there is very muddy. We might get some bullheads or eels there, but we are not looking for them."

"A bullhead is called a catfish by the boys," said Jack. "You must be very careful when you take them

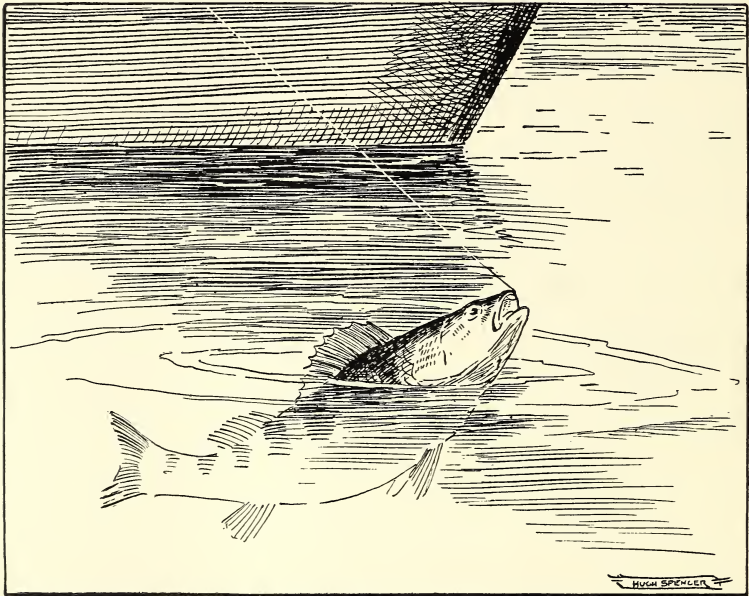


off the hook, or they will prick you. Their back fins are very sharp."

"Yes," said Father, "that is true. I would like to go out farther, where the bottom is sandy and somewhat cleaner. We will look for a school of perch. Perch

are very fond of worms and perhaps we will be able to catch some.”

Very soon some perch were found and it was not long before Jack caught one.



Holding up the fish, Father said, “You will notice that the fish has really three parts. There is a head, a body, and a tail.”

It has no neck,” exclaimed Sister. “I never thought of that before.

“I know that the tail gives most of the power for

swimming," remarked Jack, "but what are the side fins for?"

"They help the fishes to balance themselves," answered Father, "so that they remain right side up. They are also useful for steering. A fish breathes by means of gills," added Father, as he pointed to the slits just behind the head. "Almost all fishes breathe with gills."

"Have they no teeth?" asked Sister.

"Oh, yes," said Father. "You notice that this perch has many sharp teeth. They prevent little animals from escaping when taken into the mouth. Fishes do not use their teeth for chewing their food. They swallow it whole."

"But where are the ears?" asked Jack.

"There are no ears on the outside of a fish," replied Father. "There are ears on the inside that are used for balancing rather than for hearing."

"That is very strange," said Sister. "I suppose fishes do not need ears as much as animals do."

After they had fished quietly for a while, Father remarked that spawning time would soon be here.

"What is that?" asked Jack.

“Spawning time is egg-laying time,” replied Father. “Fishes lay many eggs. Thus Nature makes up each year for the fishes that are caught and killed by others. Some fishes lay as many as eight million eggs a year, but often only a few of all these eggs are hatched. That is why we have many kinds of fish protected by law. The trout may be caught only at certain times, and but few may be caught each time.”

“Well,” said Father as they started back with four fine perch, “we will have these for dinner. From very early times fish has been important as a food for man.”

QUESTIONS

1. What kind of fishes likes to eat shiners?
2. Can you explain what is meant by a school of fishes?
3. Where is the catfish or bullhead found?
4. What are the three main parts of a fish?
5. Explain how a fish breathes.
6. Where are a fish's ears, and how are they used?

LESSONS FROM ANIMALS

“I wonder, George, if you have ever noticed how carefully your dog chooses his food. There are certain things that he never touches. and others that he always eats.”

“Yes, Father,” was the reply. “Whenever we give him stew, he searches for the things that he likes and leaves the rest. I have often tried to make him eat fruit and many other things, but he never will.”

“A dog’s body,” said his father, “is so made that it needs certain kinds of food. There are other foods that his body cannot use. He needs meat, but he does not need fruit.”

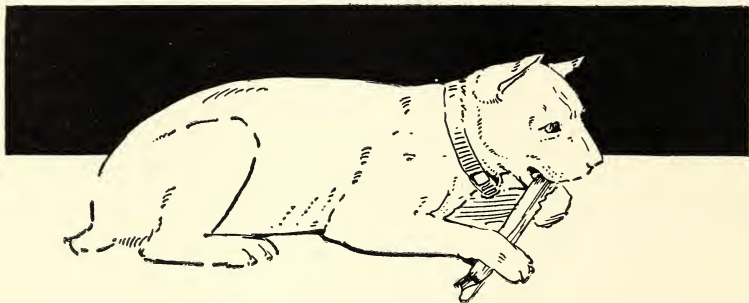
“I remember,” said George, “his teeth are made for tearing meat. That shows that meat is the kind of food that he needs.”

“Cats,” continued his father, “are just as particular about their food. Their bodies also require meat.

“Our horse also picks his food very carefully. If you mix things that he does not want with his oats or hay, he eats the oats and hay, but leaves the other things.

“The thing that I want you to notice is that

these animals do not eat everything that is thrown their way. They are particular as to their choice of food. That is more than can be said about human beings. Little boys and grown-up boys eat many things that should never be eaten."



"My dog likes candy," said George. "Should dogs eat it?"

"Too much candy is not good for dogs," answered his father. "Don't you remember how sick Rover was about a week ago after he had eaten taffy?"

"I remember," said George. "He looked just as I feel after I have eaten too much candy. But why did he eat it? I thought you said that animals do not eat things that are not good for them."

"Candy is not a natural food for a dog," said his father. "Dogs learn to eat candy because they live with

human beings. If you had offered him meat at the same time that you gave him the candy, he would have eaten the meat. When animals are very hungry they will eat things that they would not otherwise touch.

“Human beings eat almost anything at any time whether they are hungry or not. So you see that the dog is wiser in his choice of food, even if he does eat the wrong things sometimes.

“You have probably noticed that horses and cows eat very slowly. They chew their food very thoroughly. If they did not, it would not only do them no good, but it would make them sick.

“Grain needs to be chewed because around each kernel is a hard tough coat. The animal’s body cannot take care of it unless this covering is broken. Hay and grass also must be crushed, or the body could not take care of them. Besides, they must be mixed with the saliva in the mouth, or they could not be swallowed and used by the body.”

“What is saliva?” asked George.

“It is a fluid that pours into the mouth when we eat. It mixes with our food and puts it into a condition so that it can be digested.”

“But I don’t know what you mean by being digested,” said George.

“I mean that it is mixed with certain fluids that so change it that it can become part of the body.”

“But dogs do not chew their food the way horses do,” said George. “They just swallow it whole.”

“Meat is different from grain and such things,” said his father. “There are no hard sheaths around it like those around grain. Some saliva is mixed with the meat in the mouth, but there are other fluids in the stomach that take care of it.”

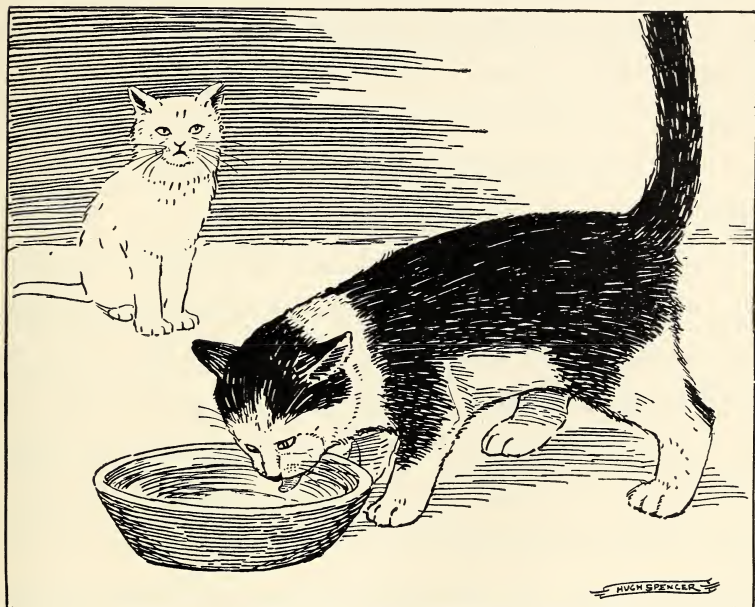
“Then it is all right to swallow meat without chewing it,” said George.

“Human beings should not swallow meat as dogs do,” said his father. “Meat is the natural food of dogs. Human beings need many kinds of food. So you can see their bodies have to take care of it differently. It is necessary for us to chew all of our food, except, of course, such things as fluids, which cannot be chewed.

“Another thing that you probably have noticed is that animals drink plenty of water. The bodies of all animals, including man, contain more water than any other thing. It is mixed with other things in such ways

that you would not recognize it as water. But it is there just the same."

"I know my dog and kitty both drink lots of water,"



said George. "They make a big fuss when their saucer is empty."

"Animals drink water between meals and while they are eating," continued his father. "But there is one thing that I hope you will notice. They never fill their mouths with food, and then wash it down with water. I have seen a certain little boy do that many times. He

does it most frequently when he is eating something that he does not like very well, like spinach.”

“What harm does it do?” asked George.

“It prevents the food from being mixed with saliva,” answered his father. “As I said before, food cannot be digested properly unless there is saliva mixed with it.”

