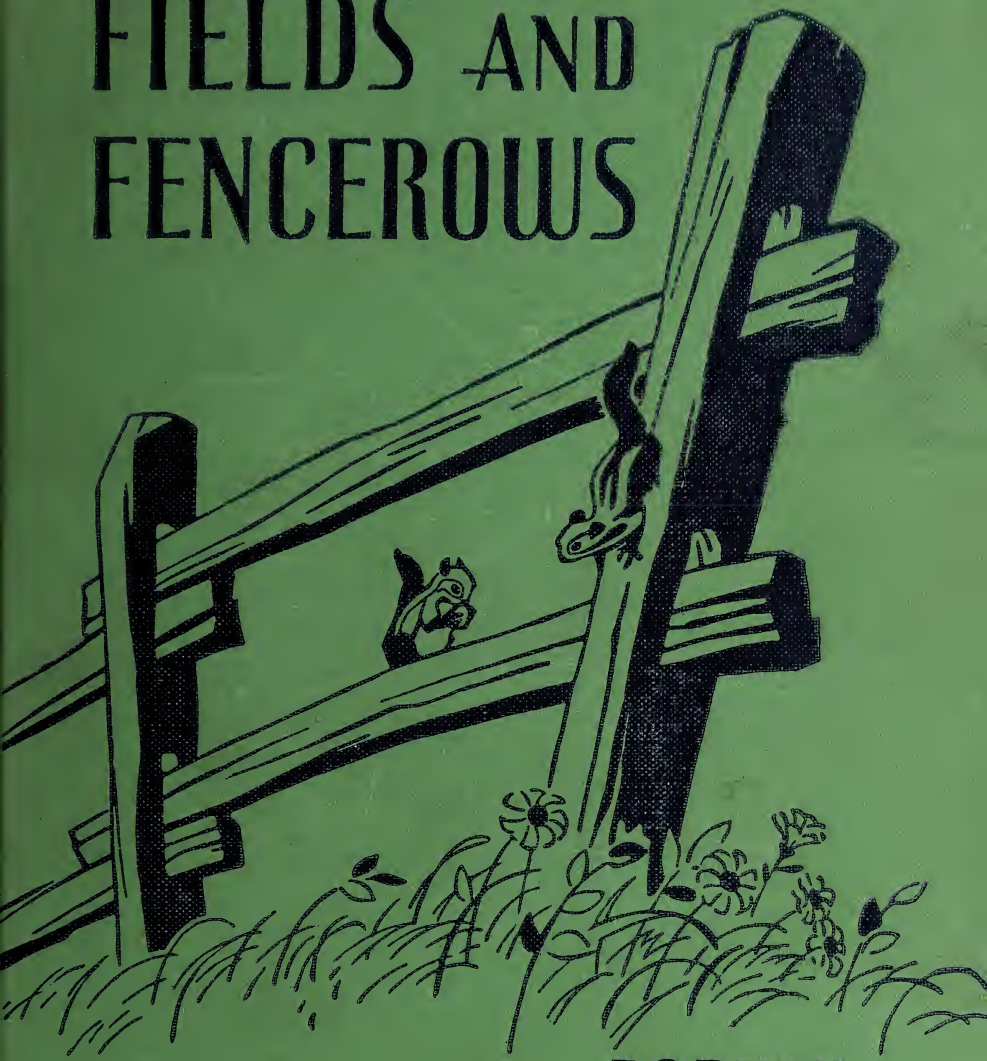
FIELDS AND FENCEROWS



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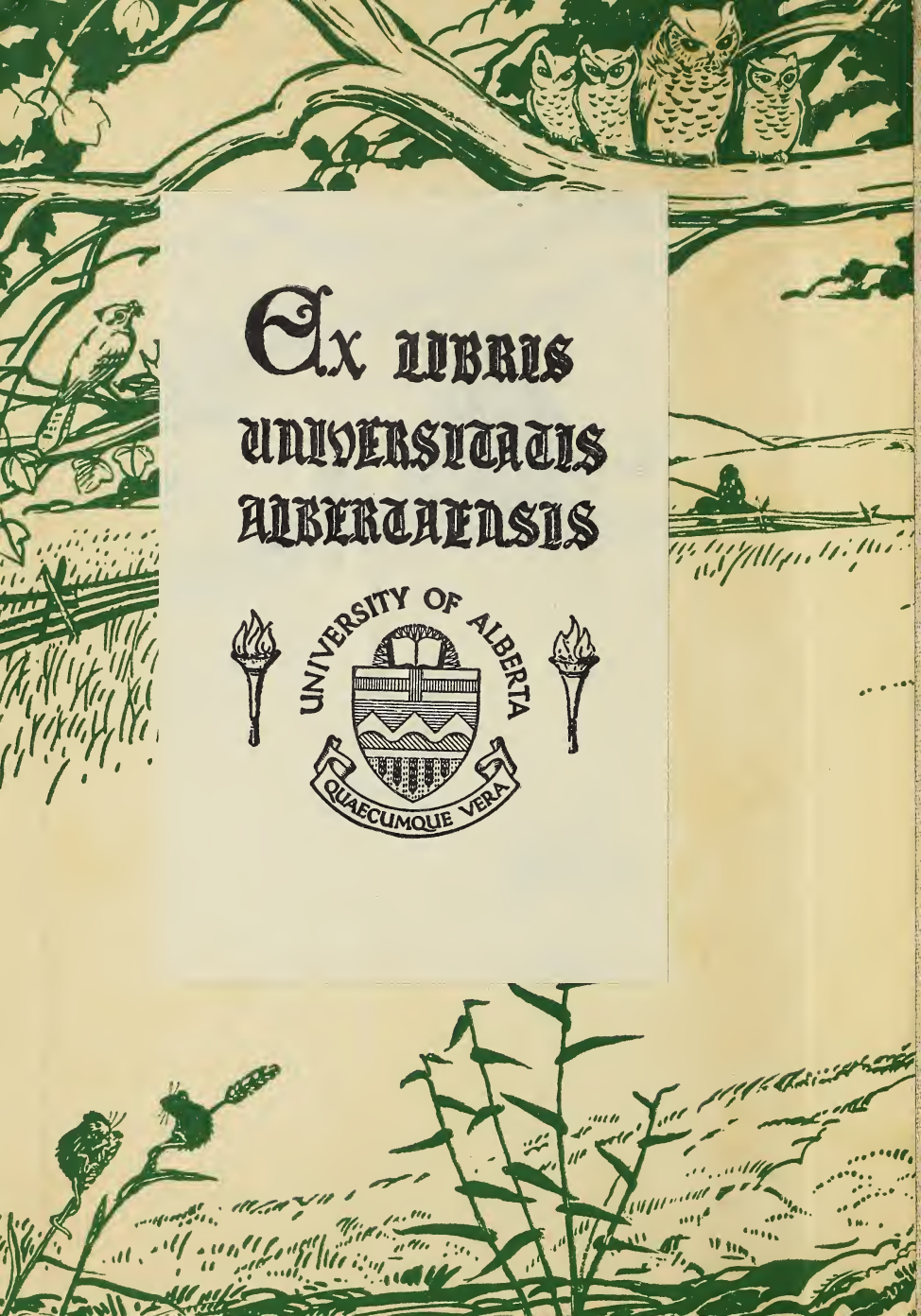
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INSECTS YOU WILL LEARN ABOUT

FIELDS AND FENCEROWS

By

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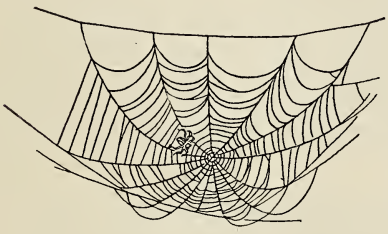

Illustrated by Hugh Spencer and Ottilie Foy

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FIELDS AND FENCEROWS

W.P.3.

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PREFACE

Thoughtful teachers have long recognized the need of content books in the intermediate grades which might serve as supplementary material in the reading and as source material in other subjects. In reading instruction such materials facilitate the work of developing those reading abilities which are basic to good study. In the other fields they supply that authentic information which makes for correct understandings and the growth of wholesome appreciations and interests. But even more important, with the steady growth of the work in elementary school science and interest in unit and activity type teaching has come a need for sound material on the child's level of interest and difficulty.

To make such material available to grade school pupils and teachers *Fields and Fencerows* is being offered. Until recently there have been comparatively few authentic books in the field of biological science on the grade school level. Children have come away from too many so-called elementary science books without having learned much, since the material is either too difficult and therefore uninteresting, or it is incomplete because it has been written down to their level.

This little book aims (1) to interest children in common field plants and animals from both lay and scien-

tific viewpoints (2) to provide interesting reliable informational content appropriate to modern school science study, and (3) to build up a reading familiarity with the vocabulary, idioms, and terminology of biological science. *Fields and Fencerows* has been examined carefully for its accuracy and authenticity by reputable scientists. Its grade placement on the basis of interest and difficulty was made the subject of actual schoolroom test in elementary schools. Its possibilities in connection with the development of the study type reading abilities have been recognized by teachers of reading.

It is a privilege also to remember here the helpful suggestions and criticisms of three scientists: Edward S. Thomas, Curator of Natural History, State of Ohio Museum of Science; and Frederick H. Krecker and William C. Stehr, Professors of Biology at The Ohio University.

July 22, 1936
Athens, Ohio

Walter P. Porter
Einar A. Hansen

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ANTS

"Oh! the ants are in my kitchen." Did you ever hear that?

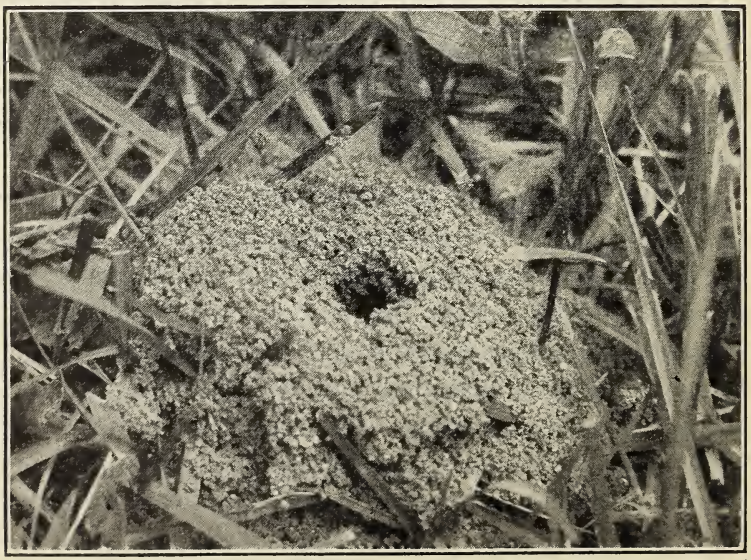
Of course ants do not usually live in kitchens, but certain kinds of ants do sometimes visit kitchens. Where do you suppose they come from and why do they come to a kitchen?

Follow the ants and see what they are doing. There they go in a long line to the refrigerator. How do they get into the refrigerator? There is a crack under the door; just a tiny crack, to be sure, but some prying, snooping ant scout found it and made his way inside. Straight home he went and told the others of the good things to be found there. In a short time they were back at the refrigerator and ready to carry home any food that might be handy. Soon there was a double line, one going and one coming. Down over the edge of the refrigerator, along a crack near the wall, across

a rug, under a door, down the steps, and across the walk to their home.

Watch how they struggle along. Many are carrying loads larger than they are. Through the yard they go, climbing stalks of grass, toppling off and struggling over stones and sticks. All of them are as busy as they can be. Very few give up and quit. They keep trying until they get home with their burdens.

Here is the home. Of course you have seen ant homes before. Some of them are small mounds of sand, while others are piles of dirt as big as a bushel basket. The door to the small home is in the center, while a larger home may have many entrances. This



Brownell

ENTRANCE TO A BLACK ANT NEST

particular one is small, about as big around as an inkwell. The workers are dragging their loads of food up over the side of the house.

Other ants are about the entrance. Some just rub their feelers together and pass on. Perhaps they are the guards that challenge each newcomer to be sure that no strangers or enemies enter the house uninvited. These friends with the loads must live here because they all disappear through the door with their burdens of food.

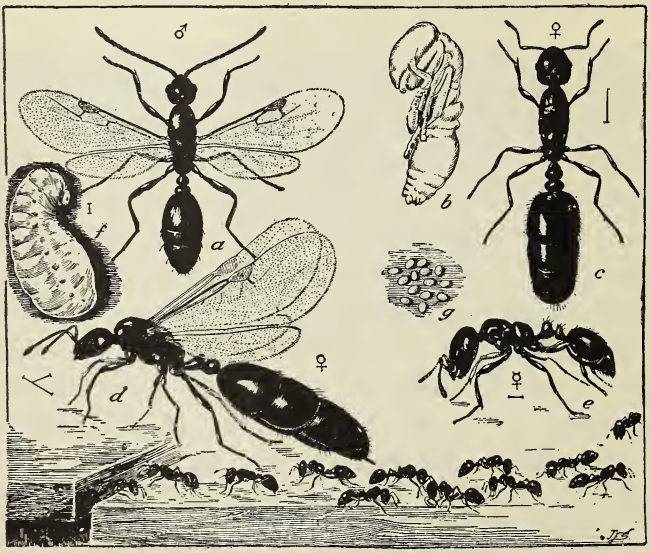
Perhaps you could feed them. Put a small piece of meat or a bit of sugar on the edge of the ant hill. How quickly an ant comes to investigate. First it rubs our offering with its feelers. That is the ant's way of feeling and smelling. See how it moves about, as if wondering what to do with this new find.

But the ant does not wait very long. It fastens its pincerlike jaws into the piece of meat and soon ant, meat, and all disappear into the nest. What do you suppose they do with all of this food they collect?

If you could see inside of one of these homes we would understand. It will be easier if you hunt a larger ant hill, however. Perhaps you remember a large one you saw by the roadside. Such a fine large ant hill would surely have nearly all kinds of activities going on inside. Dig into it and see. You will have to be careful, and you may have to run away if too many ants get on you, because sometimes they pinch with their strong jaws. As soon as you dig out the first spadeful of earth you will see ants scurrying in

all directions. Some of them seem to be carrying a load.

What do you suppose it is? Food? No, it is what is commonly called ant eggs. You are going to learn that they are not eggs, but tiny cases in which the baby ants live while changing from eggs to ants. They are called pupa cases, and are much the same as the cocoons that we find on weeds and trees. Ant eggs are much smaller than these cases. The eggs are laid by the queen ant. They soon hatch out into tiny helpless creatures. The ants have nurses to take care of these helpless babies. In a short time they are cov-

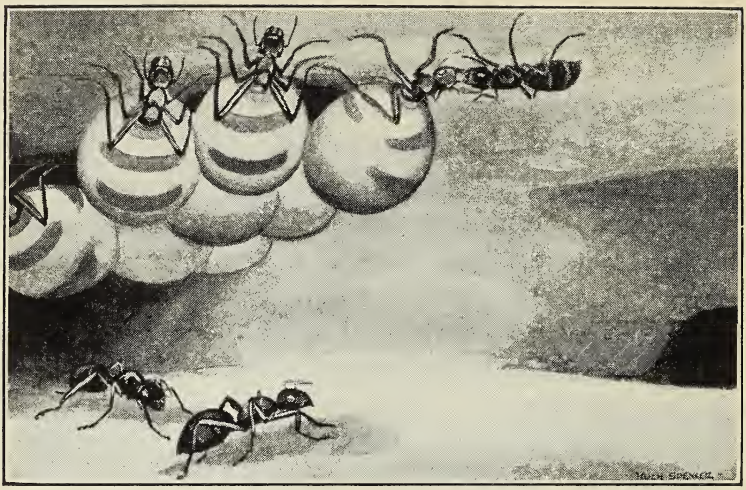


THE LITTLE BLACK ANT: *a*, male; *b*, pupa; *c*, female; *d*, same with wings; *e*, worker; *f*, larva; *g*, eggs; group of workers in line of march below. All enlarged, the lettered illustrations all drawn to the same scale.

ered with a soft case. This is the pupa case and is what the ants carry away to safety when disturbed. Soon the pupae become ants. The cases split open and the full grown ants come out. They are helpless at first, and can hardly walk. The nurse ants teach them to walk and soon they are working about the nest as busily as the older ants.

Did you know that ants kept cows and gardens? They do. And not only that, they take care of their cows in stables built for that purpose. Now what do you suppose an ant cow looks like? Of course you know at once that they could not keep big dairy cows, as farmers do. Perhaps you can get an answer by finding an ant stable and looking at the cows. The ants may make a stable under the ground, or in a plant somewhere. If in a plant, the ants bind a couple of leaves together and then carry grains of sand to place on them. Soon they have the leaves of the plant plastered up and covered with sand. Now they are ready for the cows. Where do you suppose they will get them?

Ants really have peculiar notions about cows. Ants like sweet things, so in looking for cows they find those which will give them the sweets they desire. Plant lice, the little green insects you have seen on plants, give off from their bodies just such a sweet substance as ants like. The ants have learned this, so they take the aphids or plant lice from one plant to another, or to their burrows and use them for cows. The plant lice are kept on plants, so that they are always well fed



ANTS WITH THEIR HONEY POTS

and the ants have only to milk the cows to get the sweets they like so well.

Do you wonder how ants milk their cows? Let us watch one and see. The ant approaches the aphid and begins to rub its feelers over the aphid's back. The aphid seems to like this, for very soon tiny drops of sweet liquid called honeydew appear on little horns on the aphid's body. The ant eats this liquid and goes from one cow to another until it has all that it needs.

Most ants seem to like sweet things. Try them with some sugar placed outside the ant hill. Soon they are scurrying about carrying it into the hill. There is one kind called honey ants that have a peculiar way of storing honey. How do you suppose they do it? In hives like bees? No, guess again. In ants! Now how

do you suppose that could be? A few of the slave ants are selected for honey pots. The workers collect the honey and bring it to the nest. Down through the nest they go until they come to the honey storage room. Then they pump the honey from their own body into the body of the "honey pot." The honey pot ant begins to swell and swell and swell. Larger and larger it grows as its body fills with honey. Soon it is full. Then it hangs itself to the ceiling of the honey room with its feet, and hangs there until some nurse ant comes to pump out some of the honey for the young ants. Isn't that a funny way to store honey?

Ants not only keep cows but they have gardens. Down deep in the nest where it is dark most plants would not grow. However, there is one kind of plant that likes to live in the dark. Such plants are called fungi. Mushrooms are a kind of fungus plant. The ants have learned that this plant will grow in the damp, dark ant hill. So they take pieces of this plant into the hill and place it among leaves and dirt. Soon it begins to grow and the ants can harvest their crop. The ants have learned many ways of getting food.

One thing that you will notice about the ant hill is that it is always clean and orderly. You don't find things scattered around over the floor. There is a place for everything and everything is in that place. There is a nursery where the nurse ants take care of the eggs and young, a place for the cows, a garden, and storage place for food.

If an ant dies it is carried outside by a worker and

usually carried well away from the nest. If it is left inside at all it is carried to some far off place. You have seen ants carrying dirt and things out of the nest. Perhaps they were digging new tunnels or were just cleaning house.

Every ant has work to do. The queen ant lays all of the eggs. The workers take care of the nest and gather food. Each one seems to know what it is supposed to do. Some clean up the house, some guard the entrance, and others take care of the ant babies.

The slaves usually take care of the babies. Did you know that some ants had slaves? How do you suppose they would get slaves? Here is the secret. Some of the workers of one nest form a sort of raiding party. They visit another ant hill and make a dash through the tunnels to the nursery. Each warrior grabs a pupa case in his jaws and runs away with it. Sometimes the other ants fight back, but most of the warriors escape without injury. Out of the ant hill they come, and rush home with their prizes which they place in their own nursery. Soon these stolen pupa cases break open and the new slave ant comes out. As soon as they are able to work they go about their business just as the others. They do not seem to mind being slaves. The other ants seem to be good to them and treat them much the same as members of the family.

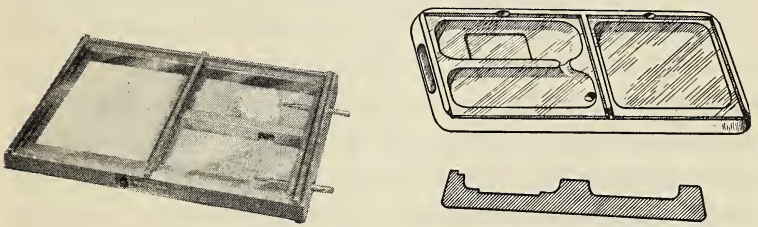
There are many kinds of ants. There are red ants, black ants, brown ants, brown and black ants, and maybe some other colors. And there are tiny ants, and medium-sized ants, and great big overgrown ants,

and maybe other sizes, too. Some of them live under the ground. Some of them live in the walls of houses, and some of them drill out the insides of logs, poles, and trees to make their homes.

If you look around your home you may find several kinds. There may be an ant hill in your own back-yard. If there is one you are fortunate, because you can prove many of the things you have learned.

Things to do

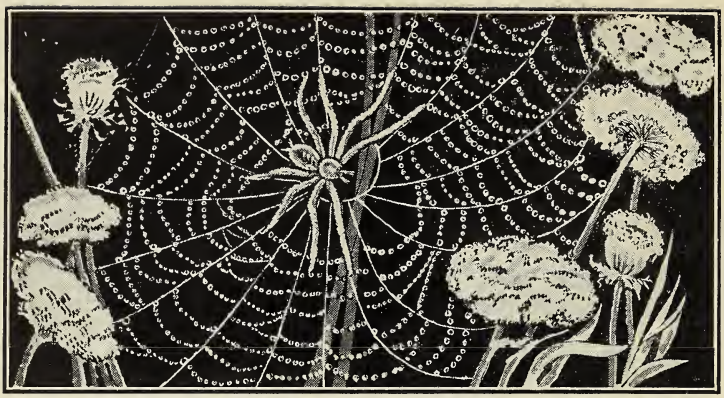
1. Make an ant nest.
2. Watch the ants in the nest and describe what you see.
3. Make drawings of different kinds of ants.
4. Make an ant nest for your schoolroom.



General Biological Supply House

AN ARTIFICIAL ANTS' NEST

5. Make a collection of ants and mount them.
6. Write a story about the work ants do.
7. Find out how to help mother keep the ants out of her house.
8. Read some other interesting stories about ants.



SPIDERS AND THOUSAND-LEGGED WORMS

Have you ever noticed the spider webs in the grass early in the morning? Why do you see so many more of them in the morning than in the evening? Some are built at night but not all of them. In the early morning the dew clings to the spider's web making it more noticeable. Look closely at one. How the tiny droplets of water sparkle in the morning sun. It seems as though the threads of the spider web had been strung with tiny crystal beads.

The spiders of the field and roadside are most interesting because of their ability to make these wonderful webs. There are many pretty stories about the spider and why it spins webs. The scientific name for the spiders and scorpions is Arachnida. Now how do you suppose we happened to give this group of animals

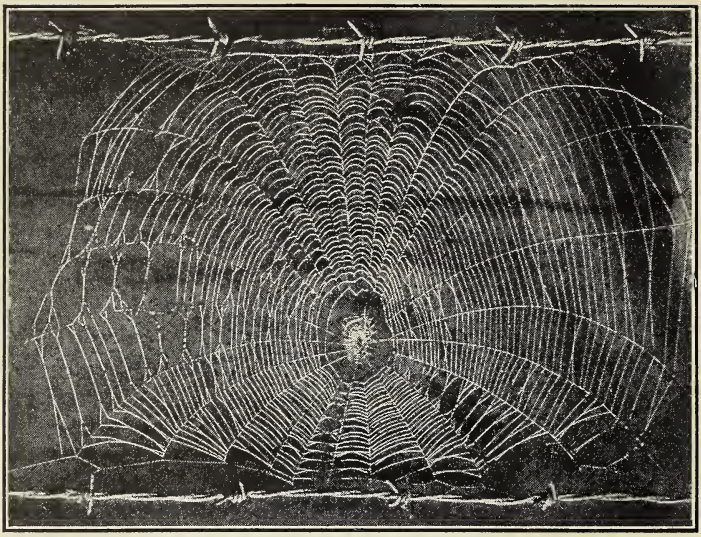
the name Arachnida? Here is the reason. The ancient Greeks had a story by which they explained where the spiders came from.

There was a beautiful girl named Arachne. She was very proud and boasted of her ability as a weaver. She was not very well liked on account of her boastful ways. Finally she became so proud of her ability that she said she could weave as well as Minerva. Minerva was the goddess of peace, war, and needlework. Of course, no mortal could hope to defeat a goddess, yet Arachne boasted of her ability to do so.

Finally Minerva disguised herself as an old woman and came to see Arachne. Minerva told Arachne that she should not boast of her ability. Arachne told the old woman that she was a better weaver than Minerva, and that she would challenge Minerva to a contest. The goddess then threw off her disguise and accepted the challenge. They set up their looms and began to weave. When the tapestries were finished each turned to look at the other's work. Arachne saw at a glance that Minerva's work was better than her own. Now she was very sorry for the way she had boasted. In despair she tried to hang herself. Minerva seeing her dangling by the rope changed her into a spider and condemned her to weave forever.

We know that such stories are not true, yet they show us what people of long ago thought of many of our animals and plants. From this interesting story the spiders and scorpions get the name Arachnids.

We know the spider is a wonderful weaver. If you



WEB OF AN ORB WEAVER

could only see one at work you would agree that this is true. Perhaps you may find a web between two trees or posts. And perhaps the two supports may be quite a distance apart. Now how do you suppose that the spider got the first line from one support to the other? It is too far to crawl down to the foot of one support and up the other side. And as you know spiders cannot fly.

Here is the secret. The spider has tiny tubes on its body called spinnerets. From these tiny spinnerets the spider gives off a liquid which turns into silk when it strikes the air. The spider climbs up on one of the posts and begins to spin. Out goes the thread on the

breeze. Longer and longer it grows as the spider spins. Soon the breeze has carried the silk quite a distance. It waves here and there, and it strikes the other post and is caught just like a kite string in a tree. Now the spider begins to work. It takes hold of the silken thread with its feet and pulls it tight. When it is just tight enough the spider fastens the silk thread to the posts. Now the bridge is made. Not a very firm bridge, to be sure, but a bridge nevertheless. Out on this frail support the spider goes spinning more threads. Now it is in the center, swayed to and fro by the breeze. Surely it will fall. Farther and farther it goes. Now it is nearly across. There it has arrived at the other side! Now the same thing must be done to get another line out just below this one. This time it does not take very long. The silk thread catches on the post below the other line. This one too is pulled taut and made fast.

Now the spider climbs out on the upper line. There it has fallen off! No, it drops too slowly. It is spinning a line as it falls. Now it stops halfway between the two lines and hangs suspended by its own thread of silk. Soon it drops down to the lower line and fastens the silk thread. Back up this line it goes again and starts a line from a new place. Soon it has a regular criss-cross of lines. How regular they are. Almost as regular as the spokes in a wheel.

Now the spider is ready to finish the web. It starts in the center and begins to put in the spiral threads. This time the spider uses a different kind of silk. Not

a different color, but a different sort altogether. This spiral line is made of a sticky kind of silk. It is so sticky that the spider is careful to walk on the foundation lines and stay off the spiral lines. In this way the spider keeps going round and round until the web is completed. Sometimes it makes a heavy zigzag line in the center to strengthen the web.

The spider does not put up a sign on its web saying, "Fresh Paint," or "Sticky Silk," or "Stay Off." No indeed. It does not need to put up a sign for spiders, because they know these spiral lines are sticky. But maybe the insects would appreciate it if the spider put up a sign. They do not seem to know that this sticky silk was put there just for their benefit. Some blundering insect flies right into the trap. "Buzz-Buzz-Buzz" he goes, as he threshes around trying to get out. But he does not jump around long. Down in the center of the web the spider stands with one of his eight feet on a line. As soon as the insect touches the net the lines vibrate. The spider shakes the line to make sure his prey has not escaped. Then he darts out and catches it. The insect is soon killed, and the terrible ogre sucks its blood. As soon as that is done it throws the skeleton away. If the web has been torn it is repaired, and the spider goes back to the center to wait for another visitor.

Such spiders are called the orb weavers. Sometimes they are called garden spiders or gold spiders on account of the place in which they are found and their gold color.

The garden spider lives on insects. Its bite is poisonous enough to kill insects, but so far as we know it would not hurt you if you were bitten by one. In fact they do not seem to want to bite human beings.

In the fall the garden spider spins a different web. This time it is a sack for her eggs. This sack is about as large as the end of your thumb. It is nearly round, and fastened securely to a weed or bush by a silk cord. In this case the spider lays her eggs where they soon hatch. Now an interesting thing happens. The mother spider does not supply her young with food as some of the insects do. She leaves them to shift for themselves. This they do by eating their brothers and sisters. From all that hatch in the fall only a few are left to start out in the spring.

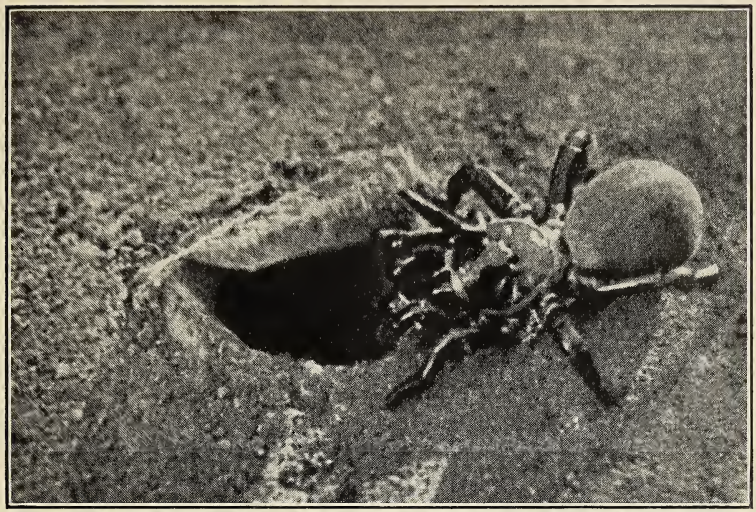
There is another spider that takes better care of its young. In fact several kinds do. This one is called the wolf spider. It is called the wolf spider because it stalks its prey rather than trapping it. The wolf spiders are the big brownish black ones we often see in holes in the ground or under rocks. The wolf spider makes

WOLF SPIDER

an egg case of silk, too. But instead of attaching it to a tree or weed the mother attaches it to her own body and carries it about with her wherever she goes. Just try to take it away from her and she will immediately put up a fight to protect her property.

Soon the eggs hatch out into tiny babies. They do not run away but climb on their mother's back, and she carries them about just as she did the egg case. What a crowd of them there are. You would think they would all fall off, but they don't seem to. The mother carries them with her and protects them until they are old enough to care for themselves.

You have all seen the spider that builds the funnel-shaped web. Perhaps you have thrown flies into the web to see the spider dart out of the hole in the funnel to catch the fly. There are others called tarantulas, some of which are said to be poisonous. Some of them build peculiar homes. One is known as the trap-door spider. His home is in a hole in the ground lined with silk. On the top of the hole the spider fits a lid made of silk and earth. This lid fits snugly into the hole. On one side of the lid the spider makes a hinge of silk, making its home complete. From the inside it merely has to push on the door and it opens outward. If it wishes to enter from the outside it sticks one of its feet under the edge and opens the door. If it should be pursued by an enemy it merely rushes home with all speed, lifts the trap door, darts in. The door closes quickly and securely, leaving the pursuer wondering what has become of its intended prey.



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THE TRAPDOOR SPIDER AND NEST

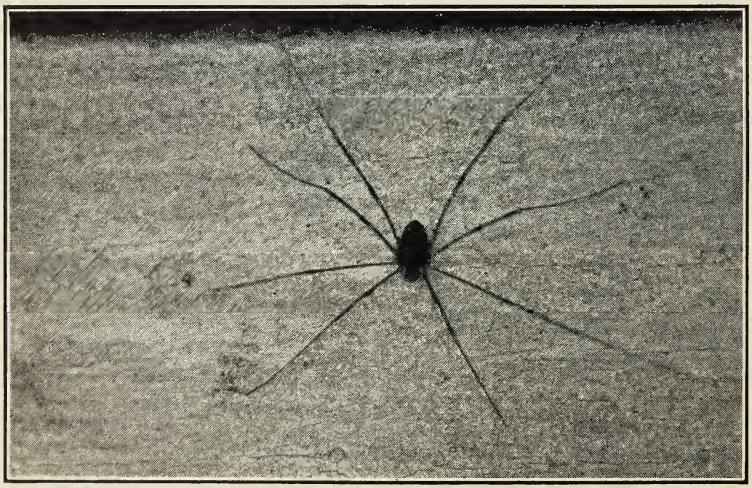
There are many other kinds of spiders to be seen also. The little black jumping spider is a very common one. What a jumper it is! Just try to catch one and away it goes jumping before you can grab it. These spiders are interesting in other ways. In the mating season the male spider dances for a mate. That is, when he goes courting he must dance for the lady of his choice. Such a dance it is, cavorting before her trying to win her favor. If he does not win her favor she is very likely to pounce upon him and eat him. These jumping spiders are so common you will have no difficulty in finding one to observe.

A great many spiders are harmless, but the bite of some of them may cause much pain and even death.

You should not handle any spider unless you know it is harmless. There is a spider called the black widow which is known to have caused severe injury. It gets its name of black widow because it eats the male spider soon after mating and it is black in color. The black body has a red or orange hourglass mark on the under side. The body is a little larger than a pea. The legs are long and black.

The black widow is more of a southern spider, but is found as far north as Ohio. It builds its web in old buildings, under rocks and other places on the ground. It usually will not attack man unless the web is touched or it is handled roughly.

The grand-daddy-long-legs is a close relative of the spider. You have often seen this long-legged fellow.



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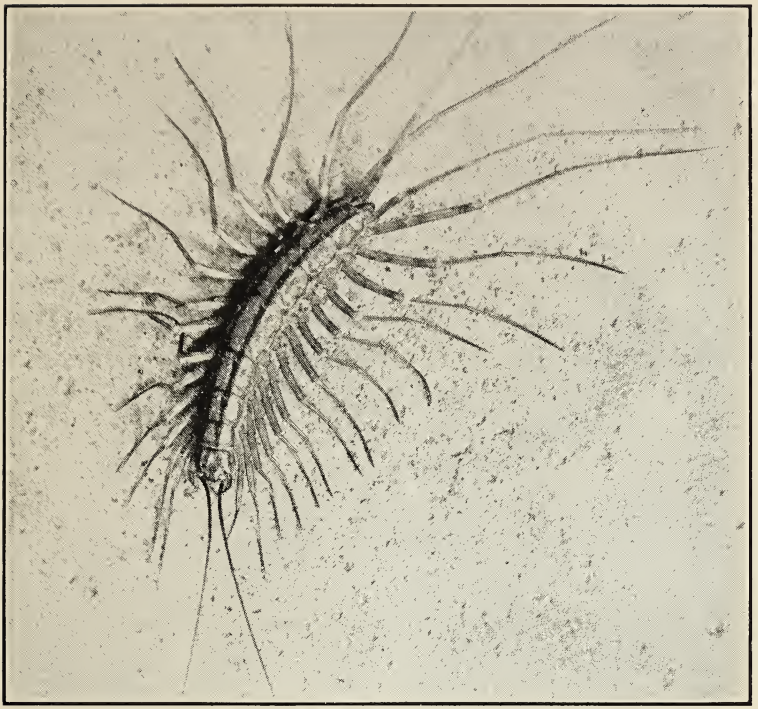
A GRAND-DADDY-LONG-LEGS



C. Clarke

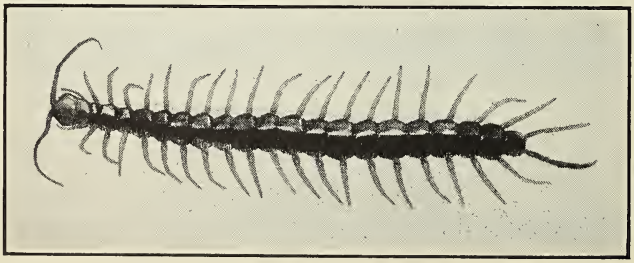
HOUSE CENTIPEDE

How he can run with those big long legs! How lightly he walks! He could almost walk in the water. Sometimes he is called the "harvest man" because he is more often seen during the harvest time.

In the fall the "grandmother" long-legs lays her eggs in some protected place, then she dies. In the spring the baby daddy-long-legs hatch out. They look much like daddy and mother long-legs only smaller. As they grow larger and larger they shed their skins.

There are some other relatives of the spiders that are often found. One is the common centipede. "Centi" means hundred, and "ped" refers to feet. Not all of them have a hundred feet, but they do have many feet. Almost every boy knows them as "thousand-legged" worms. They are not thousand-legged, nor are they worms. They are not even a close relative of the worm. They live in damp holes and under bark of dead trees and under stones. Here they can catch whatever insects they need for food. Most of them are not poisonous, as is supposed, but in the south we find larger kinds that are poisonous. Most of the common kinds found in the north are not dangerous. The house centipede or Scutigera is a long-legged one that is often found about houses. It lives on flies and other insects. It would be a friend if it were not for its bad reputation for biting. However, very few people seem to get bitten.

Many children have funny notions about "thousand-legged worms." They believe that if a thousand-legged worm should count your teeth you would die. This



C. Clarke

ONE VARIETY OF CENTIPEDE

might be true if the thousand-legged worm could count, but don't worry or feel you must keep your mouth tightly closed; the centipede cannot count.

The scorpion is another relative of the spider. It has rather a bad reputation. It looks like a kind of slim-tailed crayfish. On the end of its slim tail is a sharp stinger with which it kills the prey. The scorpion grasps it with its claws, then curving the stinger over its own head proceeds to sting the prey. The poison from the stinger kills the victim. The sting of a scorpion might even cause death to a man. At least it is an animal to be let alone rather than one to be handled.

Most of these Arachnids are interesting because of their habits. The spiders are most interesting because of their webs. While most spiders would not bite you, and only a few would cause any serious harm if they did, it is best to let them alone and watch them rather than to become too familiar with them.

Things to do

1. Watch a spider weaving its web. Write a story with illustrations showing how it is done.
2. Find as many kinds of webs as you can and describe them.
3. Find as many kinds of spiders as you can.
4. Describe the eggs and egg cases.
5. Catch some spiders and feed them.

6. Feed spiders on their webs by throwing in flies.
7. Compare spiders with insects.
   a. How many legs does each have?
   b. What kind of eyes do they have?
   c. What do the spider's fangs look like?
   d. Find its spinnerets.
   e. Is the body hairy?
   f. Look at the feet. How can they hold on to things?
8. Describe the trap-door spider's home.
9. Describe the centipede. Try to find out what it eats.
10. Describe the scorpion. What does it eat? Is it dangerous? Why?
11. Look for grand-daddy-long-legs. Try to find out what it eats. Make pictures of grand-daddy-long-legs.

Photo by the author

NIGHT HUNTERS

Did you ever hear of anyone "playing possum"? If you should happen to catch an opossum, you would know what that means. As soon as an opossum is caught or cornered, the first thing he thinks of is playing dead. Down he drops, stretches out, opens his mouth, and becomes as limp as a rag. You can poke him or maul him as much as you like, but he goes right on "playing possum." A dog comes along and bites him a few times, but a dog does not want to fight an animal that is already dead. So off the dog goes, leaving the opossum for dead. As soon as the coast is clear, the opossum's little black eyes open to see if all enemies have gone. Then up he gets and ambles off about his business.

The opossum usually lives in hollow trees. At night

he comes out to feed. He looks like a great big rat and can climb trees nearly as well as a squirrel. In fact he rather likes to climb persimmon trees, especially when the persimmons are ripe. Out on the limbs he goes, eating, eating, eating. He is a great glutton and will eat all he can find. He does not stop at eating persimmons either. Not he! He eats most anything he can find. Insects are to his liking, especially big fat larvae. Any insects that come in his way are likely to be gobbled up at once. He is not very careful about the rights of others either; a bird's nest with eggs or young birds makes a good meal. And if he gets half a chance, he does not hesitate to eat the parent birds as well. Young snakes, rats, mice—all are food to a hungry opossum. If he gets a chance at a farmer's chickens, he is not at all likely to miss the opportunity. Nuts, fruit, berries—all these he eats too. He is even accused of plying the buzzard's trade and eating carrion. So you see with such a variety of food he should never be hungry, but hungry he usually is, and goes out each night to hunt for more to eat.

The opossum uses his tail for an extra hand. How he can hold on to things with it! If he wraps it around a branch he can hang his whole weight on his tail. Just try to shake him out of a tree. He sticks on like a leech. He wraps his tail around the limb, grabs the bark with all four feet, and as an extra safeguard bites into the branch with his teeth. Shake him out if you can.

The opossum is said to use his tail to carry leaves

Photo by the author

NOTICE THE YOUNG IN THE POUCH

into his home. This home is usually in a hollow tree. Leaves and grass are carried into it to make a nice, soft carpet. Here the young are born. What tiny helpless little things they are, not much larger than a small butter bean. How can such tiny creatures ever live? Now here is one of the most interesting things about this animal. The opossum is a relative of the kangaroo; that is, the females have a pouch on the underside of the body in which to carry the young ones.