“Why is water so necessary to our bodies?” asked the little boy.

“The water in our blood carries needed substances to every part of our bodies. It also carries away things called waste that are not needed. Besides, there is water in everything of which we are made.

“In the summer we need more water than we do in the winter, because we perspire more then. Perspiration, which is nothing but water and waste, cools us off. If it were not for our perspiration we would become too hot.”

“What happens to the waste in winter when we do not perspire?” asked George.

“We perspire in winter as well as in summer,” replied his father. “But we do not perspire as much when it is cold. There is not so much danger then that we will get too hot.

“A story is told of a little boy who lived many years ago. His people put gilt all over his body so that he looked like a golden statue. Then he rode through the city in a chariot, and everybody said, ‘How beautiful he is!’ But the little boy’s body could not stand such treatment, and he lived only a short time.”

“What did the gilt do?” asked George.

“It prevented the perspiration from leaving his body,” said his father. “The waste in the perspiration that could not get out poisoned his body.”

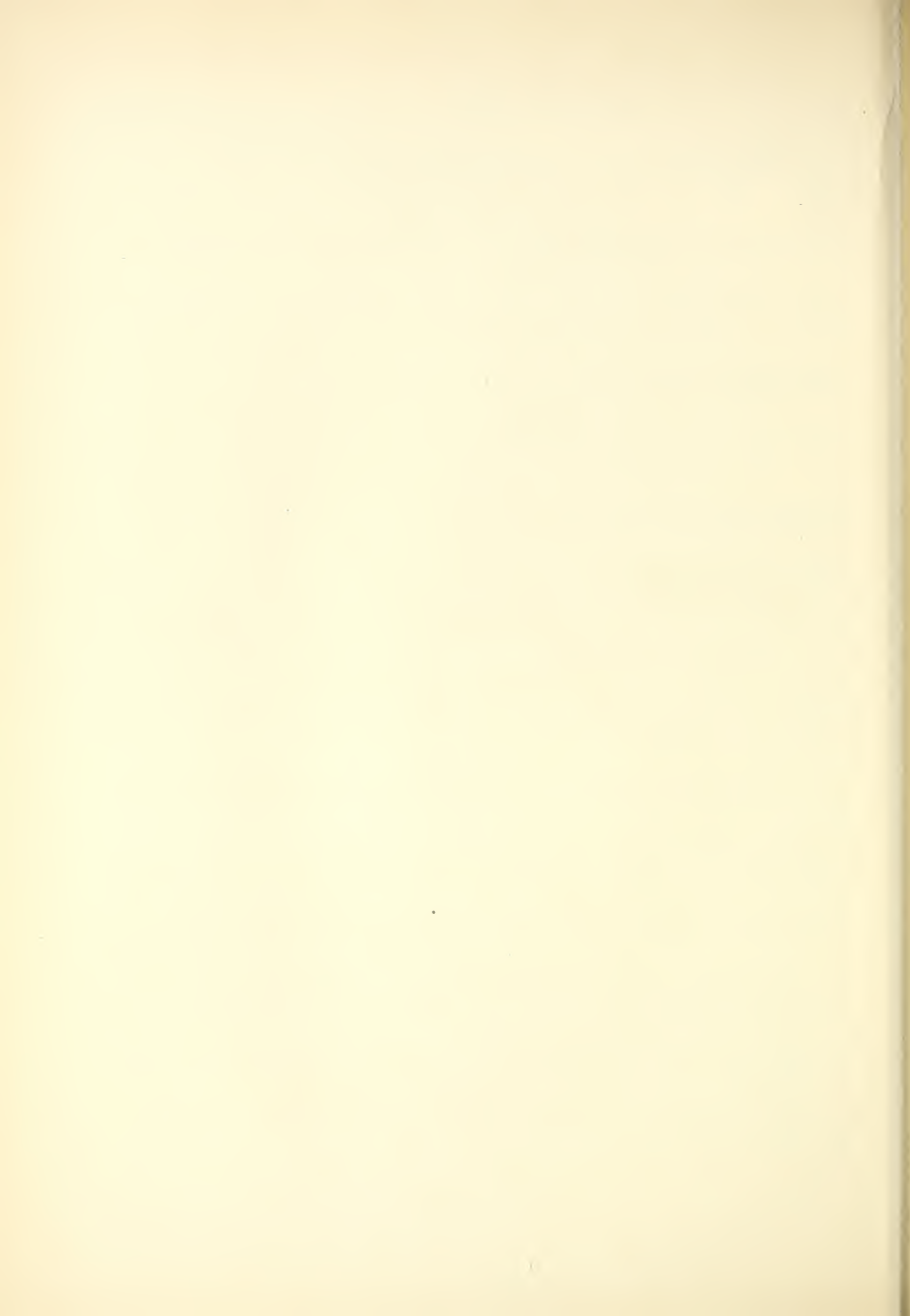
“Do animals perspire too?” asked the little boy.

“Some of them do and some do not,” his father said. “The animals that do not perspire have other ways of getting rid of waste.”

“I will try to follow the example of the animals and drink more water, and be more careful as to how and what I eat,” said George.

QUESTIONS

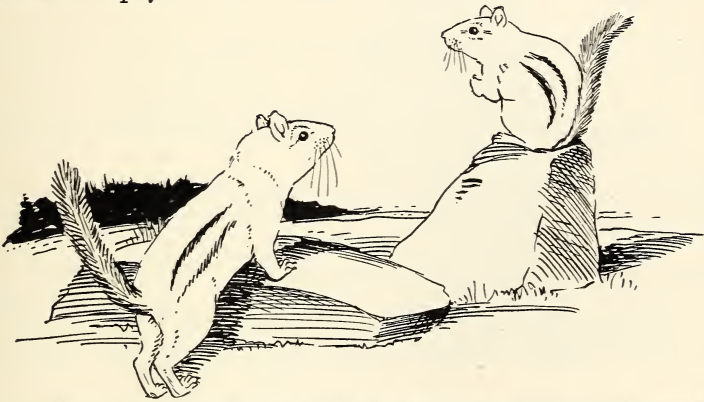
1. What kind of food is required by dogs and cats?
2. Why do different animals eat different kinds of food?
3. Why should we chew our food thoroughly?
4. Explain what is meant by digestion?
5. Why should we not wash our food down with water?
6. What is perspiration and why is it necessary?



ANIMAL PETS

“Where is Rover?” asked George’s father one morning.

“He is out on the back porch sleeping in the sun,” was the reply.



“Have you ever noticed that many animals love the sun?” said his father.

“Yes,” said George. “The chipmunks seem to be always out when the sun is shining brightly. Many birds, too, do not mind how hot it gets. It seems to make them happy.”

“The sun is a wonderful thing,” said his father. “All the heat, light, and power that we have come from it.”

“I remember,” interrupted George, “that it is the sun’s rays that make it possible for plants to make their food. There would not be any plants if there were no sun.”

“The rays of the sun are very powerful,” continued his father. “Even on a day that is cold, when the sunlight does not seem very warm, its rays are at work just the same.

“Do you remember any of the things that the sunlight does for our bodies?”

“I know that it kills the little plants, called bacteria, that are in the air and upon us,” was the reply.

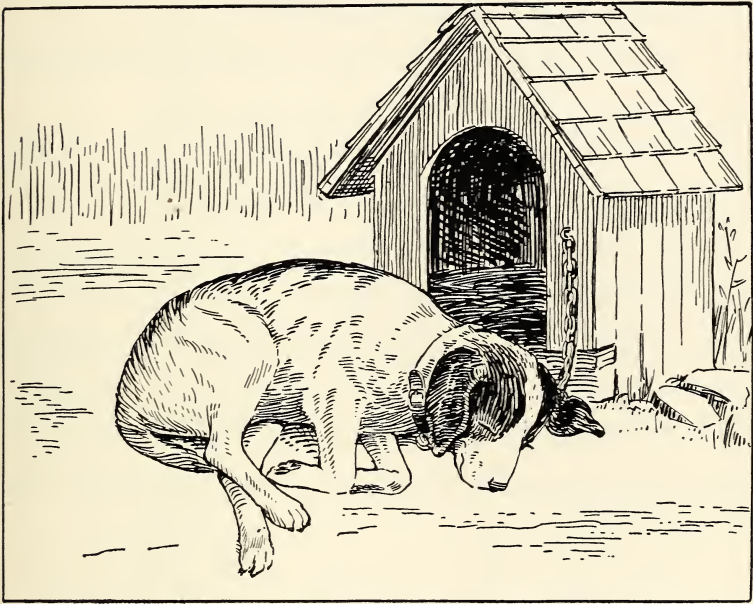
“There is another thing that you must not forget,” said his father. “Some of the rays of the sun give us vitamins. These are things which make our bodies grow properly. We can also get them from green vegetables and other kinds of food. No one who does not get enough vitamins can be in very good health. They are just as necessary as anything that we eat.”

“What are vitamins?” asked George.

“I will not try to explain now what they are, because you would not understand. You will study about them when you are in the high school. All you need to know

about them for the present is that they come from the sunlight and certain foods.

“Can you think of anything else that you can learn from Rover?” continued his father.



“He sleeps a lot, if that is what you mean,” replied the little boy.

“Yes,” said his father, “he spends a great deal of time sleeping. Animals need a great deal of sleep, and so do little boys. You know how it is with yourself. When you stay up late at night it is very hard to get up

in the morning. And when you do get up you feel cross and tired.

“If you were to stay up late for many nights in a row you would become thin and weak. If people want to be well they must sleep enough.