When the baby opossums are born, the mother picks them up and places them down in this nice warm pouch. Each young opossum begins to suck, just as kittens or puppies do. Here they stay and continue

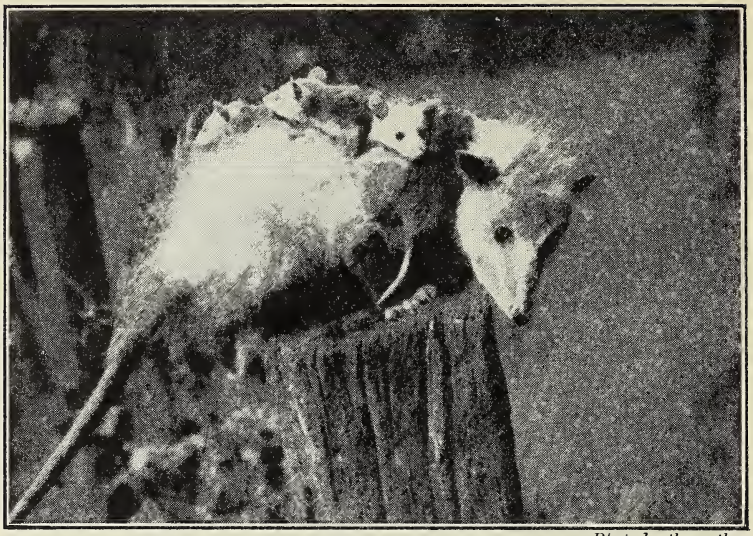


Photo by the author

AN OLD OPOSSUM CARRYING ITS YOUNG

to grow until they are big enough to crawl out of the pouch.

In a few weeks they are big enough to come out. They clamber all over their mother, holding on to her thick fur. And if the mother takes a notion to walk about or climb a tree she takes the whole family with her.

Each baby holds tightly to her fur. Sometimes they wrap their tails about her tail and hang like clothes on a clothes line. It is a rare thing for one to fall off.

A young opossum makes a good pet, but is careless about whom it bites. It may get into mischief like the crow or the raccoon, but it will soon learn to know the people who feed and take care of it.

The opossum is much sought by hunters. The fur is worth something, but some people like to eat the opossum as well as the opossum likes to eat other things. The opossum is usually very fat, and the meat is rather dark. He may be hunted both winter and summer because the opossum does not hibernate like the bear or groundhog. He is likely to be found prowling around whenever he gets hungry, which is quite often.

On any night that you see the opossum, you might see a raccoon. What an interesting fellow he is! He gets to be as large as a good-sized dog. What an intelligent looking face he has! And he is about as intelligent as he looks. He knows pretty well how to take care of himself.

He likes to live in a hollow tree. And if you don't mind he would like the tree located near a pond or stream. He has a liking for water animals. Often at night he can be seen down at the water's edge, dabbling his paws in the water. If you just happened upon him you might think he was washing his hands. But woe unto a frog or fish or crayfish that comes too close to those claws. Quick as lightning they will flash out and usually catch the unwary victim before he can escape. Now the raccoon does a peculiar thing. Although he has just taken the frog or fish out of the water, he souses it back into the water two or three times as if washing it off. Each bit of food is treated in this same way. Just why he would have to wash a freshly caught water animal is not known, but he does.

A clam lying on the bottom closes its shell as he

Eastman Kodak Company

A RACCOON FISHING

comes near. Surely here is one animal that has eluded him. But only for a little while. He takes the clam and proceeds to bang it against a rock until the shell breaks, and then he devours the clam.

He is as much at home in the water as on land, because he is an excellent swimmer. If pursued by man or dog he is likely to take to the water to throw them off the trail. On land he is a good match for most dogs, but in the water he is right at home. He is likely to drown all of the dogs that come after him.

His track is easily recognized. He walks on his entire foot so his track looks like the track of a very small baby. These tracks are often found along the margins

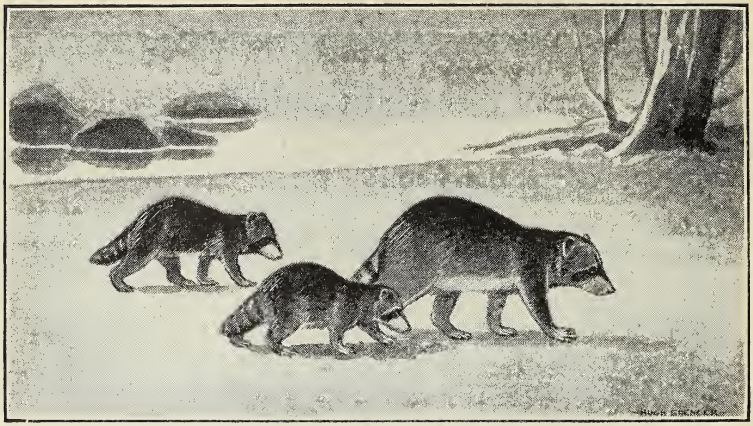
of streams or ponds where he takes his food to wash it. His track may be found in the snow, far afield in the winter. He may even visit a farmyard if it offers a likely opportunity for something to eat.

In the home in some hollow tree the young raccoons are born. Sometimes there will be four or five in the family. The parents take good care of the family until the babies are full grown.

What a happy family it is playing and frisking about the home. But let an intruder come near and such growling and vicious noises you never have heard. Little tiny snarls and great big snarls come from the family, and if you get too familiar you will be bitten.

In the daytime the raccoon sleeps. Usually it finds a place high in a tree and curls up for a nap. It snuggles down and wraps its big bushy tail around its face. It looks like a big furry ball. It usually makes sure that it is safely hidden by leaves or branches before it goes to sleep.

The raccoon has a lot of curiosity. Almost anything that is none of his business interests him. Poking along through the trees, a bird's nest offers food. He would not be too good to poke his arm into a woodpecker's nest and rob it if he found anything there. Fruit trees, berry bushes, and grape vines all must be investigated for what they might yield in the way of food. He is often trapped by placing a piece of bright metal or other shiny object above the trap. If he sees it, he just can't let it alone. He must find out what it is.



A RACCOON FAMILY

And when he goes to investigate he may get caught, but not often.

As a pet he is the most meddlesome animal in the world. Nothing is sacred; boxes, rooms, and drawers he is likely to investigate. And if left alone he will very probably find the pantry and stick his nose into everything there. He might even borrow a chicken from the poultry yard if not carefully watched.

Men hunt the raccoon at night. He is useful both for his fur and for food. The fur is long and thick and is often used in making "coon skin" coats. The meat is dark, but is said to be very good food. A coon hunt is very interesting sport. Often the coon may whip several dogs before he is finally caught. He is not such a good friend, because he does some damage, but most of us would hate to see his kind entirely killed off. This may easily happen unless game laws help him.

Another prowler of the night is the skunk. You do not have to be told what a skunk is. Most any boy or girl would recognize his black and white coat as soon as he saw it. All would recognize the terrible odor of the skunk when frightened or excited. This odor is produced at the base of the tail. It is so strong that it can be smelled for long distances, and only a few drops are given off at a time.

The skunk is one of the most independent of all the animals. He makes almost no effort to get out of your way. And if you attempt to come too close, up goes his tail as a warning to keep your distance. If you should be so foolish as to go closer he fires his scent with deadly aim. Your clothes are ruined. It will be days before the scent leaves them. Other animals have learned to leave the skunk alone too, so he is fairly safe except from automobiles. He refuses to give way even to automobiles, and is often run over and killed. But most drivers of cars try to avoid him if possible.

The skunk lives in a hollow stump or a burrow in the ground. If near a city, it may make its home under a house. Here it may live in perfect peace, unless some prowling dog happens to crawl under the house and find the home. Then the skunks and the family in the house may both have to move. If the burrow is in the ground a nest of leaves or grass is made. The young skunks are born in this nest. There may be as many as ten in the family.

When they are large enough, the mother takes them out to teach them to get food. What a sight they are,

A SKUNK FAMILY

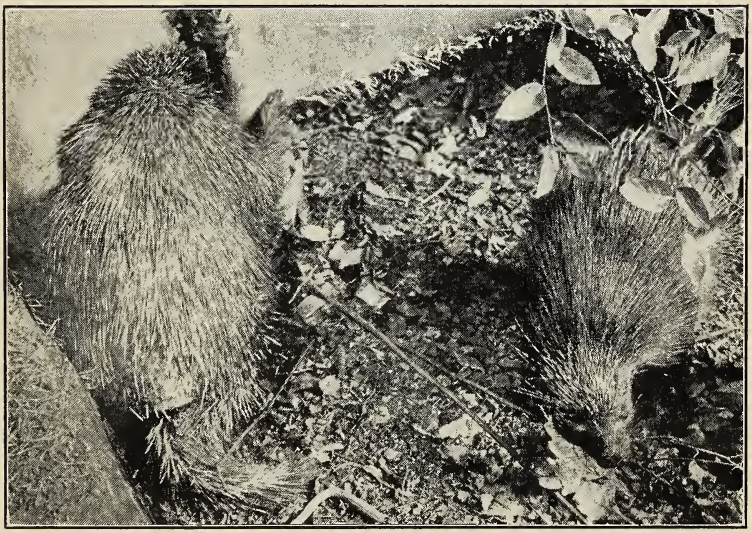
trailing along with the mother in close formation. At a distance the family looks like a small fur rug walking about over the field. Away they go, digging and scratching. Grub worms and insects are favorite food for the skunks, and grasshoppers are eaten with relish. A family of skunks would have a regular picnic in a field full of grasshoppers.

The skunk is trapped for its fur. The fur is thick and fine and of good color. It is used for fur collars and fur coats. The fur is sold under different trade names, and is rarely called skunk. This is probably because it would not sell as well by its true name.

You could not get very far in some parts of our country, especially the north, without seeing a porcupine. This little animal is also very independent. It does not have any fear of man or other animals. If it is

surprised it rolls itself into a ball and waits to see what happens. And such a ball it is, covered with sharp thorny stickers or quills. These quills are not fastened very tightly and come out easily. If a dog or other animal comes too close it is likely to get a slap from "porky's" tail. The quills stick in the dog's nose and mouth. He rarely goes after a second treatment.

The porcupine cannot shoot its quills from its body. It must depend upon an animal coming close enough to slap with its tail or some animal that would be foolish enough to try to bite it. The quills are barbed on the end, and stay in once they get into the flesh. In fact, they work into the flesh if they are not pulled out at once.



American Museum of Natural History

PORCUPINES

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THE GREY SQUIRREL

The porcupine lives in a hollow tree. Here the baby porcupines are born, usually two or three to the family. The porcupine spends much of its time in the trees, where it eats the green bark and buds. It is not afraid of man and often visits his camps to look for food. Those in North America are about two feet long and are either grey or yellowish brown.

A more common visitor among the trees is the squirrel. He may be found either day or night. Squirrels usually live in some hollow tree. They also build nests of leaves in the tops of trees. The young are usually born in the hollow tree nest. The other nest is used more as a place for sunning and playing.

They take great care to store up enough food to last through the winter. All during the summer they are

busy gathering nuts for the winter supply. Sometimes they bury nuts in the ground and forget where they buried them. In this way they plant many trees which help to reforest the land.

The babies are born in April, about three to six in the family. In a short time they are big enough to come out of the home. Then they begin to make short trips around the front door. Slowly and cautiously at first, but soon with greater speed they frisk about. Before long they go farther and farther, as if daring one another to see who can go the farthest. It is not long before they are scurrying about over the trees, jumping from branch to branch, just as their parents do. Then they go about making a home for themselves. In the winter time several of them may be found in the same hole.

There are many other animals to be found after dark. The fox is a night prowler, as are many of the other animals. You cannot usually see them, because they are out when you are asleep, but nevertheless they are there and tomorrow when you are about they will be at home asleep.

Things to do

I. Opossum

1. Describe fur, teeth, tail, tracks.
2. How do the young travel? How does the mother take care of the young?

3. Where do they live? How are they often caught? What use have they as food?
4. Describe "playing possum." What do they eat?

II. Raccoon

1. Describe the raccoon—teeth, fur, tail, food, home, hunting, tracks, and feet.
2. Tell about the curiosity of the raccoon.
3. For what is the fur used?
4. Where do they live?
5. Write a story of a "coon hunt."

III. Skunk

1. Where does it live? Describe its young.
2. How does it get food?
3. How does it protect itself?
4. Describe the fur and tell what it is used for.
5. Tell how skunks are caught.

IV. Porcupine

1. Describe the porcupine.
2. How does he protect himself?
3. How did the Indians use the quills?
4. Can the porcupine throw its quills?

V. Squirrel

1. Where do they live?
2. What do they eat?
3. How do they plant trees?

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OUR FRIENDS THE TREES

There are several ways to learn to know the trees. Let us see what things we already know that will help us. Of course, every boy and girl knows what a leaf is, and what a wonderful thing it is! If it were not for green leaves on plants you could not live, because in the leaves of plants all of the starch and sugar in the world is made. Think of that! Everything that you eat depends upon the green leaves of plants. If you eat meat, the animal from which the meat came ate green plants or their fruits to make the meat.

Think what a wonderful process this is! The green coloring matter in the leaf, called chlorophyl, is the most wonderful substance in the whole world. It is

made up of tiny green cells. When the sun shines on this substance it begins to work. It takes the carbon dioxide gas from the air and the water which the roots get from the ground and changes them into substances which become either starch or sugar. This process must not be confused with the breathing of the plant. Many people think that plants breathe carbon dioxide, but this is not true. Plants breathe oxygen just as we do, and use carbon dioxide only in this starch-making process.

Making starch and breathing is not all that leaves do. They also help to digest the food for the plant, and excrete waste matter. So the next time you see a tree, think of all of the activity that is going on in the leaves. The whole tree is alive and working. Water is going up the trunk and food is being carried down. Only at night when the sun is not shining does any of the activity cease. And then only the starch-making process, which requires sunlight, stops. The plant continues to breathe and to carry the food made in the leaves down to the roots. You will not be able to see or hear this work going on, because it all happens inside the leaves and stems.

The leaf also, is something to help us recognize the tree when we see it again. There are four things you should remember about the leaf of the tree: its shape, color, size and how it is arranged on the stem; that is, whether the leaves are opposite each other on the stem or whether they are alternate, one above the other on opposite sides of the stem. If you remember these things, it will help you to identify trees in summer.

Another part of the tree that most of us know is the trunk. The trunk is a big thick stem. This stem is filled with tiny tubes and cells. Some of these tubes are full of sap, constantly moving upward to the leaves. Others carry the food made in the leaf to the storage places in the roots or some portion of the stem itself. These tubes are on the outer portion of the woody trunk just under the bark. The liquid in these tubes is constantly moving downward. The growing part of the stem is just under the bark also. It is called the cambium layer. If this layer is girdled all the way around the tree, the tree will die. The bark offers protection for this growing layer. By the bark and the buds we are able to know the trees in winter. There are several things that we should know about the bark also: its color, whether it is smooth or rough, corky or hard, and its appearance in general. If we know these things we will soon be able to recognize many kinds of trees.

Did you ever try to think of all of the things trees do for us? Can you imagine a great plain without a tree in sight? If you live on the great prairies this may be the case, but most of us see trees every day. They beautify the land and so make our world a beautiful place in which to live.

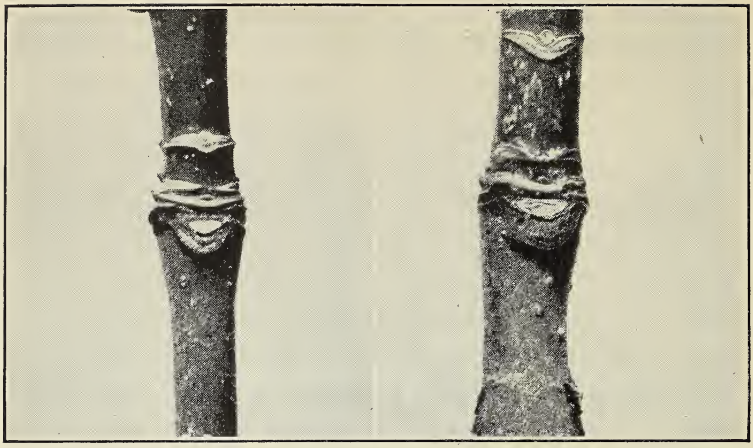
They do more than beautify our world. They even help purify the air for us. You have learned how the trees' leaves take up carbon dioxide and give off oxygen in the process of starch-making. When the trees use the carbon dioxide the air is better for us.

The roots get moisture from the soil. The stem carries it to the leaves, and the leaves allow the water to evaporate into the air. This supplies the air with the proper amount of moisture, which is necessary for our health.

Trees break the force of the wind and in many places they are planted near homes as a wind-break. Their roots hold the soil and they are often planted on the sides of hills to prevent landslides. The leaves drop to the ground and become soil. In the friendly branches of the trees, birds find a place to rest and build their homes. All of us like trees in hot weather for their shade.

If you try to think of all the ways you use wood, you will have a long list. Even the paper that this book is printed on is made of wood. Many of our houses, much furniture, and thousands of other things are made of wood. So you see it is well for us to know something of the trees.

Trees are the oldest living things on the earth. Some of them are as much as three thousand years old. Just think, a tree that old would have been more than one thousand years of age when Christ was born. Think of all of the history such a tree could tell. We can tell something of the age of a tree from its growth. To grow larger around, the tree adds a new layer under the bark each year. So year after year it makes rings as it grows. If we cut a tree down, we can count these rings. In this way we learn its age. Sometimes the tree makes more than one ring each year, but it



Spencer Photo

BUD-SCALE SCARS

HICKORY ASH

usually makes only one. If you look at a tree stump, you will see that some of the rings are thick and some thin. A thick one would show a good growing year, and a thin one a poor year. The growing year of 1930 would probably show a thin layer on account of the drought. In this way scientists have traced back through the lives of old trees and have found that when great famines appeared on the earth the trees often showed thin rings, and in times of plenty the rings were well-developed.

If you fasten a fence to a tree and leave it alone for several years, you will find that the fence is the same distance from the ground as when you put it there. The tree trunk grows outward. The upward growth comes from buds in the center and at the ends of twigs

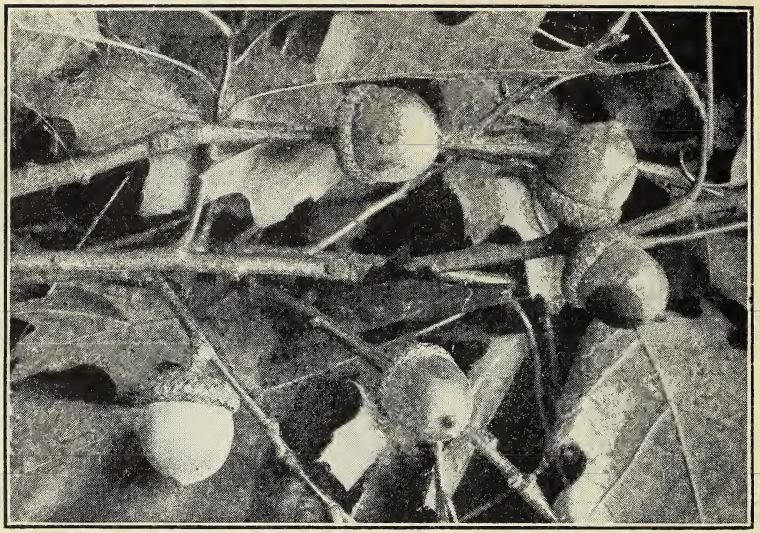
and branches. When the scales drop off of this bud, a scar, called a bud-scale scar, is left. By counting the number of these scars you can tell the age of a twig.

By looking at the bark you can see how the tree has been injured and how it has escaped its enemies. Trees are often in great danger of being destroyed by forest fires, but many of them even escape this dreadful enemy. Insects and diseases attack trees the same as they do animals, and trees must continually fight to keep well. If they escape all enemies they may live to be very old.

Trees are manufacturers. They are constantly making wood which we use as lumber. The leaves are busy making starch and sugar, but that is not all. They supply us with medicines, auto tires, oils, dyes, perfumes, gases, fiber, chemicals, cork, resin, turpentine, chewing gum, water, honey, gums, food, shelter, and hundreds of other things that you could name.

It would be well to get acquainted with some of our friends. The oak is readily found. You can learn to know the oak trees in two or three ways. One is by the shape of the leaves and by the acorns. The other is by the color and texture of the bark and the shape of the buds. You will see many kinds of oaks. Try to learn their names.

The oaks may be divided roughly into two groups, the white oaks and the black oaks. The white oaks usually have lighter colored bark than the black oaks, and the leaves are rounded and do not have sharp



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OAK LEAVES AND ACORNS

points on the edge. On the white oaks the acorns get ripe in one season and fall off. The black oaks take more than one season to ripen the acorns. The old acorns of the black oaks may be seen clinging to the trees even after the new acorns have formed. The leaves of the white oak cling to the trees far into the winter, and may even wait for the new leaves to crowd them off in the spring. The acorn is always a sign of the oak, whether it is a white or black oak. The acorns are of different shapes; one kind of oak tree will have one shape, and another kind a different shape.

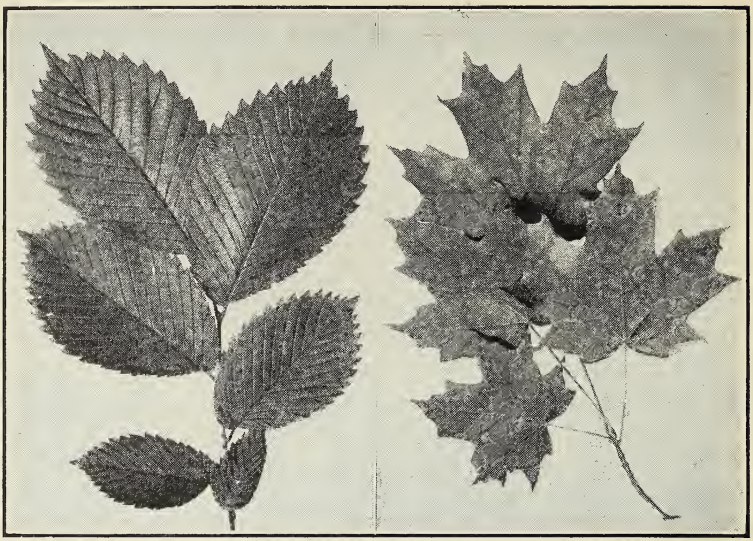
The lumber of the oak tree has long been of great value. The wood is stout and strong and does not rot quickly. By cutting the oak log into quarters, length-

wise, and then sawing these quarters the lumbermen get what they call quarter-sawed oak. This wood shows flat white flecks over the surface, and is valuable for furniture-making.

The oak is a beautiful tree, and is often used for shade. It is sturdy and strong, and its gnarled limbs remind you of some great giant. In the fall the oaks are a beautiful mass of color. Some of them are scarlet, some yellow, and some nearly purple.

Some of the common oaks of the white oak group are the white oak, which is probably the most valuable, and the bur-oak or mossy-cup, named for the mossy-cup that holds the acorn. The acorns of this tree are used by the squirrels for their winter stores. The post oak is so named because its lumber is often used for posts. It does not rot easily but lasts a long time. The leaves of the chestnut oak look like the leaves of the chestnut tree. This oak is used as a source of tan bark. The swamp white oak lives in swampy ground. The basket oak is used in making baskets. The wood splits easily into thin strips from which baskets are made. The live oak also belongs to this group. It is called live oak because it grows in warm climates and does not shed its leaves. This tree grows in the southern part of the United States.

The black oak has dark colored leaves with bristly tips. It is used for tan bark and fuel. The scarlet oak is one of our most beautiful trees in the fall, its scarlet leaves showing up among all the many colors of the seasons. The pin oak's branches are covered with



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ELM LEAVES MAPLE LEAVES

sharp, short pins or twigs which give the tree its name. It is often used for a shade tree. The red oak, too, has a beautiful red coloring in the fall. The willow oak has a leaf like a willow tree. It is often used for a shade tree in southern cities. There are many other kinds of oak trees. In fact, there are more than three hundred different kinds. Fifty of them are found in the United States east of the Rocky Mountains.

In towns, as well as in the country, you will find the maple and the elm tree. There are several kinds of each of these. The maple is particularly interesting on account of the usefulness of its wood, and because one kind gives us maple sugar. There are several kinds

of elms, also. You will learn to know them by the bark, leaves, and buds. One elm that every country boy knows is the slippery elm. The inner bark of this tree has an unusual quality. When chewed it becomes very slippery. This is how it gets its name. Most boys and girls like to chew it very much. It is also used in medicine.

The beech tree can be recognized by its bluish-gray bark and can usually be identified from quite a distance. You can also identify the sycamore by its white trunk and branches.

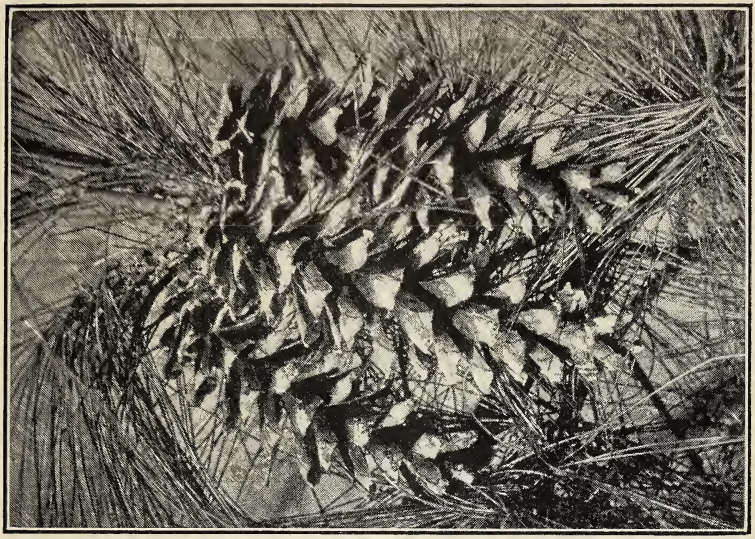
The beech tree leaf somewhat resembles the elm. It is smoother and has a shiny surface. The beech nut is a favorite with many people. This small three-cornered nut is packed full of rich, sweet kernel. The chipmunks like the beech tree because of its nuts. In the fall these little fellows may be seen scurrying around under the trees, their tiny jaws full of beech nuts. The wood of the beech is used in furniture-making, and makes an excellent wood for fuel. The Indians thought the beech could not be struck by lightning, and often stood beneath it in storms. The beech does not seem to be struck as often as other trees, so perhaps the Indians were correct about its ability to resist lightning.

The wood of the ash tree is quite valuable as lumber. It is stout and strong and straight-grained. On account of its toughness and straight grain it is often used as handles for pitchforks, shovels, and other tools. The Indians often used the wood for making bows and

canoe paddles. It is still used for making boat oars. There are many superstitions about the ash tree. It is said to draw lightning, just as the beech was supposed to resist lightning. No snake will ever go under an ash tree if it can go around, or so runs an old superstition, and a serpent would rather go into fire than over an ash twig. We would rather not trust the ash tree to protect us from snakes, however. These trees may be identified by their leaves and the paddle-shaped seeds. There is something about the bark of an ash tree that will help you, too. Once you learn its appearance you will not forget it.

The trees that bear cones are called conifers. They are sometimes called evergreens, but that is not a true name. The larch tree and the cypress both bear cones, but shed their needles, and so are not evergreens. Other trees such as the holly and magnolia are always green, because they do not shed their needles or leaves all at once, as the maple or elm trees do. The conifers do shed their leaves, but only a few at a time, and as new ones grow on you cannot notice that the tree has shed its leaves. If you look on the floor of a pine forest, you can readily see that the needles are shed. In old forests this carpet of needles may be a foot or so deep. So you can see the needles fall off the same as the leaves of other trees.

Pine trees have sticky, resinous sap, some more than others. This sap is one of the most valuable parts of these trees. From it pitch, resin, and turpentine are made. These are often called "naval stores," because



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CONES AND NEEDLES OF THE WHITE PINE

much of the pitch and turpentine is used by the navy in building boats. Turpentine is used in mixing paints and for other purposes as well.

The white pine is one of the most valuable of the pines. The wood is soft and smooth-grained and easily worked. It is used in cabinet-making, and was formerly much used for boxes. The white pine has its needles arranged in bunches of five, and by this you can identify it.

The sugar pine is one of the largest of the pines. It grows in Oregon and California. It may grow as high as two hundred feet and be eight feet in diameter. The sap is sweet and wherever the gum escapes crystals of sugar form on the trunk. The seeds of this tree are

used by the Indians for food. Squirrels also gather them and store them away for winter.

The loblolly pine is often found along the coast. In the southwest it grows large and is an important timber tree. The needles are six to ten inches long and are in groups of three. The pitch pine is often found in swampy places. Its leaves are shorter, and arranged in threes. Scrub pine is found on poor land. The yellow pine is usually from eight to a hundred feet high. Its needles are three or four inches long and found in pairs. It is a valuable timber tree and is often tapped for turpentine.

Spruce trees are often found in the forests. The needles of the spruce tree are short and cover the many branches of the tree. The hemlock may be mistaken for the spruce. The needles of the hemlock, however, are flat and lie flat along the stem in two rows. Three common spruce trees of the eastern United States are the red, white, and black. The Norway spruce is also found, but it is a native of Europe. It is being grown as a forest tree because it is hardy and lives well in our climate. It is a beautiful tree and often is used in landscape work.

The tamarack or larch is distinguished from the pines by the shedding of its leaves. It lives in the swamps and often the mud is very deep around its base. The needles of the tamarack are set in small bunches of fifteen or twenty that look like small brushes.

The balsam fir resembles the spruce. The leaves are arranged spirally around the branches. The sap is

clear and forms in blisters over the tree. This sap is used in medicine.

The cedars commonly found are the white cedar, the juniper, and the red cedar. The leaves of the cedars appear more like scales on the branches than needles. The wood is light and used in boat-building and for the making of pails and barrels. The juniper is found all over the United States. It reaches the height of about twenty-five feet. It bears bluish berries that have a very pleasant flavor. Birds are fond of juniper berries. The red cedar is a large tree, often growing a hundred feet high. It is one of our most valuable trees. The wood is used in making cedar chests and drawers for storing woolen clothing. The wood has a pleasant clean smell and keeps the moths out of clothes. The wood is red in color, with streaks of white through it. It is becoming quite expensive because it has been cut so freely.

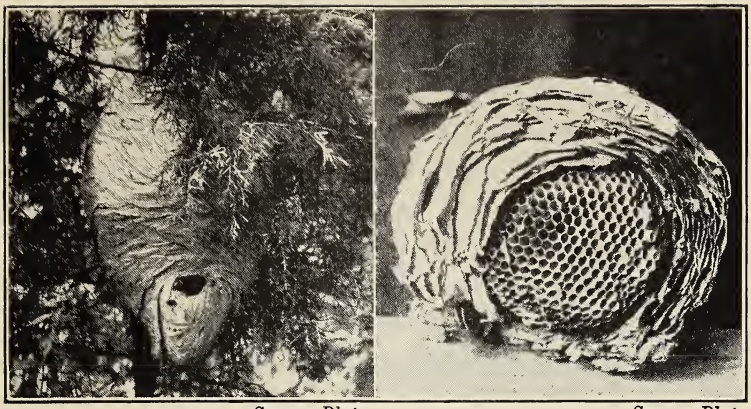
The Indian often chose this tree for making his "dugout canoe." The Alaskan Indians used it for carving their strange totem poles. The bark was used for huts, and the fiber for cords and thread for weaving. The red cedar is truly one of our most valuable trees and should be planted and protected.

These are not all of the trees you will find as you travel about, but this list will give you an idea of what to look for and how to identify them. But learning the names of the trees is only a small part. If you learn to know all of the uses of trees, and how they help us, you will be more interested in protecting and

saving them. And if you plant some trees you will help to keep new forests coming on, so that other boys and girls in the future may be able to enjoy the trees as much as you do.

Things to do

1. Collect leaves of trees for a leaf collection.
2. Look at a twig and count the bud-scale scars to see how old they are.
3. Count the rings in a stump to tell the age of the tree.
4. Tell how the leaf makes starch.
5. Collect fruits or seeds of trees.
6. Collect twigs for an exhibit.
7. Plant some trees.
8. Plan an Arbor Day program for your school.
9. Write about the tree as a manufacturer.
10. Draw illustrations of leaves and fruits of trees.
11. Cut some twigs and put them in water or sand to sprout.
12. See how many trees you know by their leaves and by their bark.
13. Make a tree calendar. Tell when the flowers and leaves come out, and when they die.
14. Write about trees as friends of man.
15. Make a tree census of your school grounds. Draw a map showing where the trees are.



Spencer Photo *Spencer Photo*

HORNET'S NEST CELLS OF THE HORNET'S NEST

HORNETS AND OTHER WASPS

The very first paper makers in the whole world lived in a tree near your home. Some of them may be in your attic even now. Have you ever seen them? Perhaps you do not know who the first paper makers were. So far as we know the very first paper makers were wasps and hornets. Now the secret is out so you can look to see if this is really true. What would wasps do with paper? They do not have problems to get at school or papers or books to read, so what would they need of paper?

Did you ever see a hornets' nest hanging in a tree or hanging to a rafter in an old attic? The hornets' nest is round or pear-shaped, and sometimes it is as large around as a basketball; in fact, some of them are

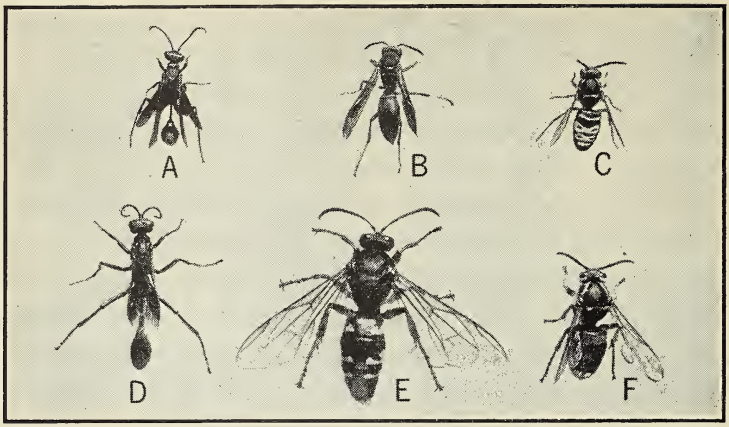
even larger than that. You can usually find them in the winter time when the hornets are not using the nest. Indeed this is a very good time to find them, because you might get stung if you went too close while the hornets are at home. But what has all of this to do with the first paper makers?

Let us look at the nest to see what it is made of. The rough gray outside looks like the wood of an old unpainted barn or an old rail fence. If you look closely you can see that the nest is made of wood fiber. This wood fiber is a kind of paper. If you could look at most any kind of coarse paper with a hand lens, you would see that it is made of fiber too. This nest is made of paper. It is not pieces of paper glued together, but is made as though the fiber had once been soft like paste, then plastered on in thin sheets to make this house all in one piece. This is exactly what happens. The hornet or wasp makes wood pulp paper to build the nest. If we could follow a hornet through the nest building season, we could see her making her paper. Let us do that very thing, and find out about this house.

In the spring there is only one hornet to start the new nest. This one is a new queen from a nest built last year. She and a few others are the only living members of the thousands that filled the paper house last year. Late last summer she mated with a male wasp then crawled away to some protected place to spend the winter. Any hole in the ground or a crack in a log would do for a hiding place. Here she stayed all winter and when spring came she was up and about

early, ready to start a nest of her own. What a great task this is to be for her. First she must build a new nest, because the wind and rain and snow of winter have torn the old house to pieces. Or perhaps some boy found it and took it to school.

She does not attempt to build a whole large nest at once. But let us watch her. First she goes to an old fence and begins peeling off tiny strips of the wood with her jaws. Now she chews these strips, mixing the mass with saliva in her mouth, adding more and chewing and chewing until she has a whole mouthful of paper pulp. Back she goes to her nest site, and lays the foundation by spreading the mouthful of pulp out on a twig. Back and forth from fence to nest she goes, many, many times until she has one cell finished. Working hard, the queen goes about building more cells against the first one, packing them in so tightly there is no room between them. These cells look very much like the honey comb of the bee, except they are made of paper instead of wax. When she has completed several cells she lays an egg in each one. Soon the eggs hatch out into small white larvae. Now the queen mother is busy taking care of this family and hunting food for them. She feeds them on chewed-up insects and honey. The larva grows and grows and after a few days it spins a cocoon inside of its paper house and goes to sleep. When it awakens it is a full grown wasp. Now it chews a hole in its house and comes out. The queen makes sure she will have help. The first eggs laid hatch out into workers.



Spencer Photo

A—BLACK WASP; B—HOUSE WASP; C—YELLOW JACKET; D—MUD DAUBER; E—CICADA-KILLER; F—A PAPER MAKER

These new wasps go to work as soon as they hatch out, helping with the young and building new nest room. There is much work to be done if the colony is to grow to any size before winter.

Do you suppose that the queen teaches each new wasp to make paper? No, that is not necessary. Each one seems to know how when it is born. Some of these workers fly away and soon return with a mouthful of paper pulp. Now the nest building begins in earnest. The wasps spread the paper out in thin sheets, smoothing it out with their mouths and feet. The new load of pulp is placed on the nest where the wasp last worked. More workers come and more paper is added. Soon the nest begins to take form. More comb is built on the inside and a baglike wall is built on the outside.

If you examine the nest you will see that it is not made of just one layer, but of several layers of paper. This leaves an air space between the sheets of paper. Perhaps the hornets know that this is one of the ways to keep the house warm. In fact that is one of the very things we do to keep our houses warm. We put on a layer of boards, then leave an air space and put on another layer of lath and plaster. Maybe we learned this trick from the wasps, who knows?

As the colony grows new comb must be built for the young hornets. These wasps do not store up food in the house. If the house gets too small they chew away the inside wall and make new walls on the outside. In this way they can make the house as large as they care to.

Near the end of the season the queen mother will have a very large family, perhaps there will be several thousand members of the colony. These hornets are called social wasps because they live in a common home and help each other. If each one lived alone it would be called a solitary wasp.

The large family does not live very long; only one season. The queen lays some eggs that are to become males and queens. When these eggs hatch the new queens mate with the males. Then as summer goes, all members of the colony die except the new queen. When winter comes the big paper house is empty and only a few of the new queens are hidden away in old stumps or underground to live out the winter and start the colony next spring.

There is another common wasp that may be found close by your home. It is usually called the mud dauber. Why do you suppose it is called a mud dauber? If you look at its home you will have the answer to that. You see, it builds its home of mud. You have often seen these wasps flying about your house. They are usually steel-blue color or nearly black. Sometimes they get into the house and then mother gets after them with the fly swatter.

Did you ever see one building her house? Watch one sometime. How nervous she is! See her flick her wings as she walks about. First she flies to some damp place, usually near a pond or stream, where there is nice sticky mud. Then she gathers her supply of building material. See, she begins to rake the mud up with her paws to form a small ball. More and more she gathers until she has a ball about as big as a small pea. Now she is ready to go home. Away she goes to her new building site to add this bit to her house. First she lays a foundation of mud. Then bit by bit through many, many trips she builds a long hollow tube, about as big around as a lead pencil. Several of these tubes are fastened together to form the house. It is rough on the outside, but if you look on the inside you will find that it is quite smooth and comfortable.

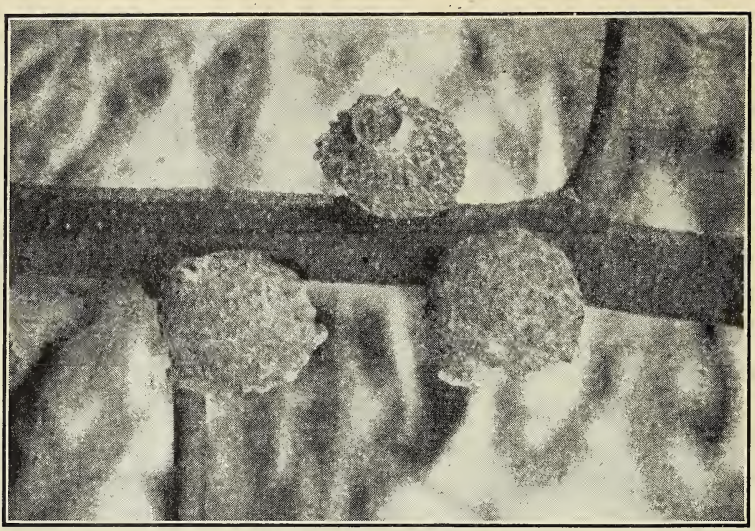
After she has it built, she lays her eggs and goes on enlarging her house for the other eggs she wishes to lay. Let us look in one that is complete. If we pick it open carefully we can see what is inside of it. There it is open now. What a surprise! Not a wasp in there.

Nothing but a few spiders. Do you suppose that these spiders have stolen the nest from our friend, the mud dauber? Let us look more closely. The spiders seem to be alive, yet they cannot move. They do not attempt to run away when we disturb the nest. Now how do you suppose they got there? There is one with a funny white thing sticking to it. Do you suppose this could be the egg that the wasp laid in her nest? Look closely. Yes, that is exactly what it is, but where did the spiders come from?

Maybe you have already guessed the answer. The mother wasp put the spiders there. And what a thoughtful mother she was. She stung each spider in such a way that it would be paralyzed, and could not move, not even lift a leg, yet it would be alive when the young wasp is ready to eat it. Isn't that a thoughtful thing to do?

Soon this little egg hatches out into a white grub. There are no nurses to feed the grubs as there are in the hornets' nest. Each must get his own food. But the mother has taken care of that and she knew that the food baby wasps like best was spiders. So she placed plenty of nice fresh food right where the baby wasp could find it. The baby eats the spiders and grows and grows. Soon it does very much like other insects, it makes a cocoon and goes to sleep. When it awakens it is a full-grown wasp. It then gnaws its way through the mud house and goes off about its business of house building or food getting.

There is another wasp that uses mud for a nest also.



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NESTS OF THE POTTER WASPS

She has entirely different ideas about house building however. She is probably the world's first potter. A potter you say is one who makes pots or jugs or dishes out of clay. How could a little wasp about one-half inch long be a potter? If you look at her nest you will see. She chooses some branch in low bushes and makes this interesting house. How much it looks like a tiny jug! If it only had a handle, it would look exactly like a farmer's water jug over in the hay field. How do you suppose she ever learns to make this jug? If we look inside we will see that it is full of small grubs or caterpillars, just as the mud dauber's nest was full of spiders. This wasp also stings the caterpillar before she puts it in the nest and in that way keeps it fresh for the potter

babies when they hatch from the egg. And the potter, like the mud dauber, when it is ready to come out, chews a hole in the side of the jug and goes away. As most of these grubs would eat our crops you can see that the potter is really a worthwhile creature to have about to help us destroy troublesome insects.