“I know another very good lesson that Rover can teach you. He spends much time playing.”

“Does playing really do us good?” asked George. “Of course it is lots of fun. But how does it help us?”

His father said, “Play makes the muscles strong, and teaches them how to work together. It makes our minds active, since when playing we have to think quickly. It teaches us to notice what our playmates are doing, and also teaches us what to do when they do something. By playing we get so that we know what to do when something happens that has never happened before.”

“Then it makes us brighter and healthier,” commented the little boy.

“Yes,” said his father. “When our muscles are in good condition and our minds are working properly, all parts of our bodies carry on their work better.

“There is another lesson that we learn through play,” added his father. “We learn to be generous, for

if a person is to play with another he must give and take. Children who do not play much often become selfish. They cannot understand that other children have certain rights. Such children are apt to think that everything should be done for them, and that there is nothing that they must do in return.

“Play teaches us how to take the lead, and how to follow—a valuable lesson to learn early in life.”

“I am glad that play is good for us, because it is so much fun,” said George.

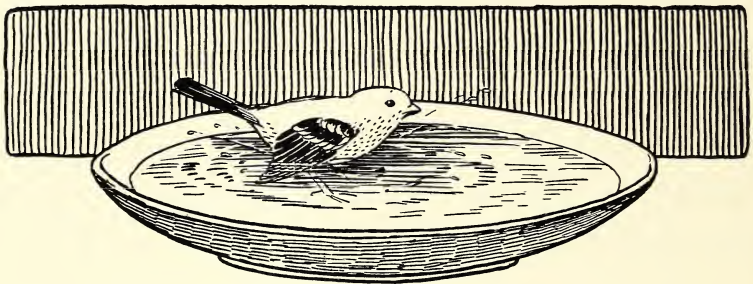
“Did you ever see such white teeth as Rover’s?” asked his father.

“They are beautiful,” said George. “I wish that mine were as white and clean. But I don’t understand how it is. He never brushes his but I have to brush mine all the time.”

“His teeth are shaped differently,” said his father. “They are pointed at the ends. Food cannot get caught between them as it can between yours. Besides, you eat many things that make them decay. The saliva in a dog’s mouth is all that is necessary to keep his teeth clean. If we did not eat so much soft, sweet food we would have less trouble with our teeth.

“When I spoke of Rover’s teeth I did not mean that you were to follow his example and do nothing for them. I wanted to have you realize how clean and white teeth should be.”

“I will try to keep mine as white and clean as Rover’s,” said George.



“You can learn a lesson from our canary, too,” said his father. “He is never contented unless he has his daily bath. I am afraid that I cannot say the same for you. We are perspiring all the time. The air cannot keep our bodies clean, because we cover them up with clothes.

“To keep ourselves clean we should take hot baths twice a week and cool baths on the other days. Bathing removes the waste that has come with the perspiration. This is a favorite place for bacteria to live; bathing keeps

the pores of our skin open. The pores are tiny holes in the skin. This allows the perspiration containing the waste to pass out freely.

“You see, there are many things that you can learn from your pets. I have mentioned some of the most important of them this evening. Let me see how much you remember of what I have told you.”

“My pets teach me to spend as much time as I can in the sun, and also to play as much as possible. They also teach me to get plenty of sleep and to keep my body clean.”

“And don’t forget your teeth,” said his father.

QUESTIONS

1. What is the effect of sunlight on bacteria?
2. Where do we get vitamins from?
3. In what ways is play helpful to children and animals?
4. How can we protect ourselves from bacteria?
5. Can you mention any other lessons to be learned from animal pets?

HOW WE BREATHE

“I do not understand,” said George to his father, “why it is that Rover breathes so rapidly when he is playing. I should think that he could play easier if he breathed more slowly.”

“Do you understand why we breathe at all?” asked his father.

“All I know about it is that if we did not breathe we could not live,” said the little boy.

“Our bodies require a gas that is in the air. The name of this gas is oxygen. Changes are taking place within us all the time. Certain gases and other things are being given off by our bodies. Since these things are being given off, other things must enter the body to replace them. If these things kept leaving us, and nothing came to us, there would be very little left of us in a short time.”

“What parts of our bodies are giving off these gases?” asked George.

“Our bodies,” replied his father, “are made up of millions of little parts, called cells. Each little cell is separate from those next to it. Within these cells

the changes take place. Each cell is like a tiny stove burning fuel. The food that comes into our bodies is the fuel that is burned. The gases and other waste that are given off are the smoke and ashes."

"Why are these changes taking place in the cells?" asked George.

"These changes in the cells supply our bodies with the power which keeps them going. We call this power energy. Everything that is in the world that is active, or that is moved, or that is changed in any way, needs energy."

"But sometimes we are not active," said George. "When we are asleep we are not doing anything."

"There is not an instant of our lives that our bodies are not active," said his father. "Our hearts are beating and pumping blood to all parts of our bodies from morning to night and from night to morning. This is just one of the many things that are taking place within us."

"I understand now why we breathe," said George, "but why does Rover breathe faster when he is playing?"

"When Rover is playing, his body needs more energy," said his father. "When we want to get more

heat from a stove we increase the draught of air. It is the same way with Rover. He has to have more oxygen. In order to get more oxygen, he must take more air into his body."

"What makes the air come into our bodies when we breathe?" asked George.

"The muscles of our chests make certain spaces that are in our bodies larger. Our lungs are in these spaces. Then the air rushes into our lungs which fill these spaces. This is what happens when we breathe in."

"What happens when we breathe out?" asked George.

"The muscles," answered his father, "that made the spaces larger, let them become small again. As these spaces become small again, the air is driven out."

"I do not understand just what the lungs are like," said George.

"They are two sacks, one on each side of the body. Each sack is made up of many little parts. Little tubes connect every part with big tubes that lead to the throat. There are also little tubes running all through the lungs that contain blood."

“What are these tubes for?” asked George.

“These small tubes,” continued his father, “are called blood vessels. Oxygen from the air passes into the blood that is in them, and waste passes from the blood into the lungs. Then the waste is breathed out of the body. You can see that breathing is one of the most important things that our bodies do.

“Since breathing is so important, we should be very careful to learn to do it properly. We should learn to take deep breaths all the time. That is, we should breathe hard enough to cause the air to enter all parts of our lungs. If we sit in a cramped position, or stoop our shoulders, our lungs cannot take in as much air as they should. If we breathe with the upper parts of our lungs only, the lower parts are not doing any work. If we breathe this way all of the time, the lower parts are liable to become diseased, because bacteria can grow in places that are not doing any work.”

“I see why it is so necessary to breathe fresh air,” said George. “If the air is fresh and pure, there is more oxygen in it, and not so many things that are not good for us.”

“You are right,” said his father. “It is very im-

portant to breathe clean air. If we take smoky and dirty air into our lungs, the small particles of dirt that come in with it may injure the delicate lining of the lungs. Besides, gases that are in impure air may poison us. Also if the air contains impure things there cannot be much oxygen in it, because the impure things occupy the space that would be filled with oxygen.

“So you see why it is better to play in the fresh air than indoors, and why the window should be open at night.”

“And we get the sunshine out of doors,” said George. “That does us good too.”

“There is a very important thing about breathing that I hope you will learn,” continued his father. “That is to breathe through your nose instead of through your mouth.

“The nose is lined with a moist surface, and there are many fine hairs present. This moist surface and the hairs catch bacteria and dust that enter. If it were not for their protection, these little enemies would pass on into our lungs, where they would cause us trouble.

“Some little boys and girls have things called adenoids growing in the passages through which the air

enters. It is difficult for them to breathe through their noses. They should always see a good doctor about these things. He can cure them of this trouble. No one can be in the best of health if adenoids are present in his head, because they interfere with his breathing."

"Do all animals breathe in the same way?" asked George.

"The same things happen in the cells of all animals," replied his father, "but oxygen gets into the blood in different ways.

"Insects have little tubes running all through their bodies. These tubes have their openings along the sides of the insects' bodies. They do not have lungs as the larger animals do.

"Fishes have gills. They are on each side of a fish's head. Oxygen that is in the water passes into the blood through these gills. Some insects have gills too, while they are growing up."

"Does a tadpole have gills?" asked George.

"Yes," said his father, "the tadpole and some other animals have gills, when they are young, but most of them lose their gills. When they have lost their gills they breathe through lungs.

“You see, animals that breathe in the water have gills, while land animals have other ways of breathing. There are a few fishes though that have lungs, but these fishes are not important.

“If you will remember all that I have told you about breathing, and do all that I have suggested, you will find that you will always feel fresh when you get up in the morning, and you will be bright and lively all day.”

QUESTIONS

1. Why do we breathe?
2. What do we mean by energy and why is it needed?
3. Can you tell what the lungs look like and what they are for?
4. Why is it necessary to breathe properly?
5. Explain how insects and fishes breathe.
6. Why is it important to get plenty of oxygen?

WATER BIRDS

“What a rainy day!” said Jack. “We were to have had our hike in the park today.”

“I am sorry it rained,” said Sister as she climbed into the auto. “Now we will be unable to learn more about the birds.”

“Well, that trip can wait for the sunshine,” said Father. “Today we will visit the Museum. There we can see many of the birds that hunt and others that are hunted.”

“Our day won’t be spoiled after all,” said Jack.

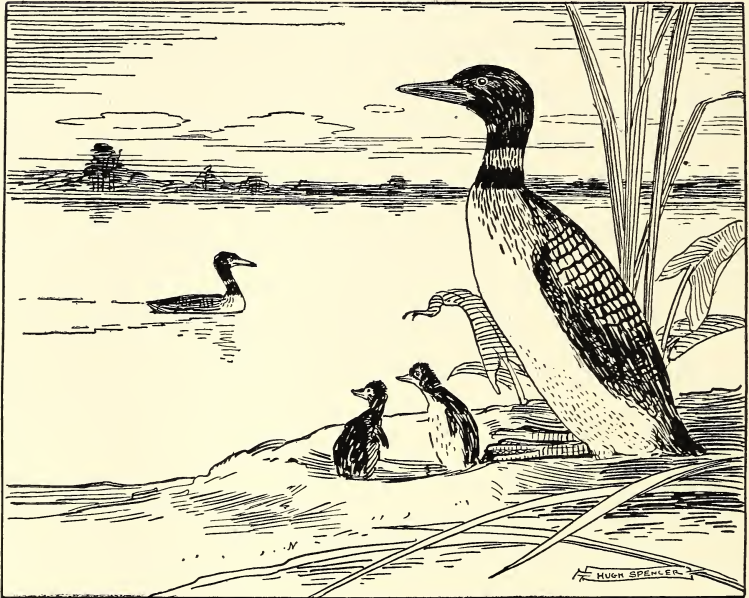
Shortly afterward Father, Jack, and Sister entered the Museum and went directly to the section where the birds were.

“There are several groups of birds that we will see today,” said Father. “The first are the diving birds. If you will look closely at these birds you will find that their feet are webbed and their bills are quite flat.”

“Some of the bills look like strainers,” said Jack.

“That is just what they are,” replied Father. “The water drains out, leaving small grains and other food to be swallowed.

“These birds are called grebes and are members of the duck family. They are wonderful swimmers. When they become frightened they sink under the surface of the water in an instant. Sometimes they dive and



swim for long distances. They swim under the surface with nothing but their nostrils above the water. It takes very sharp eyes to see them.”

“Do they ever go on land?” asked Sister.

“Oh, yes,” said Father, “but they are like fishes out

of water. They stand straight up and use their tails to help keep themselves upright. When the baby birds are placed on land by the parent birds, they move about by using their wings as legs."

"They must look very strange," said Jack. "Do all these different kinds of water birds act in about the same way?"

"In much the same way," said Father. "The loons and grebes are closely related."

"Let us now look at the gulls and loons. They have much longer wings," said Sister.

"The gulls get their food from the surface of the water," said Jack. "I have often watched them. They sometimes alight on the water and are tossed up and down by the waves."

"Yes," said Father, "they spend most of their time on the water. They do not dive for their food like the terns, and you will notice that the bill of the gull is hooked at the end. The bill of the tern is short and sharp. Terns sometimes feed on small shell fish along the shores."

"How do they open the shells?" asked Sister.

"By dropping them on a rock," answered Father.

“Sometimes they play and seem to enjoy the sport. One tern will drop a fish to another as he flies. At last one will swallow it and the sport will start over again.

“They do not take very good care of their eggs,” he continued. “The eggs are often laid on a sandy beach and the mother protects them only at night. The sun’s heat does most of the hatching of the eggs.”

“Our teacher told the class that gulls do a great deal of good by eating up refuse,” said Sister. “Perhaps that is why the law forbids our killing them?”

“Yes,” said Father. “They are very useful in that way. They are sometimes found far out at sea. They follow the ships for the refuse that is thrown overboard.”

“I know some of these birds,” exclaimed Jack, as Father and Sister joined him in front of another case.

“There is the canvas-back duck,” he said. “Uncle John has pictures of them in his den.”

“Your uncle used to hunt them,” said Father. “They are very good food and many thousands are eaten each year.”

“Their bills are like strainers, too,” said Sister.

“These birds are found on inland lakes and streams during part of the year,” said Father. “They feed in

shallow water. They plunge their heads beneath the water, and get a bill-full of water, which has many little pieces of animal matter in it. Then they lift their heads



and the water strains out of their bills. The animal matter which is left, is used for food.”

“They fly very rapidly,” said Jack.

“Indeed they do. Hunters find it difficult to shoot them when they are flying swiftly. That is one of the ways they have of protecting themselves.

“Those fine-looking birds called the fishing ducks move swiftly under water. They can hunt and fish while swimming under water.

“Eating seems to be their main business in life. They often try to swallow fishes that are too large to go down their throats. These ducks are not sought by hunters as much as some other kinds of ducks. They are not very good to eat. They protect themselves by diving, but they can fly swiftly if frightened while on land.”

“Here is a case containing geese,” said Sister. “I know the brant is found along our coast. Uncle says they wade out at low tide.”

“They eat eel grass and other ocean plants,” said Father. “They never dive for food. While the tide is out, they eat almost all the time. When the tide comes in, it lifts them off their feet and their feeding is finished for the day. They can fly out to sea and rest upon the waves during the night.”

“What a long sharp bill that one has,” said Sister, pointing to a blue heron.

“Yes, and just look at those long legs,” replied Brother.

“That is another wading bird,” answered Father. “It will stand for hours in one spot in shallow water, waiting for small fishes, frogs, or insects. When a fish comes within reach, it strikes suddenly with its long sharp bill. The fish is tossed into the air and swallowed head first.”

“Why is that?” asked Brother.

Father explained that it was swallowed head first so that the fins would not scratch.

“That little blue heron next to it,” said Sister, “has head feathers like some I have seen on hats.”

“Those are egrets,” said Brother. “Many thousands of birds have been killed to please ladies who want to wear them. These birds are getting more scarce each year.”

Father told them that the cranes also belong to this group.

“The little snipes and sandpipers that you see in this case,” explained Father, “use their sharp bills as tools. They probe the sand and mud with them for worms and other food.”

“Are they good to eat?” asked Sister.

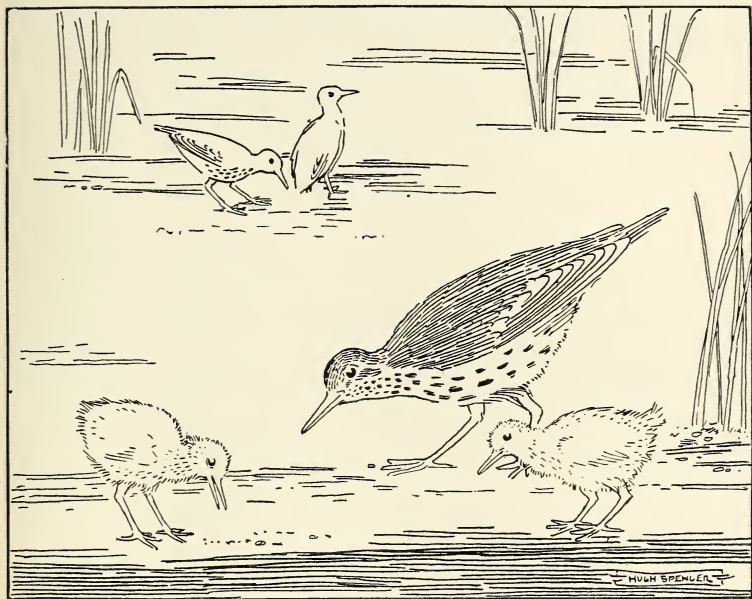
“They are hunted a great deal because their flesh is



HUGH SPENCER

fine for food," replied Father. "The woodcock belongs to this group.

"I would like to have more time to spend with these



water birds that are hunted, but we must go now for our dinner."

"May we come again?" the children asked.

"Yes," said Father. "We will come the very next time the rain spoils our field trip."

QUESTIONS

1. How do diving birds differ from other birds?
2. Name some birds that belong to the duck family.
3. How are gulls helpful to man?
4. Describe the manner in which the duck gets its food.
5. Name some of the wading birds and show how they differ from ducks.
6. How is the snipe family fitted by Nature for searching for food?

THE SMALLEST LIVING THINGS

“You have seen different kinds of plants. Some have been large and some have been small. But there are armies of plants that you have never seen. They are smaller than any thing that you can imagine.”

“How do we know that there are such things if we can't see them?” asked Margy of her mother who had just been speaking.

“I will tell you,” replied her mother. “No one ever guessed until less than a hundred years ago that these tiny plants existed. When men first made magnifying glasses, they examined all kinds of things to see what they could learn about them. Before long they discovered tiny plants and animals that they had not seen before.”

“What were the magnifying glasses like?” asked Margy.

“At first,” replied her mother, “they used single pieces of glass that were curved on both sides and were thickest in the middle. Then they used several of these glasses, one above the other. They called several of these glasses used in this way a microscope.”

“Could they see much more with the microscopes than they could with the single glasses?” asked the little girl.

“Oh, yes,” said her mother. “With the microscopes they were able to see a new world of plants. These new plants were so small that hundreds of them could have been put in one of the small ones that they saw by the single magnifying glasses.

“For a time no one was able to tell whether these tiny things were plants or animals. Finally it was found out that they were made of the same things that plants are made of. Then the men who studied them knew that they were plants.”

“What else did men learn about these little plants?” asked Margy.

“They learned that some of them do us good and that some do us harm. They also learned what kind of good or evil each kind does. And they were soon able to tell some of them from the others.”

“What do you call these tiny plants that no one can see?” asked Margy.

“We call them bacteria,” replied her mother. “This is a word that I hope you will remember. It is very im-

portant. As you grow older you will use it more and more.”

“Are the tiny plants that help the large ones get their food called bacteria?” asked Margy.

“Yes,” replied her mother, “they belong to the good kind. As you already know, they help the large plants get some of the food that they need.”

“And if the plants could not get this food they could not live,” added Margy. “And if there were no plants there would be no animals, because there would be nothing for them to eat.”