There are many kinds of wasps, some of which live in the ground. Many of them do clever things while building their nests. One kind cuts a chip out of the ground for a lid for the hole she digs. Each time she returns to put food in she takes off the lid and replaces it so carefully that the nest cannot be found.

There is one large wasp nearly as large as a dragonfly. It has yellow bands on its body and is quite the largest one we will see. It lives in the ground too, or rather they do because they are social and several live together. This wasp is called the cicada-killer or digger wasp. Do you know what cicadas are? They are those large greenish insects that sing in trees in late summer. They say: "Wee-e-e-sh-a-wee-e-e-sha-a-wee-e-e-sh." Some people call them locusts or harvest flies. At any rate these are the insects that the cicada-killer kills. Maybe you have heard a cicada stop its song right in the middle and come tumbling out of the tree. Very probably the reason was that one of these cicada-killers had found it. As soon as the cicada-killer finds a cicada she pounces on it, holding it with her feet, and then she stings it. The poor cicada is soon paralyzed just as the spiders were. It cannot move.

Now the cicada-killer must take the cicada home.

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A DIGGER WASP DRAGGING A CICADA TO ITS BURROW

Often her burden is more than she can fly away with. But she does not give up. She gathers her victim up and, straddling it with her long legs, crawls up on some high tree or bush to get a start then flies toward her home. If she does not get there the first time, she continues the process until she arrives. Within the nest, which is a hole dug in the ground, she stores the cicadas and places an egg on each one, so that when the baby hatches out it too will have plenty of fresh food, just as the mud dauber and potter babies did.

All of these wasps look somewhat alike. They all

have two pairs of wings, a head, thorax, and an abdomen. In some cases the abdomen is connected with the thorax by a thin threadlike waist. They vary in color. The hornet is black and is marked with white. The yellow jacket, of course, is well known from the yellow markings on its body. The cicada-killer does not have the thin waist, but you would recognize it as soon as you see it. All of the wasps sting but you can watch them from a distance or study some of their houses when they are not at home. Some of them are not enemies, but friends. Of course, they like to be left alone and not bothered, but that is not a strange thing; many animals are like that.

Things to do

1. Hunt as many kinds of wasps' nests as you can find.
2. Draw pictures of the nests.
3. Draw pictures of each kind of wasp in this story.
4. Draw pictures of some other kinds.
5. Read the story of the digger wasp.
6. Read the story of the African wasp that builds a kind of apartment house.
7. Try to find a wasp building a nest. Observe how it is done.
8. Write a story about each kind of wasp.
9. Compare the wasps' paper making with our own.
10. Tell how the wasp gets its food.

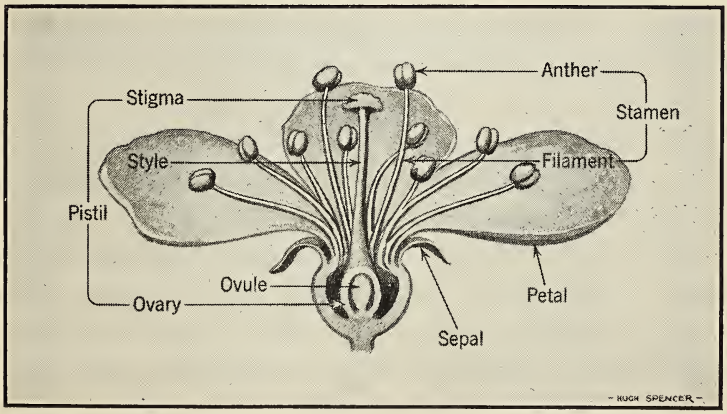
SPRING WILDFLOWERS

Most boys and girls have found some wild flowers. But perhaps you do not know the names of those you found. There are so many interesting things to learn about them that perhaps you could do a little exploring.

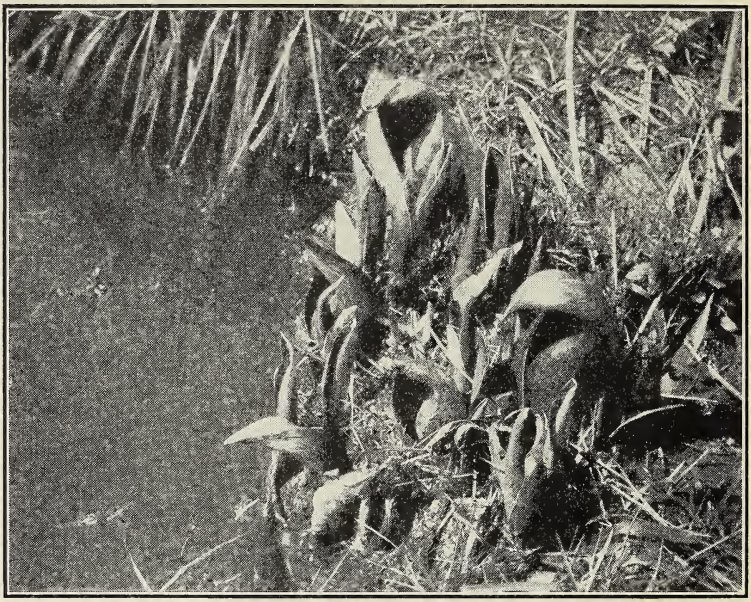
Of course you know that explorers always carry maps and charts and things, so they will know where to go. They draw maps as they go too, so that they will know what they have seen. So if you are going to explore very much you should have a sort of general flower map or chart to help you find your way. This chart should show you the parts of the plant and the names given to each part. These parts are the roots, stem, leaves, and flower. Probably the most important part is the flower. Its one use is to make seed that there may be more new plants. Now if you look at the flower chart on the opposite page

or map you will see that it has certain parts all named for you.

Starting down at the bottom of the flower you will find some green parts called sepals which make up the calyx. Next above is the colored part called the corolla which is made up of petals. Inside of this is a group of parts called stamens. Stamens produce the pollen which is the yellow powder that sticks to your nose when you touch it with a dandelion. This yellow powder must get to the ovules or eggs contained in the pistil. The pistil is the large thickened part in the center of the flower. If you would cut it open you would see it is filled with tiny seedlike parts called ovules. Sometimes the pollen gets on the pistil when the flower opens. If not, the flower has to depend upon the wind or insects to carry the pollen from stamen to pistil. Insects often carry pollen from one plant to



PARTS OF A FLOWER



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SKUNK CABBAGE

another, which is called cross-pollination. When the pollen gets to the ovule we say the ovule is fertilized. When this happens the egg begins to grow into a seed. This is similar to the way animals develop. Now you have some idea of what flowers are like and you can start on your trip of exploration.

There is one flower that blooms before all of the snow is gone from the ground. Sometimes it even sticks its head up through the snow. This early flower is the skunk cabbage. What a peculiar name for a plant and what a peculiar habit of blooming so early. Explore a little and see what you can find out about it.

You will have to go to a bog or swamp or moist place to find this first flower. Keep your eyes open now. Here is one sticking its pointed nose up through the soft earth. But this does not look like the flower on our chart. Perhaps the flower parts are covered up. See if you can learn its secret. Unfold or break open one of the big blossoms. Do you know why it is called skunk cabbage now? What an odor for a flower!

Notice the round yellow ball on the inside. This round ball is called a spadix. All over this ball are tiny groups of flowers. These flowers produce the pollen and ovules, which later develop into seeds.

How many of the greenish plants there are, and what great heavy thick roots they have. Some of them are larger around than your arm. Only the blossoms are showing now, but if you come back in summer you will see the large oblong leaves. How big they will be. Each plant will be as large as a big rhubarb plant. The flowers will be gone, and the new seeds formed ready to produce new plants.

You should be on the lookout for more flowers. If you look in the open fields or hillsides you will discover another early arrival. Its common name is spring beauty. And what a welcome little flower it is, because when it arrives spring is surely here. When it first appears above the ground it sends up two narrow grasslike leaves about two inches long. Very soon a bud appears between these two leaves. This bud develops and soon becomes a flower stalk containing several pretty white flowers striped with pink. No won-

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SPRING BEAUTIES

der it is called the spring beauty. It really is very pretty, and is one of the first flowers of the spring. If you pull it up the stem breaks a couple of inches under the ground. Why do you suppose it breaks? If you dig down along the roots you will see. The root ends in an anchor three or four inches under the ground. This anchor is a small bulb. The spring beauty seed grows and produces this bulb. The leaves make food and pack it away in this underground lunch box. When enough food has been packed away the bulb is ready to send up a flower and leaves of its own. From this bulb the spring beauty gets its food. The bulbs divide and grow more and that is why the plant spreads so rapidly. It is said the Indians used them for food.

There is another plant that has such an underground lunch box. In fact there are many of them, but this one is quite common and no doubt you will discover it on your first trip of exploration in the spring. It is the yellow adder's tongue. This plant, like the spring beauty, sends up two leaves. They are much larger and wider than spring beauty leaves though. They are about an inch wide and four to six inches long, and are mottled with brown spots. Soon a bud appears between them and one flower appears on a long stem. This plant is a kind of lily. If you look closely you will find two kinds, a yellow one and a white one. Along the fences and in open fields is the place to find the

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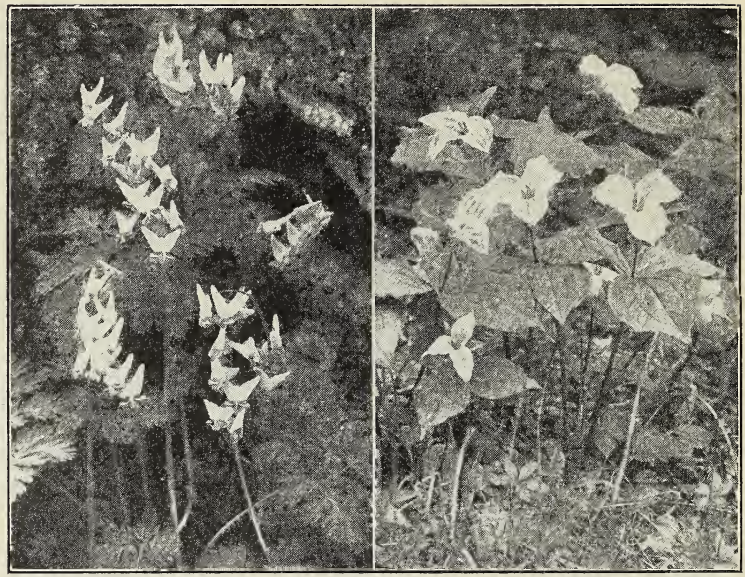
DOGTOOTH VIOLET OR YELLOW ADDER'S TONGUE



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DUTCHMAN'S BREECHES TRILLIUM

adder's tongue. Sometimes they are found in woods but more often along roadsides and fencerows.

Go into the woods to explore a little. One of the first flowers you will find is the Dutchman's breeches. Can you see why it is called this?

The flowers grow along a long, straight stem. Such a stem is called a raceme. Each raceme will have three to ten flowers on it. Each flower looks like a man wearing big, baggy breeches. The legs come to a point at the lower ends. You will see the dainty fern-like leaves of the plant too. These leaves are as pretty as the flower. Growing nearby you will find the

squirrel corn. In fact, you will have great difficulty telling squirrel corn leaves from the Dutchman's breeches leaves. If you look at the flower you will not have much trouble, because the ends of the legs of the squirrel corn flowers are rounded instead of pointed.

There are many other ways of telling the plants. The squirrel corn gets its name from its roots. The roots have small round tubers attached to them. These tubers are a golden yellow color like corn, and that is how the plant gets its name. The root of the Dutchman's breeches is whitish and looks something like grains of wheat closely packed together. If you smell the flower you will find a difference too. The Dutchman's breeches flower has very little odor; the squirrel corn is as fragrant as a hyacinth.

There are other flowers for you to discover also, while you are looking about on the hillsides. You have probably found many by this time. However there is one you should look for. It is called the trillium. Its flower parts are in threes. It is about eight inches to a foot tall. The white flower is borne on a short stem above the three big leaves. It has three sepals and three petals. It gets its name "trillium" from having its parts in three. This lily, because the trillium is a kind of lily, is one of our finest wild flowers. You may find several kinds. There is one whose flower nods below the leaves. It is called the nodding trillium. Another one has a dark maroon colored flower that is seated exactly in the middle of the three leaves. Perhaps you will discover all of them in your explorations.

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THE JACK-IN-THE-PULPIT

You may find another plant nearby that has three leaves somewhat like the trillium. It will very probably have a flower on it too. This is the Jack-in-the-pulpit. See if you can tell how it gets its name. There are usually two stems to this plant; one bears three leaves and the other bears the Jack-in-the-pulpit flower. The flower may be green or green striped with purple. On the inside is a long spadix. You remember the skunk cabbage has a round spadix hidden inside. On this long spadix are two kinds of flowers, one for pollen and one for seeds. Sometimes one plant will produce pollen and another seeds. When the flower dies the seeds develop. They are contained in bright

red berries that form a cluster on the end of the stem where the flower was. This plant is sometimes called the Indian turnip. It grows from a solid round root called a corm. This corm is very hot to the taste. In fact if you bit into it, it would burn your mouth badly. It is said that the Indians learned to cook it so that the hot taste was removed. It still bears the name of Indian turnip, but you had better not try to use it instead of turnips.

The Indians are said to have made good use of another wild flower that you may find on this trip. It is the blood root. The name of the flower should tell you something about it. Its roots give off a blood-red dye when cut. This dye the Indians used to paint their faces and tomahawks. When the plant comes through the ground the leaves are wrapped around the flower. This protects the flower bud from injury. The leaf is nearly round, but cut deeply into lobes. The flower is a beautiful snowy white, with eight petals. The sepals fall off when the flower opens. It is one of our prettiest wild flowers, but it does not last very long. Just a day or so, then it falls off, leaving an oblong seed pod. It is not a very good flower to pick, because the petals fall off so early that they will all be gone before you get them home.

You will find another friend of the spring also. It is the hepatica. It is called hepatica because a long time ago people named plants according to what they looked like. This plant has a liver-shaped leaf, so they took the Greek word meaning liver, which gave it the

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HEPATICA

name hepatica. Look closely and you will find the hepatica raising its hairy stems and showing its white or blue flowers in close-set bunches. One of the first things you will discover is that the flowers have come out without the leaves. Only the flowers seem to show above the ground. If you will look among the old leaves at the base of the blossoms, you will find some of last year's leaves. Soon the pretty flowers form seeds, and by that time the hepatica has a new set of leaves ready to work for it.

If we come into the more open parts of the woods we will find the May apple. The May apple likes the sun, but not too much sun. You will recognize this

Dr. F. W. Copeland, Ohio University

THE MAY APPLE

plant at once by its umbrella shaped leaf. It comes up through the ground looking much like a closed umbrella, with the leaf folded around the stem. Soon after the umbrella opens the pretty white flower appears. The white flower soon attracts the big bumblebees. They scatter the fine pollen over this and other flowers. Then the May apple develops. At first it is a small triangular seed box. But by July the seed box has developed into a yellow May apple. And if you have never eaten one, there is a treat in store for you

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MEADOW VIOLETS

sometime. The root of the May apple is poisonous if eaten, and you should be careful not to taste it. It is, however, useful for medicine.

You are sure to discover some violets on your trip. The violets are of two general kinds. One group sends its leaves up from a root, while the other sends up a stem and the violets grow from this stem.

The violet has five sepals and five petals; four petals form the top part of the flower with a broad one at the bottom. This broad bottom petal makes a nice resting place for bees and other insects while they gather pollen. There is a part on the flower filled with nectar, which attracts the insects. The insects pollinate the flower as we have learned, and so help to produce

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MOUNTAIN LAUREL FLOWERING DOGWOOD

seeds. The violet has another way of producing seeds also. Down under the plant small plain flowers are found. They do not look like flowers at all, but more like buds. Inside this budlike flower the pollen is ripened and the seeds fertilized without ever breaking the outer skin. This develops into a seed box late in the season. In this way it produces seeds that are not mixed with other flowers by cross-pollination.

These are only a few of our common spring wildflowers. There are many others to be found which are just as interesting and pretty as those described here. They change as the season advances and new plants of other species take their places throughout

the summer and fall. If you care to hunt for them in the woods, you will find much to interest you, and the more you search for them the more you will learn about them.

Among the most beautiful spring flowers are those of the dogwood tree and mountain laurel bush. The pretty white dogwood flowers come early in spring. The Indians waited for the flowers before planting their corn. The wild tree grows ten to fifteen feet high. The mountain laurel is a tall shrub sometimes growing twenty feet or more in height. The dark glossy leaves stay green throughout the year and its flowers are pink and white.

Things to do

1. Take a flower apart to see how it is made.
2. Draw the parts of a flower and learn their names.
3. Write about the work of each part of a flower.
4. Collect some common wild flowers and make an exhibit.
5. Make colored drawings of our wild flowers.
6. Make a wild flower garden.
7. Make a wild flower census of your neighborhood.
8. Learn how to tell herbs, shrubs, and trees.
9. Learn the parts of a plant.
10. Collect the seeds of wild flowers to plant.
11. Make a nature trail near your school.
12. Read myths and legends about wild flowers.

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TALL GOLDENROD BUSHY GOLDENROD

WILD FLOWERS OF SUMMER AND FALL

Did you ever go exploring? What a lot of fun it is. Of course, you cannot go to the South Pole as Admiral Byrd did. That would be out of the question. But you could go exploring in the fields near your home. Or even a better place to start would be in your own back yard. Go out into your yard and see if there is any exploring that could be done. Do you know all of the plants that grow there? If you do not know all of them, there is some exploring for you to do.

Let us go out into a great big field where there is sure to be a vast amount of exploring to do. What a

sea of plants meets your eye. Dotting the landscape everywhere are plants, adding color and beauty to what would otherwise be ugly, bare land. But you say this is only a weed patch, and that there is nothing to discover about that.

Let us look and see. Do you see that patch of yellow over there? What do you suppose it is? Yes, you have guessed it, goldenrod. What a pretty plant it is. If you get closer, you will see other explorers there before us. Many insects are crawling about over the goldenrod flowers. Why do you suppose they are there? A long while ago some insect explorer found that there was pollen and nectar to be had there. Perhaps the goldenrod helped in the discovery. Their pretty yellow flowers would attract insects just as they attracted us.

Look closer at these flowers, and as soon as you explore a little you will see why we say flowers when we speak of the goldenrod. Each goldenrod stem is made up of branches that have yellow flowers on them. There are in fact two kinds of yellow flowers on one of the small stems. They are called disk flowers and ray flowers. If you look closely you can see that there are different kinds. All of these small flowers are arranged on the top of the little branch. The bottom branches are larger than the ones above, so that in the common goldenrod the head is spear shaped.

If you carried your exploration into a book about the goldenrod you would discover more things. There are eighty-five different kinds in the world, twenty-five of which are found in the United States.

Spencer Photo

GOLDENROD GALL

Look at the stem of your goldenrod. Is there a round or oblong swelling on the stem? If there is not, look around until you find one. What do you suppose caused that? Cut it open and see what you find.

A small insect called a gallfly stings the stem and lays an egg in it. The insect also does something to the plant stem which causes it to grow this great round knot on it. When the egg hatches the larva has all this extra growth to feed on. So when you cut this knot open you often find the fat gall insect larva inside. There are other explorers interested in the goldenrod also. For a long time Mr. Thomas A. Edison worked with the goldenrod. Mr. Edison believed that he could make rubber from goldenrod. He did succeed

in making rubber from this plant before he died in 1931.

But like all explorers you cannot stay too long in one place. You must cover more ground. And since you thought of rubber let us hunt up a plant that has a sticky juice from which rubber could be made. Such a plant is the common milkweed. Did you ever get the sticky milkweed juice on your fingers? How it does stick! Just like glue. It really could be used for rubber, but as we are explorers and not inventors we should be more interested in other things concerning the milkweed.

See the color of the common milkweed flower, a delicate shade of lavender. What a pretty flower it is. Let us get closer to it so we can see. Just as we found in the goldenrod, other explorers such as bees, ants, and other insects are here before us. When we shake the flower most of them leave or fall off. Look! There is a bee that does not fly away. See how it pulls and struggles as it tries to get away. It acts like a boy stuck in the mud and afraid to lift his feet for fear his overshoes will come off. Why doesn't the bee fly? Do you see? The round flower ball is made up of many little flowers. Each flower has a top part and a turned down part. The parts that turn down form notches between them, and when the bee or fly gets his feet into this notch he is stuck just as the boy was stuck in the mud. But the insect does not stand still as the boy did. The insect begins to get excited and buzzes and buzzes, flaps its wings and struggles to get free. The

Photo by the author

MILKWEED PLEURISY PLANT

milkweed trap holds it firmly. If you look down on the flowers, you will see five little horns with a black dot on each one. Poke a needle into the dot and out come two little pollen bags. The bee in trying to get free pokes its feet about and the pollen sets on them. It also leaves some pollen on the plant that it has collected from other milkweeds so the milkweed can be pollinated and its seeds can develop. Sometimes, however, the insects are trapped too tightly and die.