“I am glad that you have not forgotten how important these bacteria are to the world,” said her mother.

“What do bacteria look like?” asked Margy.

“Some of them are round,” was the reply, “some of them are rod-shaped, and some of them are shaped like little spirals.”

“I don’t know what a spiral is,” said the little girl.

“The crooked part of a corkscrew is a spiral,” said her mother. “And so is one of your long curls.”

“Many bacteria have little hair-like things on them that help them move around. Different kinds of bacteria have these hairs differently arranged.”

“Bacteria sometimes form in chains. Sometimes two remain together in a little case, called a capsule. Sometimes each bacterium lives by itself. We call one of these



little plants a bacterium. Bacteria means more than one.”

“What else besides helping the big plants do the bacteria do?” asked Margy.

“They bring about changes in things that we eat,” was the reply. “You know that after milk has been

standing it becomes sour. It would not turn sour if it were not for the bacteria that are at work upon it."

"Then sour milk is bad for us," observed Margy.

"No," replied her mother. "The bacteria that turn milk sour are good for us. Of course, if milk stands too long, it becomes spoiled, because there are some of the bad bacteria in it. Then it is not good to drink."

"Are there bacteria in buttermilk?" asked Margy.

"Yes, and they are good for us, too," answered her mother. "There are also many of these little plants in butter. The flavor of cheese is due to the bacteria that are in it."

"What else do bacteria do for us?" asked Margy.

"There are certain kinds of bacteria in our bodies that help our bodies use the food that we have eaten.

"Other kinds of bacteria destroy filthy things that contain bad kinds of bacteria. If such things were not destroyed we could not live very long, because there would be so many bad bacteria in the world.

"Bacteria also help us make many of the things that we use, like hemp and flax. You see, they destroy certain parts of these plants that we do not want, but do not touch the useful parts.

“Bacteria turn cider into vinegar. You have seen what we call ‘mother of vinegar.’ Mother of vinegar is nothing but a mass of bacteria that are at work making vinegar.

“These little plants also help men make wine out of fruit and other things.”

“Then they are bad bacteria,” said the little girl, “because wine is bad for us to drink.”

“It is not the bacteria that are bad, it is the use to which men put the wine that is bad,” said her mother.

“Do you remember the time a can of peas popped open and sizzled all over?” asked her mother.

“Oh, yes, I remember,” said Margy, “but why did it do it?”

“When the peas were put into the can,” replied her mother, “the can was not properly sealed up. A little air was left in the can. There were bacteria in the air. Then later the bacteria began to work upon the peas, and before long the can popped open, as you remember.

“Fruits decay, because bacteria are present in them. If fruit never decayed, the seed could not get out unless animals ate the fruit. So you see that the bacteria that spoil things also do good.

“Another bad thing that bacteria do is to cause trees to rot. They work in places where trees have been injured. Unless something is done to stop them, they kill the trees.”

“Where do the bacteria come from?” asked Margy.

“They are everywhere,” answered her mother. “They are floating around in the air. They are on everything that you touch. There are some in everything that you drink. As I said before, most of them do us no harm, and many of them do us good.”

QUESTIONS

1. Describe some forms of bacteria.
2. In what ways are bacteria helpful to man?
3. How do bacteria affect preserves that are not tightly sealed?
4. Can you tell how bacteria kill trees?
5. Where do bacteria come from?

HARMFUL BACTERIA

“I told you last evening that there are bacteria in everything we touch and in the air we breathe,” said Margy’s mother the following evening. “Most of them are friendly, but some are able to do us great harm.

“There are many more in some places than there are in others. There are great numbers where it is dark and damp, and few where it is clean and light.

“The sunlight is the greatest destroyer of bacteria. The harmful ones do not live in the sunlight.”

“Is that the reason why it is a good thing to go out into the sunshine?” asked Margy.

“That is one reason why I have sent you out of doors to play in the sunshine whenever it has been possible,” answered her mother.

“You just said that that was one reason why you sent me out,” said Mary. “Is there another reason?”

“Well,” said her mother, “the sun gives us certain things called vitamins that our bodies need. We get the same things from plants, but we need the sunlight too. I cannot tell you about them now—it would take too long.”

“Do the bad bacteria that we breathe always do us harm?” asked the little girl.

“Not always,” replied her mother. “When we are in good health, our bodies can destroy them, if there are not too many of them. When we are not very well, the harmful bacteria are able to remain in our bodies. When this happens, we usually become sick.”

“When we are well, we can nearly always fight them off,” said Margy. “We can do it, unless there are too many of them. When we are not well we are unable to fight them off. Am I right, Mother?”

“Yes, you are right,” said her mother. “Now I think you can see the importance of keeping well.

“As soon as bacteria get a foothold in our bodies they begin to increase in numbers very rapidly. Each one divides into two. In a single day there will be millions where there were but few to start with.

“These little enemies cause many kinds of diseases. Each disease is caused by a particular kind of bacteria.”

“I see now why you always tell me to keep away from people who have colds,” said Margy. “But do colds do us much harm? I have had them, but I always got well quickly.”

“Colds are very serious things,” replied her mother. “It is dangerous to catch them, because they make us weak. When we are weak, the bacteria that cause disease are able to enter our bodies and stay there, and make us very sick.

“Whenever you catch cold, I keep you in the house. If I were to let you go out where other people are, you would be in great danger of breathing air that contained harmful bacteria.”

“If bacteria cause colds, how did it happen that the last one that I caught came from sitting in a draft?” asked Margy. “I remember just when I caught it, because I began to sneeze.”

Her mother answered, “The draft did not give you the cold. It did, though, chill your body, and bacteria that were in your body had a chance to attack you. When one gets chilled, his body is not able to fight the bacteria that are waiting their chance.”

“Are there bad bacteria in us most of the time?” asked Margy.

“Yes,” replied her mother. “There are bacteria of many kinds in our bodies. The nose and the throat are the places where they are most likely to be found.

You see now why I have you spray your nose and throat every morning and evening when you have a cold."

"Yes, Mother, the medicine that is in the spray kills the bacteria," said the little girl. "The gargle that I sometimes use does the same thing."

"No matter how hard we try, we cannot kill them all. We must, therefore, keep as many out of our bodies as possible, and put ourselves in a condition which will enable us to resist them.

"I have always warned you not to eat candy or fruit that dust had been blown on. Bacteria can enter our bodies just as well through the food we eat as through the air we breathe. Nothing that has been in unclean places or that has been handled by unclean people should be eaten."

"Is that the reason why you have always told me not to put my fingers in my mouth?" asked Margy.

"That is the principal reason," her mother replied. "If you should touch your finger to something that a sick person had touched, you would probably get some disease-carrying bacteria on your finger. Then if you should put your finger in your mouth, you might become sick too, unless your body was in perfect condition. We

never know when we are in perfect health. It is, therefore, wise to be careful.

“Bacteria can also enter the body through the eye, the ear, and the nose. The best thing to do is to keep your fingers away from your face altogether.”

“You have always told me not to drink out of cups that other people have used and never to use towels that others have used,” said Margy. “Now I understand why. I might have caught some terrible disease by doing so.”

“Yes,” answered her mother. “I wanted you to form clean habits. It is just as easy to be careful as it is to be careless, if you begin early enough.

“Whenever you have cut or scratched yourself, I have put something on the injured place. Bacteria that were in the air or on the knife or whatever you injured yourself with might have entered your body through the opening in your skin.”

“What was that stuff which you put on me?” asked Margy. “It smarted and stained my skin brown.”

“It was iodine,” replied her mother. “Iodine is one of the best things that can be used for killing bacteria.”

"I don't like it," said Margy, "but I won't cry any more when you put it on me. I am going to tell the other girls in my class to have their mothers put it on their cuts and scratches."

"That is a kind thing to do," said her mother. "You may be able to save some of them a great deal of suffering."

"So that you will not forget, I want you to write down the different things that one should do in order to guard against sickness that is due to bacteria."

Margy was busy for several minutes. This is what she wrote:

"I must keep my fingers away from my eyes, my nose, and my mouth, because my fingers may have picked up bacteria from things that I have touched."

"I must be sure that the things I eat are clean, because dusty or dirty things may have bacteria on them."

"I must keep away from people who are sick. This means from people who have colds, too. I must be careful not to breathe their breath, because there are many bacteria in the breath of people who are sick."

"I must not use drinking cups or towels, or any similar things that other people have used."

“I must always put iodine that will kill bacteria on a cut or scratch, because bacteria can enter the body through breaks in the skin.”

“That is very well done,” said her mother, when she had read what Margy had written.

“There is one thing that I forgot to tell you. Some bacteria can pass though the skin even though there are no cuts or scratches. For this reason it is not safe to touch unclean things at any time.”

QUESTIONS

1. What is the greatest destroyer of bacteria?
2. What is the importance of keeping well?
3. Why are all colds serious?
4. Can a draft give you a cold?
5. Name some of the ways in which bacteria enter the body.
6. Describe some methods of guarding against sickness due to bacteria.

THE SMALLEST ANIMALS

“Are there any animals as small as the bacteria?” asked Margy several days after her mother had told her about the disease-carrying bacteria.

“No,” said her mother. “There are none as small as the bacteria, but there are many different kinds that cannot be seen without using a microscope. Animals of this kind are called protozoa. A protozoon, which is one of these animals, consists of but a single cell.”

“What do you mean by cells?” asked the little girl.

“I told you,” answered her mother, “several evenings ago that animals, like men, are made up of millions of tiny parts called cells. Our bones and skin and muscle and everything but the fluids of our bodies consist of cells.

“Most cells are little jellylike masses with thin coverings around them. Some, though, become hard after a time. Bone cells are of this kind.”

“Are plants made of cells too?” asked Margy.

“Yes,” was the reply. “Each bacterium consists of one cell, but the large plants are composed of great numbers of them. There is one great difference between

plant and animal cells. The cells of plants have thick coverings, but animal cells have thin coverings."

"I don't understand," said Margy, "how the protozoa eat and breathe and do other things if they have only one cell."

"A protozoon," said her mother, "can do many things that a large animal can do because the material of which the cell is composed is like that in the cells of the large animals. I will tell you first what one of the simplest of the protozoa looks like, then you will understand better what takes place within it.

"The simplest protozoon that we know is called the ameba. When it is at rest it looks like a tiny drop of almost transparent jelly."

"Can an ameba move?" asked Margy.

"Oh, yes," said her mother. "All protozoa can move about, but the ameba moves in a very strange manner. In order to move, this little animal pushes out part of its body in one direction. Then all the rest of its body flows into the part that was first pushed out. By doing this over and over again the ameba is able to move from place to place."

"Its covering must be a lot like rubber," said Margy.

“It is somewhat like rubber,” said her mother, “since it can be stretched out of shape. But the cell covering of an ameba is not a distinct substance. It is really the outside portion of the body that is a little firmer than the rest.”

“I don’t see how an ameba gets its food,” said Margy.

“When the ameba’s body touches anything like a particle of plant material, it sends out parts of its body on each side of the particle. Then these parts of its body come together on the other side of the particle. The particle then lies within the ameba’s body.

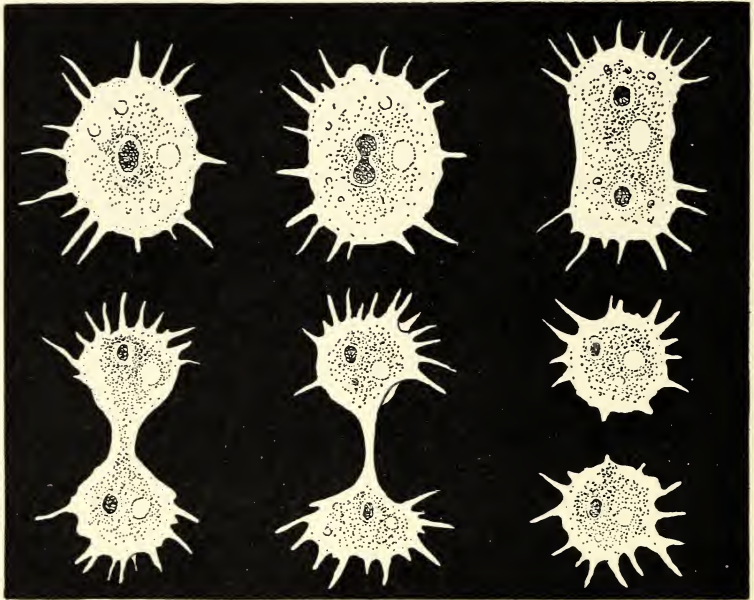
“The ameba uses it, if it is the right kind of material, for building up its body. If anything enters its body that the ameba cannot use, it just moves away and leaves the particle behind.”

“I don’t see how an ameba can breathe,” said Margy, “because it has nothing to breathe with.”

“Oh, yes, it has,” said her mother. “The ameba breathes through its cell covering. Oxygen comes in and carbon dioxide goes out through it. It has to breathe as the higher animals have to, because its body is constantly being broken down and being replaced by new materials.”

“Why is its body being broken down?” asked Margy.

“Because,” answered her mother, “the ameba needs energy so that it can move. It also needs energy so that



changes can take place in a certain spot near its center.”

“What is this spot and what does it do?” asked the little girl.

“It is an egg-shaped portion of the ameba’s body, which is a little clearer than the rest of it. It is believed that its most important work is to bring about the making

of new amebae. Amebae means more than one ameba."

"Tell me about the baby amebae," asked Margy.

"There are no baby amebae," said her mother. "After certain changes have taken place in one of these little animals it begins to divide into two parts. Each part becomes a new animal. They keep on dividing in this way forever."

"If the protozoa are all made up of just one cell, they must all look alike," said Margy.

"But they don't," said her mother. "The different protozoa are of many shapes and sizes. Some of them have little hair-like things over their bodies, with which they move about. Some of them have long lashes which they whip through the water. This enables them to move.

"There is one kind of protozoon that is shaped like a slipper and another that looks like a bell. These protozoa do not change the shape of their bodies in the same way that the ameba does. They do not need to, because they have mouths into which their food may enter and the hair-like things that I just told you about with which they move. Besides these, there are thousands of different kinds of protozoa."

“Do they all live in water?” asked Margy.

“Yes,” said her mother. “They all live in water or some other kind of liquid. Some live in ponds and similar places and others in the bodies of plants and animals. Certain kinds of protozoa cause disease.”

“I don’t see how they can cause disease, because they are so small,” said the little girl.

“That is just the reason that they can do harm to the animals in which they live,” said her mother. “Their small size enables them to find their way even into the cells of the animals. If they once get into an animal’s body it is very difficult to get rid of them. Some of the most terrible diseases known to man are caused by these little animals.

“The protozoa do not do nearly as much harm to human beings now as they used to, because we know how some of them live and are able for that reason to get rid of them. We know that they spend part of their lives in insects and other animals. By destroying the insects and animals in which they live, we are able to keep the protozoa from entering our own bodies.”

“How did people find out about the lives of these little animals?” asked Margy.

“By much hard, patient work and great sacrifices,” said her mother. “Some men even gave their lives that the rest of the people might know how to protect themselves from some of the protozoa.”

“Oh, tell me about them,” asked Margy.

“Not today,” said her mother. “It would take too long.”

QUESTIONS

1. What is a protozoon?
2. What is the difference between plant cells and animal cells?
3. Describe how the ameba moves.
4. How are some of the protozoa harmful to man?
5. Can you tell how man protects himself from harmful protozoa?



HARMFUL PROTOZOA

“There was a time when men knew very little about the things that made them sick. It sometimes happened that thousands of people in certain regions became sick with the same disease. No one knew what had caused it and no one even thought that it could be prevented.

“Many of them thought that they were being punished for wrongdoing. Some believed that they were the victims of evil spirits. They made many guesses as to the cause of these diseases, but none of them was right.”

“I know what the cause was,” said Margy. “It was bacteria.”

“That was the cause of many of them,” said her mother, “but others were due to certain kinds of protozoa. The protozoa, you remember, are the smallest animals while the bacteria are the smallest plants.

“It was not long ago that few people could live in many parts of the world because of yellow fever and malaria. Panama, which is between North and South America, was one of these regions.”

Margy had just heard about the work of certain insects in school. When her mother mentioned the word Panama, she could not keep from interrupting with, "I know what made the people sick in Panama."

"What was it?" asked her mother.

"It was the mosquito," said the little girl. "People that are bitten by the mosquito in Panama often become sick with malaria. Please tell me more about malaria."

"It is true that the mosquito carries the thing that makes people sick with malaria, but the mosquito does not cause the disease. It is a protozoon that is in the mosquito's saliva that causes the trouble."

"How does the protozoon get into the mosquito?" asked Margy.

"This little animal that causes malaria spends part of its life in the body of a mosquito and the rest of it in the body of a human being," said her mother.

"When a mosquito bites a person who is sick with malaria, some of the protozoa that are in the blood of the sick person are taken into the mosquito's mouth. Then they travel through certain parts of the mosquito for a while and finally reach the place where the saliva comes from."

“Do the protozoa make the mosquito sick?” asked Margy.

“No,” replied her mother. “When the protozoa are in the mosquito’s body they take a different form from that which they have when they are in the human being.

“When a mosquito that has some of these protozoa in its saliva bites a person, the protozoa enter the blood of the person who has been bitten. They then begin to increase in numbers very rapidly.

“The sick person soon has chills and fever, and feels sick in other ways. Many people who catch this disease never get well. There are regions in the world where the people still suffer from malaria.”

“We learned in school that it was only a little while ago that Panama became a safe place to live in,” said Margy.

“Do you know why that is?” asked her mother.

“When people from our country went down there they fought the mosquito,” said Margy. “They finally killed most of them, but there were still some left. They kept those that were left from biting them by using screens. Now they hardly ever see any mosquitoes.”

“The Americans did a great work when they went into Panama,” continued her mother. “It is too bad that all of the countries of the world have not made war on these and other diseases in the same way.

“There still are places not far from Panama, like certain parts of Colombia, where no attention is paid to the malaria and other disease-carrying mosquitoes. Many people die every year because they do not know enough to drive the mosquitoes out of their country.”

“Are there any malaria-carrying mosquitoes in our country?” asked Margy.

“Yes,” was the reply. “There are regions along the southern coasts that are not entirely free from the malarial mosquito. But we are constantly on guard against them.

“Many of the other protozoa that cause disease spend part of their lives in one animal and the rest in another, just as the malaria protozoa do.

“The sleeping sickness is a disease found in Africa. It is caused by a protozoon that is also carried by an insect.”

“Oh, yes,” said Margy. “We were told about it too. It is carried by a fly called the tse-tse fly. People

who get this disease sleep and sleep, sometimes for months. Many of them die from it.”

“There are other protozoa,” continued her mother, “that cause different diseases. Some we know about and others we do not, but we are learning more and more about those things every year.

“There are other little animals or plants, we do not know surely which, that are responsible for certain diseases. They are usually considered to be bacteria, but they seem to be between the bacteria and the protozoa.