The milkweed has a delicate perfume also, as you will find if you smell it. This also helps to attract insects. The milkweed is really a very interesting plant to people who take the trouble to do some exploring, but most of us only know about its pods and traveling seeds. We will find many kinds of milkweed growing in different places. Most of them have milky juice.

There is one called butterfly weed or pleurisy root which we should try to find. This is really a very pretty plant and deserves a place in our gardens with the cultivated flowers. It has a beautiful orange flower and will attract your attention from quite a distance. It is really the most beautiful flower of all the milkweeds and can be found blooming in the fields all during the summer. It gets its name of butterfly weed because it attracts so many butterflies. If you are exploring for butterflies in the summer it would be a good idea to look for this flower. It gets its name

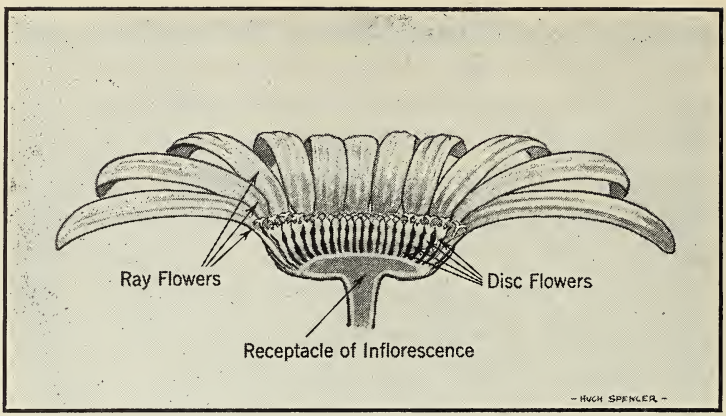
Dr. F. W. Copeland, Ohio University

A DAISY FIELD

pleurisy root from the fact that the roots were used by the Indians and early settlers as a remedy for pleurisy. The roots are still used in some medicines.

Have you noticed all of the daisies there are? You do not have to explore very much to find them, for they are all about us, but how do you suppose they spread all over a field? They are so close together that at a distance they appear to cover the field like a carpet. You have probably made chains of the daisy or perhaps have pulled the petals off one. Let us sit down and look closely at the daisy flower. We are about to make a great discovery. Pick just one daisy. Just one, no more. Now for the discovery. You have many flowers in your hand. But, you say, you have only one daisy. That is true, but let us do a little exploring. Take hold of one of the white petal-like parts and pull it out. Look what comes with it. Take it apart. You see you have a flower right there, and that one flower would produce one seed. This particular kind is called a rayflower, just as we found in the goldenrod. Count them. There may be as many as twenty or thirty of them. So you see you had twenty or more flowers in your hand. But that is not all of the discoveries to be made about the daisy.

Look at the yellow center part. Pick out just one of these. What do you find? It has nearly the same parts as the white outer flowers had. It is a flower called a disk flower and it also will produce one seed. Count the disk flowers and there are as many or more disk flowers as there were ray flowers. So you see you



PARTS OF A DAISY FLOWER

really have fifty or sixty flowers in your hand when you held just one daisy.

Now here is a discovery that the farmer has made. The daisy seed does not have hairs or wings to carry it about as the milkweed does. It gets mixed up with the grass and clover seed and when the farmer sows his seed he sows daisies too. They grow quickly and come up year after year from the same root. So you see it does not take them long to get possession of a field. If the farmer is to get rid of them he must plow the field and plant some crop like corn for a year or so. Corn must be cultivated so seeds and daisies are killed off.

You have already discovered another kind of daisy called the yellow daisy or black-eyed Susan. Its flowers are very much like the common white daisy except for color. The ray flowers are yellow and the

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WAVY-LEAFED ASTER NEW ENGLAND ASTER

center or disk flowers are brown. There are not so many of these as there are daisies, and they grow much larger than the ordinary white daisy. However, they are very pretty flowers and add color to the landscape.

You cannot go very far in late summer or fall without discovering another very common flower. It is the common aster. Not the aster you raise in your flower gardens but the kinds that blossom everywhere from late summer until the frost kills them in the fall. See if you can find some of them and find out what they are like. You do not have to go far because they are so plentiful. The flowers look something like small daisies. Just as in the goldenrod and daisy, the aster too has many flowers on one stem.

It might be interesting to find out how the aster got its name. Our word aster comes from the Greek word meaning star. If you look at some of the asters

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LOWRIE'S ASTER FLAT-TOPPED ASTER

you will see that they do look something like stars with many points.

Many of them are white with yellow centers. They vary in size from tiny ones no larger than the end of a pencil to ones as large as a quarter. The New England aster is one of the most beautiful of the asters, as well as one of the largest. It is purple in color with golden yellow centers. These asters make the low fields and swampy places beautiful in the fall.

If you take an aster apart you will find that it is made up much the same as the goldenrod and daisy. The aster seeds have hairs on them so that the wind can carry them about. That is one of the reasons why they are so easily scattered and accounts for there being so many of them everywhere.

Let us explore a little further and see what we can find.

Here is a common flower that almost every boy and girl has seen. Most people call it butter and eggs. Do you see why? The flower is yellow and near the top has a darker yellow like the yolk of an egg. Another common name for it is toad flax. Look at it closely. The pretty yellow flowers are about an inch long with a long spur on the bottom. The upper lip is yellow and the lower lip is yellow below, but has an orange-yellow part on top. Now why call these parts lips? If you pull down on the lower lip it opens up like a mouth and shows

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EVERLASTING TOAD FLAX

the stamens and pistils inside. Most insects cannot get into this flower. The big heavy bumble bee climbs on the lower lip and it opens at once. So the bumble bees and a few butterflies are the only ones that can collect honey from this plant. The toad flax was originally a flower in our great grandmothers' gardens, but it soon spread around everywhere and became a weed. Like the daisy it is perennial, that is, it comes up from the same root year after year. And besides, it produces many, many seeds that are scattered far and wide.

If we look about farther we will find the pearly everlasting or old field balsam. This plant has two kinds of flowers on one plant. It raises pollen on one and on the other it raises the ovules which make seeds. Insects carry the pollen from one plant to another. This plant has a very pleasant, woodsy smell about it. Sometimes people collect it to make cushions. The leaves are grayish-green above, and pearly-gray beneath. It is a flower you should know and once you learn the odor of it you will never forget it.

If we do much exploring we are sure to come upon some Queen Anne's lace, or wild carrot. The large white, umbrella-shaped flowers are made up of smaller groups of flowers and they in turn are made up of tiny flowers no larger than the end of a match. Each of these tiny flowers produces seeds. One plant may develop as many as ten thousand seeds. The flowers wither and curl up toward the center, closing the sticky seeds in a sort of nest until they ripen. Then they are all

YOU SHOULD KNOW THESE FLOWERS

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WILD CARROT JOE-PYE WEED

shaken out and scattered around to make more Queen Anne's lace plants.

The purple ironweed is another flower that we soon spy. It is a tall straight plant often taller than we are. What a pretty sight its bright purple tops make in the fields. But it, too, is a common weed. Near it we will likely find the joe-pye weed. This weed grows tall like the ironweed, but has a large, round, lavender flower head. You can learn many interesting things about it if you care to explore further.

You should get along though. Just notice the flowers as you pass and perhaps later you can carry your explorations further. There is the yellow flower of the evening primrose. Its flowers open in the early evening and bloom at night. They are partly closed during the day. There is a tall mullein plant with its

velvety leaves and yellow flowers. In a field nearby is wild bergamot. Its leaves have a pleasant odor. The purple "heal all" is here and there under foot as you walk along, but you must not stop now. All of these plants have some interest for you if you care to go exploring. But like all expeditions, this one must come to an end.

Things to do

1. Make a collection of the different kinds of goldenrod.
2. Look at the flowers to see the parts.
3. What insects are found on goldenrod?
4. Write a story of Edison and his rubber experiments with the goldenrod.
5. Collect different kinds of daisies.
6. Dig up a plant and look at the roots to see how the plant spreads.
7. Find seeds of the daisy.
8. Find a black-eyed Susan and compare it with the daisy.
9. Write a story about the daisy and make some colored pictures of it.
10. Gather as many kinds of asters as you can find.
11. Tell about seeds.
12. Examine flowers to see how they are made up.
13. Describe the milkweed plant.
14. Look at a flower for insect traps and pollen sacks.

15. Look for seeds. Make a seed collection.
16. Collect the butter and egg flower and examine its parts.
17. Dig up a plant and examine the roots to see how the plant spreads.
18. Examine the Queen Anne's lace flowers.
19. Look for seeds and see how they spread.
20. Collect "pearly everlasting" for a pillow. Learn to know its odor.
21. Find other wild flowers not mentioned here.
22. Write a story about weeds as flowers.

BEES AND BUMBLE BEES

A man stopped his car and pulled over to the side of the road. Over in a clover field nearby some boys were wildly jumping about, fanning the ground with sticks. A farmer had stopped to watch, also.

"What's going on over there?" asked the driver.

Just then one of the boys let out a wild yell and began jumping around more than ever.

"Bumble bees' nest," said one of the boys.

"We're killing them so we can get their honey."

"Wait a minute," said the car driver. "Don't you know that if those bumble bees were not here that Mr. Farmer there could not have his clover field?"

"No," said the boy. "What do bumble bees have to do with red clover?"

"Didn't you ever notice bumble bees flying around over a red clover field?"

"Sure; that's how we found this nest," said the boys.

"Well, why do you suppose these bees built a nest so close to this field?

"The reason is that they like to take the honey from the red clover. If you ever noticed, you have not seen many honey bees on a field of red clover. What do you suppose the reason is?

"The answer is simple. The honey bee can't get the honey from the red clover flower. The red clover flower is long and deep and the honey bee's honey pump is not long enough to reach it. But the bumble bee's honey pump is longer and just the right size to get into the clover flower. So you see the bumble bee likes the red clover."

"What does that have to do with Mr. Farmer having his red clover, though?" asked the boys.

"Perhaps Mr. Farmer can tell you about that," replied the man.

"Well," said Mr. Farmer, "I think the red clover likes the bumble bee as much as the bumble bee likes the clover. The red clover hides a drop of honey way down in its flower. The bumble bee has to stick its head into the flower to get his honey. In doing this some of the clover's pollen sticks to the bumble bee."

"What is pollen?" asked one of the boys.

"Pollen is the yellow or red dust you see in flowers. It must get on another part of the flower called a stigma before the flower can grow any more seeds. So when the bumble bee visits the next flower it scrapes off some of this pollen on to the stigma of the flower and pollinates it so it can produce seed. The bumble

bee is the only insect that does this for the red clover; so you see the clover blossom benefits by the bumble bees' visit. I don't kill bumble bees any more because they help me grow my clover."

"What goes on inside the bumble bees' nest?" asked the boys.

"I would like to know, too," said the man who had driven up in the car.

"Well," said Mr. Farmer, "I dug one out once and here is what I think happens.

"In the spring the mother bumble bee flies about over the field looking for a nest. Back and forth she goes, flying low, her keen eyes on the alert for a nest site. Finally she finds a place that suits her fancy. Perhaps it is an old field mouse burrow, or some other hole in the ground. Into this hole she goes and cleans it out. At the end of the burrow she hollows out a small room. Then she is ready to begin nesting. First she makes a sort of bumble bee bread out of nectar and pollen. When she has enough, she lays several eggs on this bee bread."

"Don't they gather honey?" one boy asked.

"I'm coming to that part," said the farmer.

"When the young bumble bees hatch they eat this bumble bee bread and spin a cocoon around their bodies. The mother bee strengthens this cradle with wax and takes care of the babies until they hatch out. These first ones hatch out into workers. The workers clean out their old cells for honey pots. These they fill with honey to feed the new members of the family.

More workers are born and go about the house building, caring for the young, and gathering honey. The queen gives all of her time to laying more eggs."

"Do all of the eggs hatch into workers?" said the boys.

"No, later on in the summer the queen lays eggs that become drones and queens."

"What is a drone?" said the boys.

"A drone is a male bee. He mates with the queen so that the eggs will hatch.

"The workers never lay eggs. They are not as big as the queen and the drones. Their duties are to take care of the home and young bees and to pollinate the farmer's clover."

"Where do they go in the winter time?"

"Most of them die when winter comes. Only a few of the queens live over the winter. Just why that is no one knows, but I am glad they do so they can start new nests to make my clover produce seed.

"Did you notice that honey bee there? I expect that is one of my honey gatherers. I have several hives of honey bees over here in the orchard. If you will come over I'll tell you about them as I was just going over to take off some honey when I saw you boys over here."

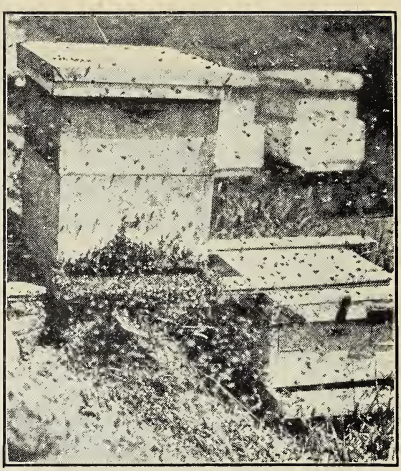
"Sure, we would like to go," said the boys.

"I'll go too," said the car driver.

"These are the hives," said the farmer. "They are the homes where the bees live."

"I thought some of them lived in trees," said one of the boys.

BEE HIVE IN TREE



ARTIFICIAL HIVES

"Those are wild bees. They live in the woods in a hollow tree or any place they can find for a nest.

"These bees do not have to hunt for a nest, because I furnish them with a nice home. They in turn furnish me with honey to eat and sell.

"The tall, lower part is the brood chamber. In this part are long frames on which they build combs. On these combs they raise their young and store honey and bee bread. Sometimes they produce too much honey for this space. Then I put on this top story called a super.

"In the super are the small frames that you buy at the store. When filled each frame weighs about one pound. The bees go right on working and in good seasons will fill several supers with honey."

"How do you get inside to see them?" said one boy.

"You stand back a little way, and I'll open a hive for you. First you put on a veil to keep the bees away from your face. Then you lift the top and blow in a little smoke. Now you're ready to look inside. See how they fly around; yet I am not getting stung. They do not bother you as long as you stand still."

"Ouch," cried one of the boys, "one stung me."

"Wait a minute," said the farmer, "until I get the stinger out.

"You see the bee's stinger is hollow and very sharp on one end, while at the other end is a little bag. In this bag is a liquid poison. When the bee's stinger comes out it squeezes the poison into your flesh, and that is what makes it hurt so much. But that bee will never sting anyone else, because when a bee loses its stinger it dies.

"Now we will look into the brood chamber. See the bees crawling about over the comb. Some of them have their heads in the cells. Maybe they are putting in honey or taking some out. Here is the queen," he said, "she is the only one that lays eggs.

"She is larger than the other bees. Her body is much longer than the workers.' You can tell her from the drone too, because the drones look like big clumsy worker bees. They just look like workers but they are not because they never do any work. They are the males and after the queen has taken her mating flight they are of no use to the colony. So the workers take them out to the front door and drop them over the edge. If the drone finds his way back, the workers

a—DRONE b—WORKER c—QUEEN

carry him out again and continue this until he stays out."

"What is that brown stuff on the inside of the hive?"

"That is a kind of bee glue that the bees gather from the sticky buds of flowers and from trees. This glue they use to stop up all of the cracks and crevices of the hive. If a bug crawls in that is too large to carry out, they glue it down and cover the whole bug over with bee glue until the bug is only a shiny bump on the bottom of the hive."

"What are these bees along in front there, fanning their wings?" asked a boy.

"They are ventilating the hive. They are busy fanning their wings to blow the smoke out of the hive. On the inside hundreds of others are doing the same thing. So you see when they all get to fanning their wings they soon clear the smoke out of the house. In the summer when it is warm they do that quite often, because the hot sun would melt the wax in the hive and let the honey out.

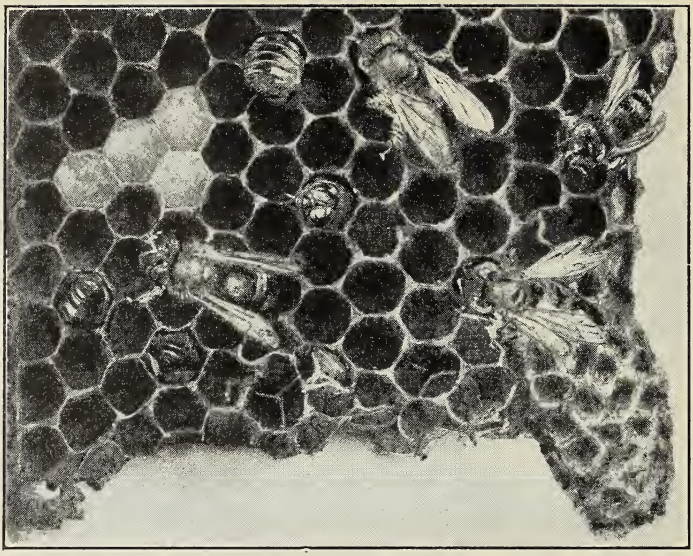
"When they want to keep warm they ball up together and in that way keep each other warm. That is the way you would find them in the winter time."

"Do the bees raise queens to live over the winter like the hornets and bumble bees do?" asked one of the boys.

"No, not exactly the same. At some time during the year, especially when the hive has too many bees, the workers begin to make queen cells. If you look on this brood frame I will show you a queen cell. See, it is about as big as a small thimble and stands out from the rest of the comb. The workers build several of these and the queen lays an egg in each one. Now the workers begin to take especial care of these larvae in the queen cells. They feed them on a special food called royal jelly. This royal jelly is made of honey. The workers digest the honey and then feed it back to the larvae. Such care as these larvae get! No wonder they hatch out into queens.

"The old queen does not pay much attention to the queens until they hatch out. Then she tries to sting them to death. The workers protect a new queen so that the old one cannot sting her. Failing to get rid of her rival the queen mother leaves the hive with some loyal workers and goes away to start a new home. This is what we call swarming.

"In the old home one of the new queens lives. She only leaves the hive once, to take one flight. During this flight she mates with a drone. The drone dies and the new queen returns to the hive to lay eggs.



QUEEN CELLS IN THE HIVE

"See, I am going to pinch these queen cells off."

"Why do you do that?"

"If I pinch the queen cells out the bees will not swarm. If I want more stands of bees I let them swarm, but right now I want them to stay here and gather honey."

"Where do they get the honey?" said one boy.

"Oh, all over the farm. I have them here in the orchard so that they can get the nectar from the fruit blossoms. That helps to pollinate the fruit, too. They go all over the farm poking into flowers wherever they find them. Some of them go great distances to get nectar. But no matter how far they go, they always

seem to know the way home. As soon as a bee gets its load of nectar or pollen, it flies up into the air and heads for the hive. How they can remember their directions is a wonder to me.

"Notice that bee over in the other hive just going in.

"See the bees loafing about the door. They are the guards. Their duty is to challenge each arrival to see that no others get in. Because sometimes bees from other hives come in to rob the hive. If left alone they would steal all of the honey.

"So you see they must keep a guard posted all of the time."

"What is that yellow stuff on their legs?"

"Oh, that is the pollen that the bees have gathered. They use the pollen in making wax and feeding the young. On each of the back legs is a group of hairs that form a sort of basket. These are called pollen baskets and that is what you see. The bee's body is hairy, and the pollen sticks to it. This is a help to the flowers, because they carry pollen from one plant to another."

"Are there different kinds of honey bees?"

"Yes," said the farmer, "there are.

"The little wild bees are black. These you notice have five yellow stripes on the abdomen. These are called five-banded Italians. They are good honey producers and easier to handle than the wild bees.

"Now, I must close up the hive so that these bees can go to work. Before I close it, I will take out some

of these full frames so that each of you may have some honey to eat. And I believe if I were you I would not kill any more bumble bees, because they are really very valuable to me in my clover field."

After thanking Mr. Farmer, both boys and the man who had stopped to see the fun made their way off over the field, each one much wiser about the ways of bees and the work they do.

Things to do

1. Put a bumble bee under a glass for study.
2. What are the differences in the appearance of a queen, a worker, and a drone? Show these by illustrations.
3. Draw a picture of a bumble bee's nest.
4. Make a drawing of a bumble bee's mouth to show how it gets into deep flowers.
5. Make a drawing of the red clover flowers.
6. Write a story about how the bumble bee lives.
7. Get some dead bees to look at. Find the stingers. Look at the mouth to see how it gets honey. Find the eyes. Find the pollen baskets. Find some pollen on them.
8. Get an observation hive to watch the bees.
9. Look at some comb to see how bees store honey. What is beeswax for?
10. How do the bees ventilate the hive? How do they use glue?

11. How do they raise queens?
12. What is a drone?
13. How does a farmer get into the hive?
14. Write a story about honey bees.