“Yellow fever is the result of their presence in the human body. They are carried by a mosquito, as are the malarial protozoa. They are found in similarly located regions.”

“They, too, used to be in Panama?” said Margy.

“Yes,” said her mother, “and they caused the death of thousands of human beings. But they were finally almost all destroyed in that region, because the mosquitoes that carried them were killed.

“The disease called rabies that follows the bite of a mad dog results from the presence of another of those parasites.”

“What is a parasite?” asked Margy.

“It is a plant or animal,” said her mother, “that lives on or in another plant or animal. All of the disease-producing bacteria and protozoa are parasites.”

“Do other animals besides man have diseases that are caused by protozoa?” asked Margy.

“Many animals are troubled by them,” was her reply. “Even worms and fishes and birds and almost every other kind of animal have protozoa in their bodies. Some of them do no harm, but others often cause death.

“We have not much to fear from the disease-carrying protozoa in this part of the world. It is the disease-producing bacteria that we have to guard against.”

QUESTIONS

1. What were some of the old beliefs about sickness?
2. How is malaria caused?
3. Tell how malaria was fought at Panama.
4. What other diseases can you name that are caused by protozoa?
5. What is a parasite?

INSECT PESTS

"This is a lovely spot," said Sister as our friends started across a field. "Nature has made a wonderful playground for us."

"Not only for us," said Father, "but for many other living things."

A piercing noise was heard just above their heads.

"What was that?" asked Sister.

"A cicada," said Jack.

"It may be a cicada," Father added. "They are due this year."

Jack was very busy trying to find the insect that had made the noise. Suddenly taking his hat off, he jumped quickly and cried, "I have it."

"Bring it here," said Father. "Perhaps you will not have another chance to see one like it for many years."

"I thought they came every year," said Sister.

"Not this kind," said Father, as he took it from Jack. "This is a seventeen year cicada."

"What do you mean?" asked Sister.

"Is it seventeen years old?" asked Jack.

“Yes,” said Father. “This insect hatched from an egg seventeen years ago.”

“I did not think insects could live that long,” said Jack. “Most of them die each year.”



“These are the longest-lived of any,” said Father. “They drop from trees just after birth, fall to the ground, and dig into the soil until they are buried.”

“How do they live?” asked Sister.

“They attach themselves to a root and suck the sap,”

Father explained. "They remain underground for seventeen years."

"But how do they know when seventeen years have passed?" asked Jack.

"No one can tell you that," said Father. "Nature in some way tells them when to come out of the ground."

"Are they of any use?" asked Sister.

"Some birds eat them," replied Father. "And it is well that they do. Many million dollars' worth of damage has been done by these little insects to orchards in our country."

"What birds eat them?" asked Sister.

"The little English sparrow has been a great help to the farmer. The sparrow eats a great many of them."

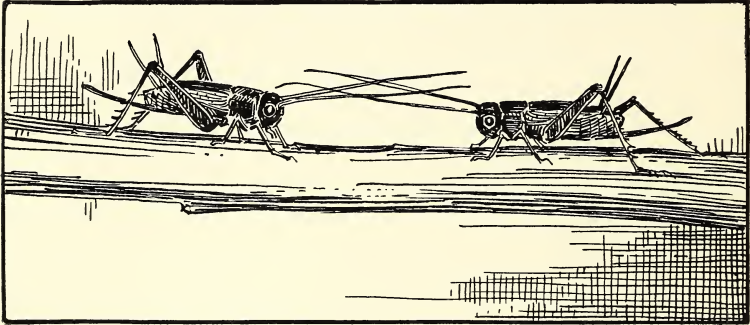
"I am glad to know that the little sparrow is useful to some one," said Sister. "Most people in the cities think they are a nuisance."

"I wish the cicada would sing," said Brother. "How does it make that queer noise?"

"It has a number of little plates that act like drum-heads," Father said. "These little plates are moved very rapidly. The faster they are moved the higher the pitch goes."

"I would never have thought that such a little creature had muscles strong enough to keep that up for long," said Jack.

Father picked something from the ground at Sister's foot.



"Do you recognize this?" he asked.

"It's a cricket," both children cried together.

"Yes, it is one of the crickets," Father said, "but it is not at all like the tree cricket. You will notice that this field cricket is black, with long feelers. If we could find a tree cricket, it would be light green."

"The cricket certainly has long back legs," said Jack. "They can hop very fast and for a good distance."

"Are the crickets harmful also?" asked Sister.

"Some are," Father replied. "They bore little holes in the branches and lay their eggs in them. This is

very harmful. The raspberry bush is chosen by one kind of cricket for this purpose. Many raspberry bushes are killed in this way."

"I have heard the house cricket sing," said Sister. "It says, chirrup! chirrup!"

Jack said, "I think it sounds like this, Cheer up! Cheer up!"

Father pointed to the short rough wings. "That is where the sound is made," he said. "The back legs are rough like a file. They are rubbed against these wings and they move back and forth.

"Watch where he goes when I free him," said Father, placing the field cricket on the ground.

With two hops he was close to a flat stone and in another moment was under it.

"They live under stones in summer, and in holes during the winter," Father told the children.

"Why did he not use his wings?" asked Sister.

"They are not used for flying," her father replied. "The powerful back legs are enough for the cricket."

"Some grasshoppers have legs like those of the cricket," her brother said. "They use wings also."

"You are right, Jack," said Father. "They spring

into the air and use the wings to help them cover more ground.”

“The little grasshopper makes good bait for fishing,”



said Jack. “He makes his legs go fast when in the water. This attracts the fish.”

“In certain parts of our country, the grasshopper does a great deal of damage at times. He has been known to destroy mile after mile of grain,” his father said.

“There would have to be a great many grasshoppers for that,” said Sister.

“I have seen pictures of them that look like a great army,” said Jack. “Millions and millions are on the march, eating as they go.”

Sister was pushing a rock with her foot as we talked. Suddenly it turned over and a number of insects started to move rapidly.

“What are those?” she asked.

“Roaches,” replied Father. “They belong to the same family as the cockroach. Cockroaches get into the houses where it is not clean and are hard to get rid of.”

QUESTIONS

1. How often does the cicada come to life?
2. In what way has the English sparrow been helpful to the farmer?
3. How does the cicada sing?
4. In what way are some crickets harmful?
5. Tell in what way the grasshopper is a harmful insect?
6. What can you tell about roaches?

THE EARTH AND HER NEIGHBORS

Jane and her brother, Fred, were patiently waiting for their uncle to finish reading his newspaper.

Before long he laid the paper down, and said, "Well, children, what do you wish me to tell you about this evening?"

"Oh," said Jane, "tell us about the earth."

"That is a pretty big subject," he said, "but I will tell you something about it.

"For thousands of years men thought that the earth was flat. They thought that the sky was the space inside of a great bowl. They thought that the sun, moon, and stars were on the lining of this bowl. They believed that the sun went down under the earth every evening, and came up on the other side every morning."

"Is that the reason why we say that the sun rises and sets?" asked Fred.

"Yes," his uncle replied, "and it was only natural that they were deceived by the sun. They had no way of knowing that it did not pass around the earth.

"But some men living hundreds of years ago thought that the earth was round. People thought that these

wise men were cranks. The people laughed at them. For ages, therefore, almost everybody thought that the earth was flat.

“Columbus believed that the earth was round and undertook to prove it. He failed, but discovered America. Finally Sebastian Del Cano sailed around the world and thus proved that it was round.

“Do you know how to prove that the earth is round? Anyone can prove it to himself. He has only to go to the seashore and watch a boat that is coming into port. At first he will see the top of the boat’s mast, then a little more of it. Finally the whole boat will come into view.

“It was not long after men knew that the earth was round before they learned many things about the sun and moon and stars. They found out that the earth and several other bodies pass around and around the sun. They also found that most of the stars that you see at night are suns like our sun. They learned, too, that these suns have bodies like our earth that moved around them. Bodies of this kind that move around a sun are called planets.”

“Is the moon a sun?” asked Fred.

“No,” replied his uncle, “the moon is a body that is far smaller than the earth. It revolves around the earth in the same way that the earth revolves around the sun.”

“The sun is hot. Why is not the moon hot, too? They both give light,” said Jane.

“The sun is a great ball of fire that gives heat and light,” said her uncle. “The moon is cold.

“The moon has no light of her own. She is bright at night because the sun is shining on her. The brightness that she gets from the sun shines on us.”

“But we can’t see the sun when the moon is shining. How can the sun be shining on the moon without our seeing it?” asked Fred.

“We cannot see the sun shining on the moon at night,” said his uncle, “because at night our side of the earth is turned away from the sun.”

“I do not understand that,” said Fred.

“I think I can make it clear,” replied his uncle. “Let us call the electric bulb that is over your chair the sun. Then let us call your head the earth. We will call your sister who is in front of you the moon.

“The light that comes from the electric bulb is shining on your sister. It is not shining on your face because

your face is not turned towards it. Now if you will turn your head so that you can see the bulb and your sister at the same time you will see what is happening."

"Oh, I see now," said Fred. "The sun shines on the moon, but we cannot see what is happening, because we are on the wrong side of the earth."

"You are right," said his uncle, "but do you understand why the sun does not shine on our side of the earth all the time?"

Fred answered that he was not quite sure.

His uncle continued, "The earth is always turning around on itself. It is like a great top. It takes one day for it to turn around once. When we are on the portion of the earth that is turned toward the sun, we call it day. We say it is night when we are on the side that is turned away from the sun.

"Sunrise is the time when we turn so that the sun begins to shine on us, and sunset is the time when we go from the sunlight into the darkness."

"The earth spins around and around on itself," said Jane. "That makes day and night. But you said that the earth goes around the sun. What happens then?"

"The spinning earth is at the same time moving

around the sun," said her uncle. "It takes a year for it to make this journey once."

"Why is it cold in winter and hot in summer?" asked Fred.

"In the winter the rays from the sun strike our part of the earth in a slanting manner. In the summer they are aimed straight at us. You will learn just what happens in your science course that you will have later in school."

"How many suns like ours are there?" asked Jane.

"No one knows," replied her uncle. "There are so many that no one can count them. Every little while men think they have seen the farthest one. Then before long new ones are discovered.

"All of these suns, including our own, are in motion. And of course the bodies, like our earth, that are spinning around them, are also traveling with them."

"Please tell us about the planets," asked Fred.

"A body like our earth that travels around a sun is called a planet. There are seven others that travel around our sun. The names of these planets are: Mercury, Venus, Mars, Jupiter, Saturn, Uranus, and Neptune."

“Why, those are the names of the Greek gods,” said Jane. “It will be easy to remember them.”

“Can you tell me, Jane, what a moon is?” asked her uncle.

“A moon is a little planet that travels around a big planet,” was her reply.

“It is clear that you understand what a moon is, but we never call them planets. We save that word for the larger bodies that revolve around the sun and do not revolve around some other planet.”

“Do other planets have moons?” asked Fred.

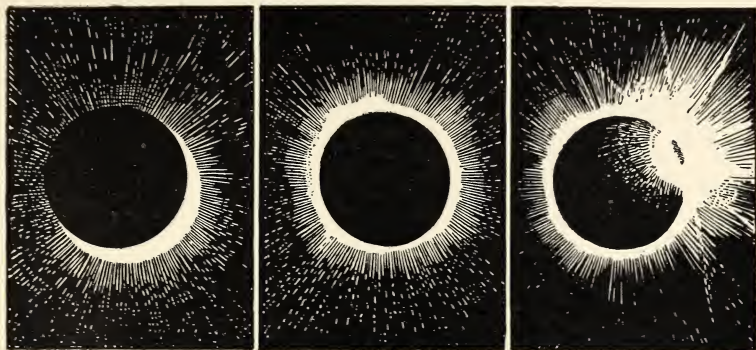
“Oh, yes,” replied his uncle. “Many of them have moons. Mars has two, Jupiter has seven, Saturn has nine, Uranus has four, and Neptune has one. But neither Mercury nor Venus has any.”

“What is a comet?” asked Jane.

“A comet is a ball of fire with a long tail that is passing through the sky. Its path is oblong, and although the sun is within this path it is nearer to one end of it than it is to the other.”

“We had an eclipse one time,” said Fred. “I never understood just what it was.”

“It is difficult to understand,” said his uncle. “Once



in a while the moon passes between the earth and the sun. When this happens we are not able to see the sun. This is called a total eclipse. More often the moon does not pass exactly in front of the sun. Then we can see some of the sun. This is called a partial eclipse.”

QUESTIONS

1. What were some of the early beliefs about the earth and the sun?
2. How can you prove that the earth is round?
3. What makes the moon bright at night?
4. Why does the sun not shine on one side of the earth all the time?
5. What is a planet?
6. Can you tell how a total eclipse occurs?



ORIGIN OF THE EARTH

“Where did the earth come from?” asked Jane of her uncle.

“I will be glad to tell you what is known about it. Of course, nobody knows just what happened. Different people believe that it was formed in different ways. Many people think that it was formed in the way that I am going to tell you about.

“Many millions of years ago there was a great cloud of fiery mist in the sky. This fiery mist was composed of gases.”

“What is a gas?” asked Fred.

“You know what we burn in our gas stove,” said his uncle. “That is one kind of gas. You cannot see it any more than you can see the oxygen that is in the air.

“Anything in the world can be turned into a gas, if it is heated hot enough. The gases that are made from various things are different.

“As I said, the earth was a great cloud of gases floating in the sky. It was not just drifting along. It was whirling around and around. As it whirled around the central part kept getting tighter and tighter.”

“Was that the beginning of the earth?” asked Jane.

“No,” answered her uncle. “This mass finally became the sun. A quantity of gas from the edge of the big mass broke away and started whirling by itself. But all the while it kept revolving around the big mass which was to be our sun. The small mass that broke away from the big one did just as the big mass had done. The middle part became packed tighter and tighter. All the while it got hotter and hotter.”

“Wasn’t this the beginning of the earth?” asked Fred.

“The small mass of gases was the beginning of the earth, but it was not much like the earth. It was more like the sun as it is now, a huge fiery ball.

“This fiery ball kept spinning along for millions of years. Then slowly the outside of it began to cool. The gases as they cooled took on a different form. At first the outside of the earth was a flowing sea of red hot melted things. Then this began to cool off. From it came the different things that make up the earth.”

“I don’t see how gases can turn into hard things,” said Jane.

“If you cool a gas, it will flow. Then if you cool

it still more, it will become hard," said her uncle. "It took a very long time for the outside of the earth to cool off. Slowly the inside kept getting cooler too, but it never became as cool as the outer surface."

"Is it hot inside now?" asked Jane.

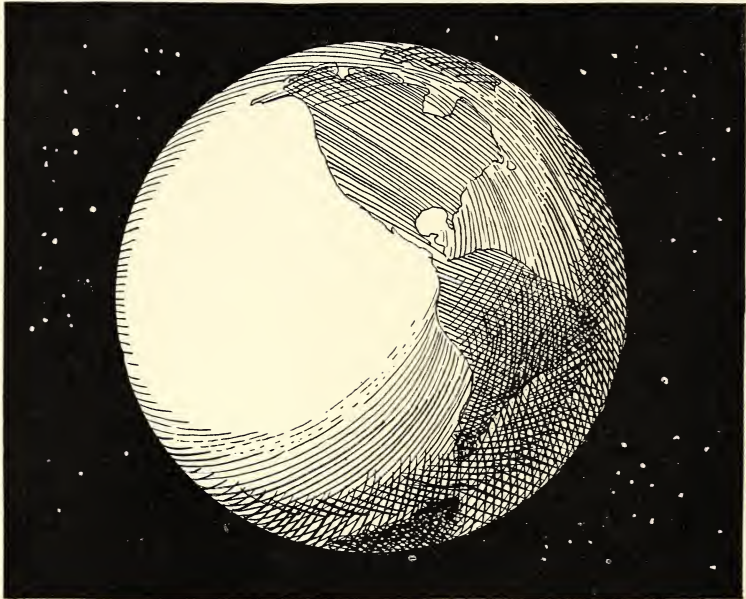
"Many people believe that the center is like a great ball of molten metal and gases. We know that as we go down into the earth it keeps getting warmer and warmer. Also once in a while melted earth breaks out through volcanoes. So we are quite sure that the center of the earth is very hot.

"After the surface of the earth cooled, a layer of air was left around it for about one hundred miles. This layer is very thin when we consider the size of the earth.

"The surface of the earth is uneven. Those parts which are the highest are the great land masses, called continents. The low parts are covered with water. These masses of water are the oceans. Here and there are small land masses that stick up through the oceans. These are the islands.

"The surface of the earth is constantly changing. The present land masses are slowly being lowered, while new land masses are slowly rising from the ocean.

“Some of the water of the oceans rises up into the air and there forms clouds, which are bodies of mist. Then this mist falls to the earth in the form of rain.



“The rain washes down the hills and mountains, carrying dirt with it. In this way the land is constantly being lowered.”

“What becomes of the dirt that is washed down?” asked Fred.

“It is carried into the sea,” replied his uncle. “This

raises the sea bottom in certain places. The waves of the sea are also at work, cutting the land away at the edges of the continents.”

“What will we do when the land is all washed into the ocean?” asked Jane.

“We do not have to worry about that,” said her uncle. “It takes thousands and thousands of years for continents to disappear and for new ones to rise up from the sea. These changes take place so slowly that we do not notice that they are going on.”

“Why is the sun still hot if it started the same time that the earth did?” asked Fred.

“The sun is thousands of times larger than the earth. It takes large bodies a great deal longer to cool off than it does small ones. Many millions of years from now the sun will become cool like the earth.”

“You did not tell us how the moons were formed,” said Jane.

“They were formed in the same way that the earth was,” was the reply. “When the earth was a ball of hot gases a small mass flew off and became the moon. The moons of the other planets came into being in the same way.”

“Do people live on the other planets?” asked Fred.

“I cannot answer that question. We think that they do. Of course, the other planets are so far away that we do not know very much about them. There is no reason, as far as we can see, why people should not live on them.”

“If there are people on them, do you suppose that they are like us?” asked Jane.

“I cannot answer that either,” said her uncle. “They are probably very different from us. That is, their bodies must be different, because some of the planets are much nearer the sun than the earth, and others are very much farther away. If people live on them, those who are on the planets near the sun must be able to stand terrific heat. Those on the planets that are far away from the sun must be able to endure extreme cold. For this reason alone, if people should live on these planets, they would have to be different from us.

“You said that other people think that the earth was formed in a different way. Please tell us about it,” said Jane.

“I have told you enough for one evening,” replied her uncle.

QUESTIONS

1. Can you explain where the earth came from?
2. How does the earth differ from the sun?
3. Describe how gases turn into solids.
4. How is the surface of the earth being constantly changed?
5. Why did not the sun cool when the earth cooled?
6. Can you explain how the moon was formed?
7. Tell some facts that you have learned about the other planets.

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