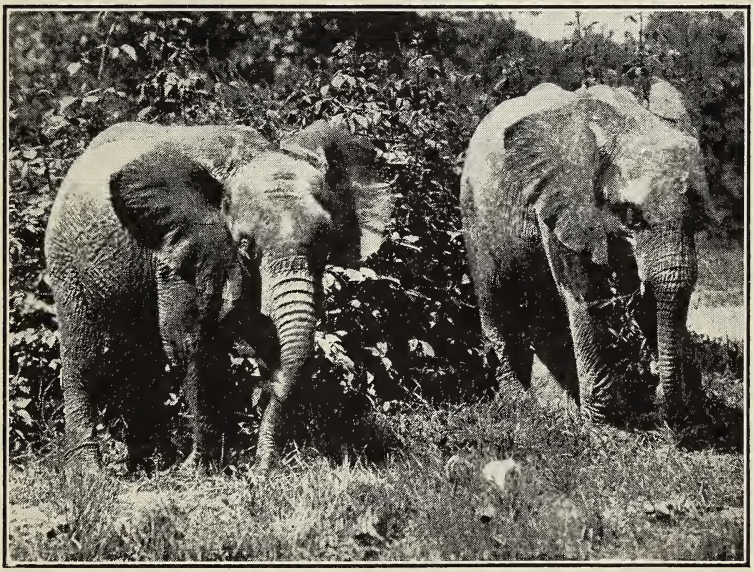
ANIMALS OF THE ZOO

How many different kinds of animals there are in a big zoo. Some are in great strong barred cages and others just fenced in like cattle. Some of them pound and tear at the cages and others stay peacefully inside and go about just as though they enjoyed it. There are too many of them to see them all at one time so you had better look at the most interesting ones first.

The animals we are most interested in are the mammals. Do you know why they are called mammals? Think of all of the animals you can; worms, insects, snakes, birds, frogs, pigs, cows, horses, sheep, and as many others as you can. Which of these are nourished with milk of the mother? Babies get their first food from their mothers also. All baby mammals get their first food from their mothers, even the bats and seals and whales. Another thing about a mammal is that its body is covered or partly covered with hair.

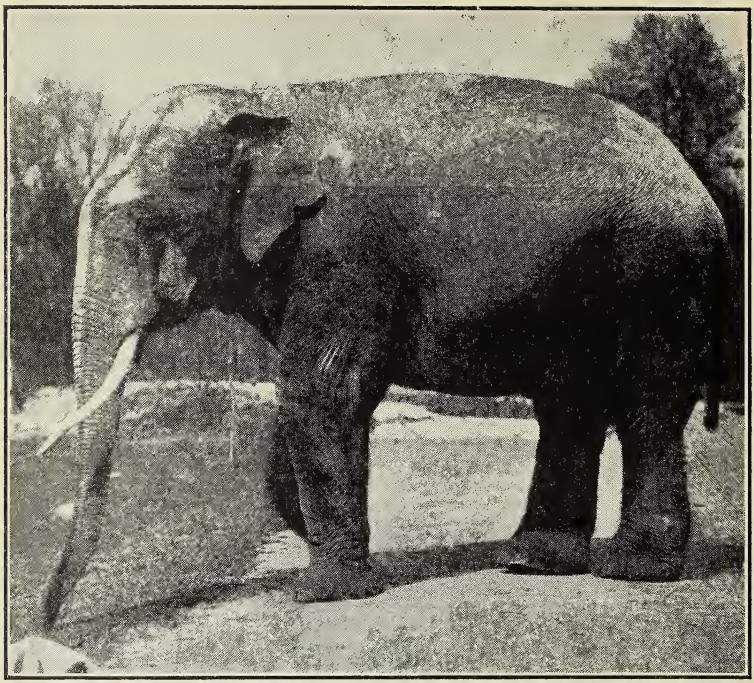
Think of all the animals you can again, and see which ones have hair on their bodies. Do elephants and pigs have hair on their bodies?

If there is a zoo in your neighborhood you should pay it a visit and see what you can learn about some of these animals. Perhaps the one you will first notice is the elephant. Every boy and girl likes the elephant. See how he swings his heavy trunk. What can he do with it? It is the handiest thing, for he can wrap it around a telephone pole and pick up the pole or he can pick a peanut up off the ground. He can draw water up through it to drink, and if he wishes to be



New York Zoological Society

AFRICAN ELEPHANTS



New York Zoological Society

THE INDIAN ELEPHANT

mischievous he can squirt water quite a distance. He can also fill it with dust and blow that around.

Where do you suppose these elephants come from? Perhaps you have seen moving pictures showing how they trap them in their native jungles, and load them aboard ships to bring them to us. Elephants are of two general kinds, those that live in Africa and those that live in India and the Far East. Long, long ago some elephantlike animals called mastodons and mammoths lived in the United States. Occasionally

we find their skeletons and teeth buried in the rock or deep in the ground. All of those formerly living here have now disappeared, and the only ones we have are the elephants in the zoo which come from Africa and the Far East.

Watch the elephant eat. He eats hay and other plant food. What a lot it must take. Imagine a whole herd of elephants feeding on a plain or in the woods. No zoo or circus would be complete without an elephant.

You will probably want to see the monkeys next. Monkeys are very interesting because they can do so many things. Other animals march about in their cages as though they never could be satisfied with the life they are living. The monkey tries to be happy even in his cage. Did you ever see one looking into a mirror? What a time a monkey can have looking at himself. Perhaps he thinks he sees a strange monkey and is trying to make its acquaintance. At any rate he enjoys looking at his own reflection in the mirror.

The ability of the monkey to move about is nothing short of marvelous. How he can climb and jump! Up the side of the cage, he goes along the roof, up on a swing, now down on the floor, now up on the roof in a twinkling of the eye.

The monkey in his natural home lives in the tree tops. When he wishes to go somewhere he follows certain trails through the trees. These trails are sort of monkey roads, and he does not have to walk on the dangerous forest floor where his enemies are. This

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OLD WORLD MONKEY NEW WORLD MONKEY

accounts for the monkey being able to climb around so easily.

For food he finds natural fruits growing wild in his native home. Eggs and small animals offer a change in diet. In the zoo he gets plenty to eat and does not have to look for it. All he has to do is wait for the keeper to bring his food. Somehow monkeys and other animals come to know the time for feeding. As this time approaches they get restless and noisy. And when the keeper finally appears with his basket of food they set up a terrible clatter, chattering, howling, jumping about as though they were half-starved. Then, when the keeper throws in the food, usually bread and pieces of banana or vegetables, each one grabs all he can get and goes off in a corner to eat it. If another approaches he is growled at viciously.

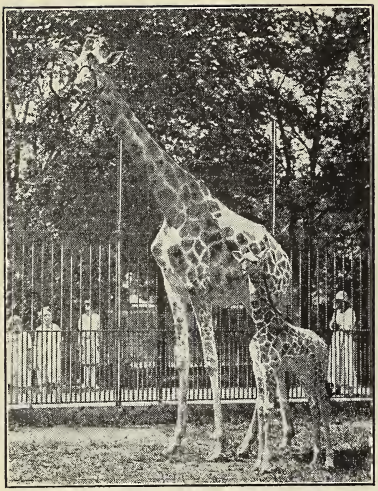
The monkeys are of two types: The New World monkeys or monkeys that are native to South and Central America and the Old World monkeys. The New World monkeys are not as large as some of the Old World kinds. Among those found in America are the spider monkeys, the howling monkeys, and the capuchins.

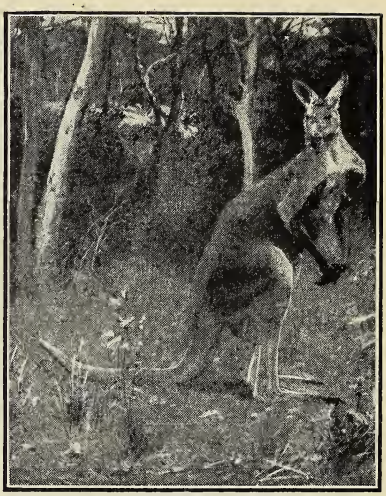
The Old World monkeys are the baboon, gibbon, orang utan, gorilla, the chimpanzee, and many smaller kinds. Of these the gorilla is probably the largest. It is a fierce manlike creature weighing as much as five hundred pounds.

The orang utan and the chimpanzee are often seen. The orang utan has brown hair and the chimpanzee has black hair. They are most interesting on account of what they do. They learn quickly and can be taught to do many things. Some of these animals at the New York City zoo one time were taught to eat at a table. They soon learned how to sit up at the table and eat their food. It is said also that they had fair table manners.

When these large apes live in the zoo great care must be taken in feeding them. They get indigestion and die very easily. Their home is always near the equator where the climate is warm. So when they are taken away from their home they must be kept warm, especially in winter or they will catch cold and die.

Everyone wants to see a giraffe on account of its long neck. What a long neck it has. Just think what





New York Zoological Society

THE GIRAFFE

THE KANGAROO

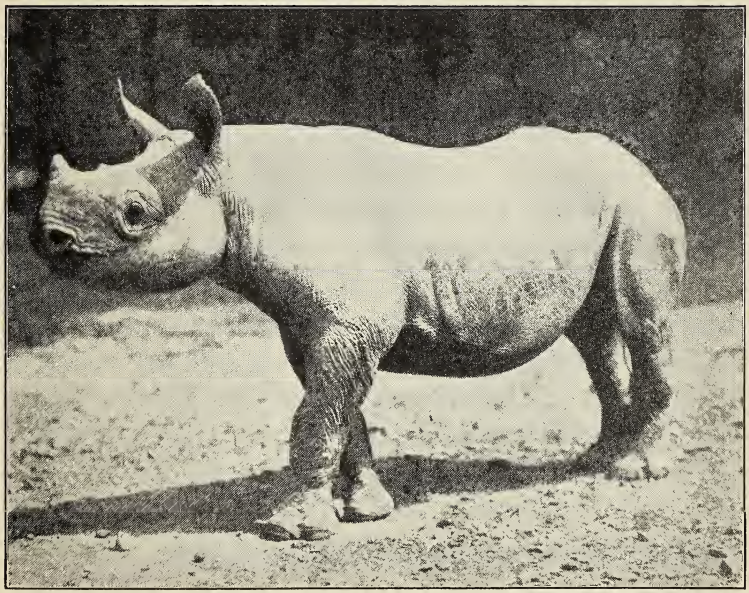
an awful thing it would be to have a sore throat in a neck like that and have it sore all the way down. But the giraffe does not seem to have sore throat so he does not mind. Some giraffes are as much as fourteen feet high. Their home is in Africa. They use their long necks to reach into the trees and browse off the young twigs. Their legs are so long that they seem to have difficulty reaching the ground, even to drink. When they wish to reach the ground they spread out their long front legs in an awkward manner and reach down. They eat hay, vegetables, bran, and some salt.

Near these animals will be found the deer and bison. The bison or buffalo are among the best known of all the hoofed animals. They were found in large numbers on the great plains of our country years ago.

Thousands and thousands were killed, until by 1875 most of them had disappeared. There are some in the United States even yet but these herds are carefully protected.

The big hippopotamus is a funny looking animal. What a great big creature it is! It lives in the rivers of Africa and eats plant food. It seems to live well in captivity and to enjoy its home.

The rhinoceros lives in Africa and in India also. The Indian rhinoceros is the larger and rarer of the two kinds. The African rhinoceros is still fairly common but is being killed off rapidly by hunters. It has



New York Zoological Society

THE RHINOCEROS

three horns on its head. Its hide is so tough that it would turn bullets from low-powered guns. One seldom finds them in zoos.

The kangaroos go hopping about on their great hind legs. What jumpers they are! What power they have in those great legs. They live in Australia and New Guinea. They are used to traveling over the plains. The mother kangaroo has a pouch on her body where she carries her babies. When the babies are born they are very weak and cannot walk or hop. The mother places her baby in the pouch where it stays until it is big enough to walk. What a funny sight it is when it gets very nearly big enough to come out of the pouch. It lives in the pouch folded up like a jackknife, with its head sticking out one side and its great big feet out the other. As soon as it is old enough the mother lets the baby come out of its pouch, and it goes around by itself.

The lions are interesting too. They are very fierce beasts. They belong to the crouching animals or the catlike mammals. When the lion is ready to catch its prey it crouches down low to the ground. Then with a mighty spring it pounces upon its victim and tears it to pieces. They have sometimes attacked man. More often it is some smaller animal that it wishes to catch for food. In the zoo lions are fed on raw beef. They can be tamed and taught to do some tricks. You have seen them in circuses, no doubt.

There is one group of animals that we would like to see and they are the walruses and seals. They live in

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COMPARE THE WALRUSES WITH THE SEALS

the water. The walruses live in the Atlantic Ocean up near the Arctic Circle. They grow to be very large, some of them weighing as much as two tons. They eat mostly clams and other small shell fish. The California sea lion or barking sea lion is often seen. It is found off the coast of California. A sea lion differs from a seal in several ways. The sea lions have flat, naked front flippers and long necks. Seals have short stubby front flippers covered with hair, and short necks. All of them live on fish, and what a sight to see them at feeding time! As soon as they know their keeper is about they start swimming, diving, and barking. What a clatter they make! He throws the fish into the water and how they go for it, diving and swirling about. If a fish happens to land outside on the rocks, they go after it and return to the water to seek for any that may have been missed. What interesting creatures they are.

Underwood and Underwood

A COLONY OF SEALS

We could not visit every animal at the zoo in one day, but there are many, many more to be seen, and if you cannot see a zoo you can find pictures of these animals at the library.

Things to do

1. Name all the animals you have seen at the zoo or circus and write a story about them.
2. Collect pictures of these animals.
3. Read stories of animals by Beebe, Seton, and Roosevelt.
4. Make a circus.
5. Tell how animals are trained.
6. Write about tricks you have seen monkeys do.
7. Write about elephant hunting.
8. Tell about the kangaroo.

FERNS AND MOSSES

Did you know that ferns could walk? Some of them can or at least they can take long steps. One of the common ferns is called the walking fern. Did you ever hear of a fern having legs? No, you never did. How then does this walking fern get its name? Let us try to find one and see if we can tell. They usually grow on rocks in the woods where it is cool and shady.

There is not much soil for them to root down in. Here are some ferns on this rock. Do you see why they are called walking ferns?

Each one of the big leaves tapers down to a point. This leaf point does not look much different than the point of any other leaf, but there is a difference. Hid-

den in this leaf tip is a tiny bud. It is just waiting for a chance to grow. Up—up—up grows the walking fern leaf. Soon it gets too tall to stand erect. It begins to bend over ever so slowly. Down—down it comes until the tip with the tiny bud inside touches the ground. Now something begins to happen. The little bud begins to grow. First it sends tiny rootlets down into the ground. As soon as it gains a foothold it starts to send up leaves. Up and up they go just like their parents. Very soon they too bend over and touch the ground, and the little bud hidden away in the tip of each leaf begins to grow and start new plants.

See how they are scattering. Some bend to the north, some to the south, some east, some west. They scatter in all directions, and soon the whole place is covered with walking ferns. The walking fern has another way of moving about. This is by means of spores. Did you ever hear of fern seed? Just try to buy some fern seed at a store and you will find there are no such things as fern seeds.

On the under side of some of the fern leaves you will find brown patches. These are the spore cases. In each one there are thousands and thousands of tiny spores. How many of them there are! You would probably be as old as Methuselah before you could get them counted, even if you worked ten hours a day. If you shake the plant these spores are sent out into the air.

They are fine as powder. Each one is a single cell. It is not like a seed with a small plant inside and a

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POLYPODY FERN BRACKEN

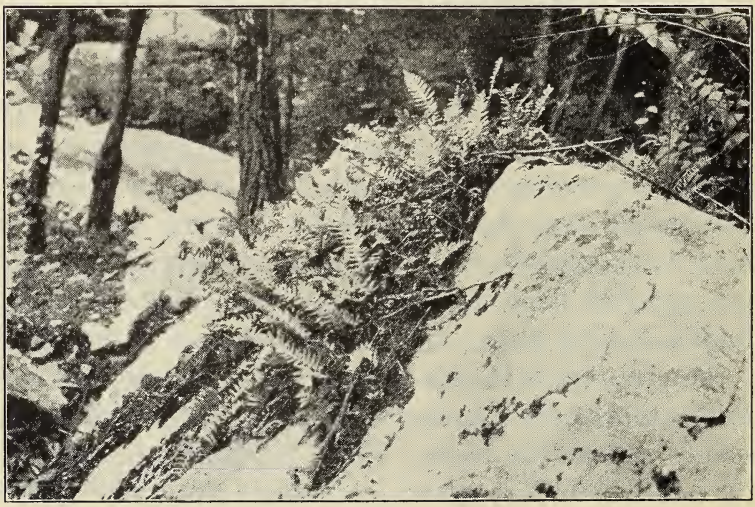
well-filled lunch box to go with it. No, it is only one tiny cell, but this cell is the beginning of a new fern plant. This tiny spore is blown about by the wind or carried by streams, and finally finds a place to grow. Thousands and thousands of its brothers and sisters have been blown away into places where they could not possibly have a chance to grow. But one spore finds a resting place on a nice damp rock in a woods.

The tiny spore begins to grow. The cell divides and makes more cells. Soon it sends rootlets down into the scanty soil on the rocks. Then a peculiar thing happens. A little flat green leaf about the size of your little finger nail grows on the rock. In the center of

this little leaf a bud forms and sends up a true leaf. This leaf grows and grows and soon it is walking about over the rocks just like other walking ferns. All ferns produce spores which grow just as the walking fern spores do. That is why you find small patches of them growing around here and there in the woods.

If you would dig up the root stock of a fern, it too would tell a story. When the fern first starts to grow this root stock is very small, but as the fern grows it begins to creep along under ground. Each year a bud forms and a new bunch of ferns comes up from the root. When they die down in winter the scar is left on the old root stock. If you look closely you will see where several seasons of growth have died down.

Did you ever notice a new bunch of ferns just be-



ROCK FERNS

ginning to grow in early spring? What funny little things they are. Not anything like the green leaves into which they develop later. Each little leaf is rolled and packed into a tiny "fiddle head," that is, it is rolled up like a watch spring. All ferns start their leaves this way. What tiny fuzzy leaf babies they are. Now they begin to stretch and stretch and unfold. Finally the watch spring begins to uncoil as they grow upward. Then the tiny leaflets coiled in toward the center begin to stretch their arms and soon the whole length is uncoiled and has become a real fern.

You will find several kinds of ferns. One is the Christmas fern. This is one of the most common ones and stays green all winter in some places. The maidenhair fern is a pretty one too. It has its leaves arranged in a sort of horseshoe which is supported by a slender stem. Then there is the sensitive fern, the cinnamon fern, the bracken, the rattlesnake fern, the ebony spleenwort, and many, many others. You can easily learn to recognize some of them by looking at the pictures in this and other books.

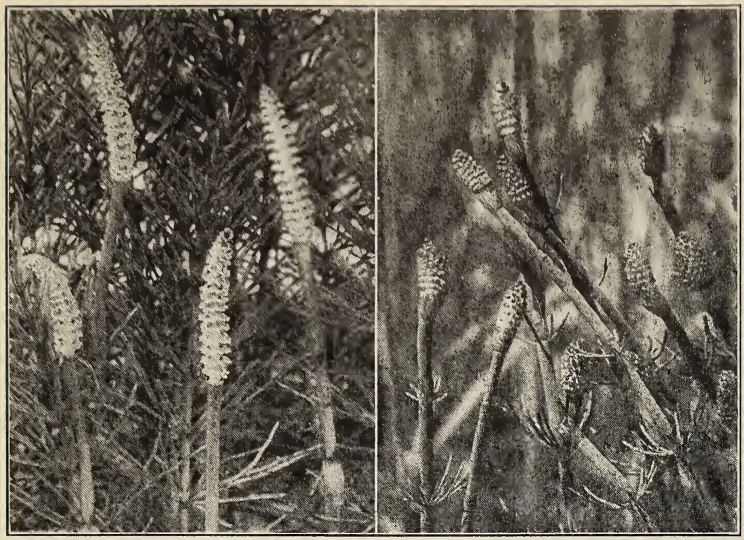
You have learned that ferns do not have seeds. Many years ago, and even today, people had funny superstitions about fern spores which they called fern seeds. Many folks thought that because the fern seed was invisible, if you found it, it would have the power to make you invisible too. There is a story of a man who, while walking through a field, got some fern seed in his shoes. He did not know it, but he at once became invisible. What was his surprise when he

walked into his house and his wife and children began asking where he was. He could see them but they could not see him. Finally they told him to take off his shoes. When the fern seed fell out he became visible again.

But that is not all of the story. Fern seed also gave the owner the power to see where treasure was buried. This man, on his way home, found some buried treasure. When he took off his shoes the fern seed fell out and was lost. So he not only lost the power to make himself invisible but also the treasure which he had found.

Other ferns were supposed to unshoe horses. One kind was known as "Unshoe the horse." Horses walking through the field would step on the fern and then in some way off came their shoes. If small pieces of the fern were put in a lock, the lock would open without a key. Do you believe any of these funny stories? Some people do, but we have learned to know better.

You know that boys and girls have relatives. The ferns have relatives too. It would not be fair to these country cousins of the fern to leave them entirely out of this story, so perhaps we had better put them in. Did you ever notice the small green plants that looked like small pine trees growing along a railroad embankment? Did you ever pick one and pull it apart at the joints? This plant is called a "horsetail," and belongs to a group of plants related to the fern called "horsetails." It gets its name on account of a supposed resemblance to a horse's tail. Another name for



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FIELD HORSETAIL SWAMP HORSETAIL

it is joint grass. It grows in fields and waste places. In the early spring it sends up a brownish stalk six or eight inches long. On top of this stalk is a conelike structure, as you can see if you look at one. Inside of this cone are thousands and thousands of spores, not seeds, because this plant, like the fern, does not produce seeds. If you were to cut this open and look at it with a magnifying glass you could see these tiny fellows come tumbling out. Each one is equipped with wings which help it to float away. These wings fold up if the weather is damp so that the spores must stay at home until a fine day comes. Then into the air they go to find a place to grow.

A relative of this one is the scouring rush, which looks like a tiny green fishing pole. It grows in great clumps in about the same kind of places that the horsetail grows in. Try to wade through them. Such a scratching and grating you never heard. It puts your teeth on edge, and causes little shivers to go chasing each other up and down your spine. Why do you suppose it is so scratchy?

Inside the walls of the stem are tiny deposits of silica, a mineral-like sand. This mineral gives it its scratchy qualities. This rush was used for scouring by people many years ago before we had so many kinds of scouring powders at every grocery store. The pioneer housewives would make bundles of the scouring rush and use them to scour their pots. It was even used to smooth wood, instead of sandpaper. If you would put a bundle of these in water containing acid, everything but the silica would be taken out and you would have the skeleton of the rush left.

Another relative of the fern is the moss. How many kinds there are. Some grow in swamps where they form peat. Each year the new moss plant grows upon the top of the dead moss of former years. Year after year and century after century it does this. Finally that on the bottom becomes pressed into peat and people use it for fuel to burn.

Some mosses grow on sunny banks, others in the deep woods. What a pretty sight it is to see a nice, soft mossy bank. You may want to lie down on its soft surface and gaze up through the trees and watch

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SEVERAL KINDS OF MOSS

the clouds go sailing by. No moss bank ever gets very old before someone takes advantage of its invitation to rest.

If you looked at this moss closely you would see that it is made up of thousands of tiny plants.

These tiny plants come from spores much as the ferns do. On top of the plant is a spore case. This case breaks and the spores fall out. They grow and make the green leafy parts. Then in the top of the leafy part a little bud is found. A new spore case grows out as before. New plants are formed by the spores. The old plants branch out and soon the ground is covered by a velvety-green carpet of moss.

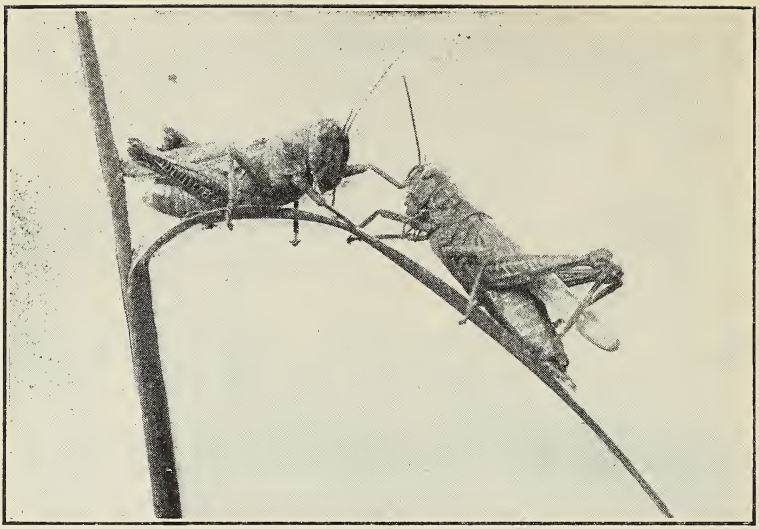
Now one more thing about ferns. Ferns are among the oldest kinds of plants on the earth. Far down in the coal mines where we get our coal we find prints of the ferns in the rocks, slate, and the coal. These ferns are not alive, of course, but millions of years ago they were alive. They fell down and were piled up just as the moss was to form peat. More and more of these ferns and other fernlike plants piled up and finally earth formed on top of them and pressed them into coal. Perhaps you can find some rocks or coal that show these prints of plants that lived many, many years ago.

You will always find ferns covering the cool forest floor or along the shady banks of your favorite stream. In all nature there is no plant more beautiful and few that are more hardy. These hardy pioneers get a living from the half-bare rocks and in places where few plants could live. They daringly cling to the edge and even to the very face of a cliff, sink their roots into tiny crevices and make a home for themselves.

Things to do

1. Collect ferns for your exhibit.
2. Write the story of ferns.
3. Find fossil ferns in rocks and write their story.
4. Make some leaf prints and find some spore plants at the florists.
5. Grow some fern spores.

6. Find walking ferns and tell how they walk.
7. Make a census of all the ferns in or near your home.
8. Write about the uses of ferns.
9. Describe how ferns unfold.
10. Find some horsetails, cut open the spore case, and look for some spores. Try to grow some horsetail spores.
11. Put some scouring rushes in weak nitric acid. Describe what happens. Tell how they could be used for scouring.
12. Describe how rushes grow. What relation are they to ferns?
13. Collect all the kinds of moss you can find for your exhibit.
14. Tell how peat and coal are formed.



C. Clarke

GRASSHOPPERS, BEETLES, AND WALKING STICKS

Now we are going to take a walk through the fields and see what insects we find. Of course we will not find all kinds but we will find many. What is that flying ahead of us? It goes only a short distance before it alights.

Yes, that was a grasshopper, or was it a grasshopper? Perhaps if you were to look in some of the books you would find that this insect is not called a grasshopper. It is a locust. Maybe you had thought of a locust as being one of those large noisy insects that sing "A-weesh, a-weesh, a-weesh" in the trees. But you have learned that they are cicadas. We will just have

to admit that the insect we call a grasshopper is really a locust, though it is more often called a grasshopper.

Do you remember the story in the Bible about the locusts that were sent as a plague on Pharaoh? Do you remember how worried he was and how badly he wanted to get rid of them. No wonder that he did.

Let us look closely at one to see if we can learn what it eats. There is one now chewing on a leaf. See how its jaws work.. They do not work up and down as our jaws do. They work sideways. What an advantage that is, because the grasshopper can move along the edge of the leaf, eating as he goes. He can also take a bite right out of the middle of the leaf if he takes a notion to. What a greedy fellow he is, always chewing and eating the leaves of plants.

The grasshopper probably prefers some plants to others, but you will find him feeding on many kinds of plants. Just think what a good time he would have in a field of nice, juicy corn or wheat or clover! In fact, that would just about suit the grasshopper.

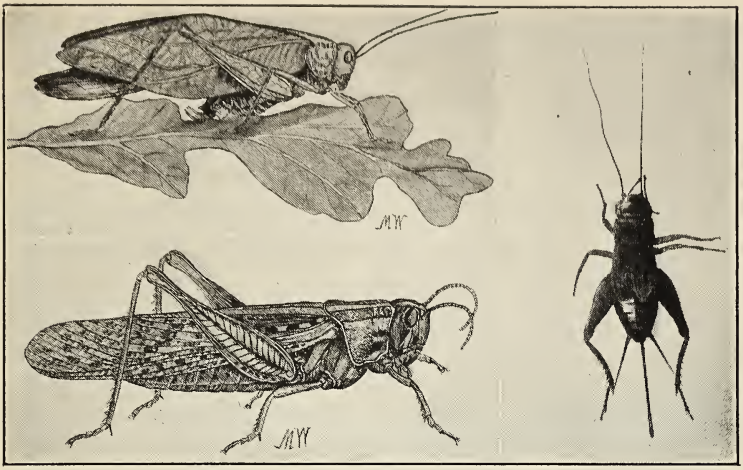
We see only a few as we go along, but sometimes they come in great numbers. In some places they come in such numbers that the air will be nearly filled with them, so many that they cloud the sun. Cattle walking through the field will stir up clouds of them. In some sections of the United States they have appeared in such numbers that the railway trains slipped on the tracks. Just think what a horde of insects like that could do to a farmer's crops. No wonder Pharaoh wanted to get rid of his plague of locusts.

Watch how they move about you. See, they can fly like other insects. They have two sets of wings, an outside set that are hard and a delicate set of inner wings folded under the outer ones. The inner ones are used for flying and the outer ones act as planes like the wings on an airplane.

But see how they can jump! They have six legs as other insects have but two of them are much larger than the others. When the grasshopper gets ready to jump he folds these long legs up, then suddenly straightens them out. What a spring that is, and how well he can hop. He can also walk about just the same as the others. So you see the grasshopper can move about by walking, hopping, and flying.

If you pick one up he may begin to chew at your finger. Very probably he will pour out of his mouth a disagreeable fluid upon your hand. Boys say that the grasshopper chews tobacco and that the brown fluid is tobacco juice. It is really made up of partially digested plants which the grasshopper has eaten. Often they will say, "Spit tobacco juice or I'll kill you." But the grasshopper needs no invitation to spit tobacco juice, he just does it whether you ask him to or not. Can you tell why he does this?

The grasshopper and some of his relatives have a peculiar way of making music. Some kinds make their music by rubbing their legs against the wing covers. The cricket, which is a relative of the grasshopper, makes his sound with his wings. He has a sort of file on one wing that he rubs over the other to make his



KATYDID, GRASSHOPPER, AND CRICKET

chirping sound. The katydid has a special music-making apparatus on its wings also.

Perhaps you wonder where all of the grasshoppers come from. The mother grasshopper lays eggs, just as other insects do. She has a different idea about where to lay them though. She digs a hole in the ground with the tip of her abdomen. Then she inserts her abdomen into this hole and begins to lay her eggs. Very carefully she lays them in until she has twenty-five or thirty in the hole. Each egg is about the size of a grain of wheat. She may lay two or three such nests of eggs before she dies.

These eggs live in the ground over winter and hatch out in the spring. What funny grasshoppers they are! They look something like the big grasshopper but they

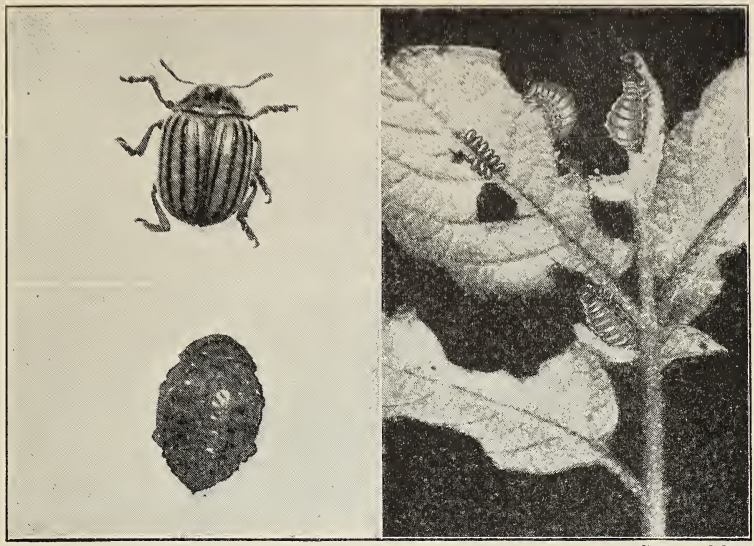
seem to be nearly all head. Soon the skin gets too small. Then it cracks down the back and the young grasshopper climbs out of its old skin with a new and larger one. Several times the young grasshopper changes its clothes before it is full grown.

There are many kinds of grasshoppers, as you will learn. There are many kinds of just common grasshoppers, not counting the grasshopper's relatives, the crickets and katydids. You can learn to know them if you collect them and look for their names.

Sometimes you wonder what becomes of all of the grasshoppers. Birds eat a good many. The quail is fond of them and destroys many of them. You have seen chickens and turkeys eat them. If the grasshoppers become too numerous the farmers put out poisonous bait for them, and as soon as they eat it they die.

If we go very far in our walk through the field we will surely find some beetles. You can tell a beetle from other insects, because its wings are split down the back which makes the beetle look as if it were wearing a frock coat.

Of course you have seen potato beetles, the striped kind that live on potato plants. They are troublesome insects. The striped ones are the adults. The mother beetles lay their yellow eggs on the under side of the potato leaf. Soon they hatch out into larvae and begin to eat. They do not look like their parents yet. They are soft-bodied creatures of a reddish color.



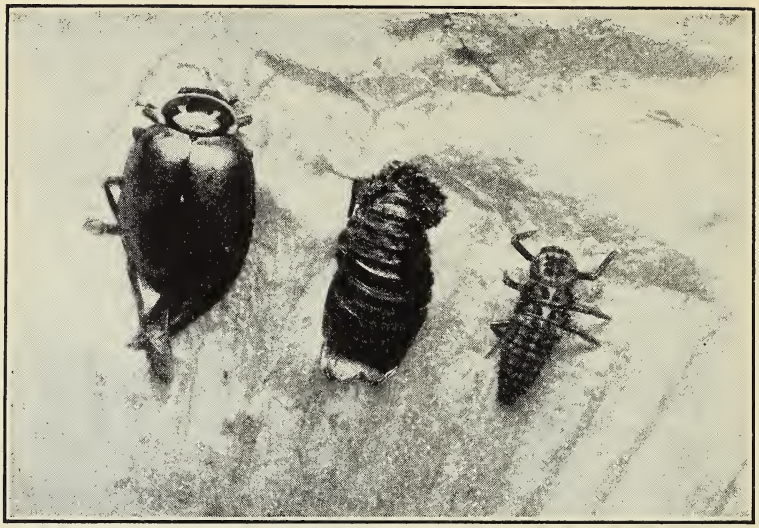
Spencer Photo

LIFE HISTORY OF THE POTATO BEETLE
ADULT, PUPA, EGGS, AND LARVAE

In about two weeks a larva has grown and changed its skin four times. Now it burrows into the ground and forms a pupa. In another week or ten days it comes out of the ground a full grown potato beetle.

Birds do not like this insect because it has a nasty odor and a disagreeable taste. Our friend the quail does not seem to mind the taste because he eats all of them he can get. As soon as the farmer finds potato bugs on his plants he sprays them with Paris green, which poisons the beetles at once.

We could not go very far before we would find a ladybird beetle. Look at one to see how it hurries



C. Clarke

ADULT LADYBIRD, PUPA, AND LARVA

about and then goes flying away. Sometimes children say:

"Ladybird—Ladybird, fly away home
Your house is on fire and your children alone!"

She does not have a home to go to, so that is not the cause of her hurry. In the spring she lays her eggs here and there on plants. Soon these eggs hatch out, not into ladybird beetles, but into queer little larvae that look like a sort of worm with six legs. They are sort of downy black in color, spotted with yellow or orange spots.

They are really good friends to the farmer, because

they go about over the plants hunting for plant lice and such insects. After a while the skin bursts open and a new ladybird beetle comes out to go rushing about in a great hurry as others did before her.

There are many kinds of ladybird beetles. Most of them are good friends. There are exceptions. There are two kinds that are not friends but enemies. One kind found in the eastern part of the United States destroys squash, melon, and cucumber vines. The other one eats the bean plants. These two we must fight, but the others are useful and helpful friends. You can recognize the bean beetles because they are very nearly round in shape and of a red or yellow color usually spotted with black. Some may be black but most of them are red or yellow.

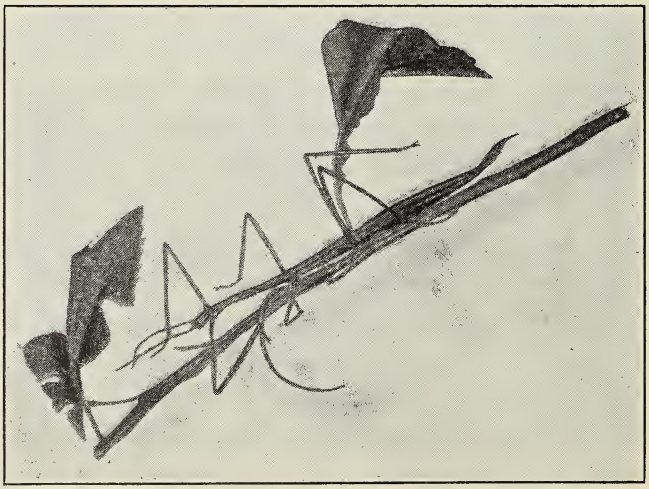
There are many kinds of beetles for us to find and study. There are known to be fifteen thousand or more kinds in North America, so you see we would not be able to study very many of them. You may come across the tumbling bug and the click beetle or snapping bug. Both of these you will recognize from their names. Another interesting beetle is the firefly.

Every boy and girl has seen fireflies. How pretty they are as they fly about at night. What fun it is to catch them. Why do you suppose they make their light? Some, who have studied them very closely, believe it is to attract their mates.

What a wonderful lantern they have! It puzzled scientists for a long time. Most lanterns or lamps give off heat as well as light and all of the lighting devices

we have give off heat as well as light. The firefly, however, seems to know the secret of giving off light without heat. Scientists and other people would like very much to know more about how it is done. Perhaps you may be the very one to find out, if you study enough. We cannot tell you about it here because we do not know either. Some kinds of fireflies have no wings that are strong enough for flying. They have to crawl along among the grass on the ground. We call these glow worms.

There is one more insect that we are going to try to find on this trip. Did you ever see a walking stick? Not a cane, but a twig or stick that actually walks! One day a boy sat down under a tree to rest. He had been wandering around in the woods and felt tired.



A WALKING STICK

As he looked around, his eye fell on a small brown twig about three inches long. Something caught his eyes and he looked more closely.

It moved!

He rubbed his eyes and looked again and, sure enough, there went the twig walking along. He made a grab for it and caught it. But when he looked closely he saw that he did not have a stick at all, but a squirming, kicking insect. He had found one of the walking sticks. It has six legs just the same as other insects, but when you look at it it looks very much like the twigs on the ground or the twigs on the trees in which it lives. It is sometimes found on fruit trees.

The mother walking stick lays her eggs by just dropping them on the ground. Each one of the black eggs has a small white stripe around it. It is about the size of a grain of wheat. These eggs lie on the ground all winter and hatch out in the spring. Or they may remain on the ground until the next spring before they hatch. When they hatch the top comes off each egg. It looks much like a small vessel with a lid. Out of these eggs come tiny green baby walking sticks. Each one is about a quarter of an inch long. They are great eaters and like leaves especially well. They grow with great rapidity and before long are full grown. Their color changes to a brown to match the twigs on which they live. It is well for them that they do look like sticks or every sharp-eyed bird would find them.

We cannot study all of the insects at one time. There

are many, many kinds scattered all over the world. But if we notice those that we come across in our rambles and try to learn something about each one, we will soon know a great many.

Things to do

1. Catch grasshoppers for your collection. See how many different kinds you can find.
2. Feed a grasshopper to see how it eats. See how far it can jump.
3. Find the egg mass of the grasshopper. Find some babies. How do they differ from the adults? Make a breeding cage, and hatch some of the eggs.
4. Find some crickets and katydids and watch them make music.
5. Write stories about grasshoppers, katydids, and crickets.
6. Tell how they eat the farmer's plants.
7. How do you recognize the beetles? Collect as many different kinds as you can.
8. Find some ladybird beetles and larvae.
9. Tell what good the ladybirds do.
10. Write a story about the potato beetle. Mount a life history of the potato beetle.
11. Write a story about how the fireflies make light.
12. Catch some fireflies for your collection.

13. Write about the tumbling bugs.
14. Write about the walking sticks.
15. Make drawings of walking sticks.
16. Make a collection of all kinds of insects.

Wright Pierce

GROWTH OF THE BEAN PLANT

HOW PLANTS TRAVEL

How do plants take care of their children? Perhaps you do not think that plants have children but they do. Each plant produces seeds which will become new plants some day. But, you say, the plant does not take care of its children, because it allows them to wander all over everywhere and never knows where they are. The plant, of course, cannot know what becomes of its seeds, but let us see what it does for them before they start out.

All through the summer the plant is busy making food. Some of this food the plant stores in its roots or its stems. Some of it the plant saves to pack the most wonderful lunch boxes in the world, the seeds. Perhaps

you had not thought of the seed having a lunch box, but it has.

If you take an ordinary bean and remove the outside covering you will see that the bean has two halves. You also know that those halves are good to eat. Take the two halves apart and what do you find hidden there? Tucked in tightly between the two halves is a tiny bean plant all ready to grow. You can even see the leaves and what will be the root if you look closely. Now if you soak the plant in water or keep it moist, it will begin to grow. Where will it get its food, since it has no ground to grow in? From the lunch box that was packed by the parent plant last summer.

Now when the bean sprouts only the little plant part begins to grow. The big parts begin to shrink and shrivel and dry up. The vigorous young plant just eats everything in its lunch box before it gets big enough to earn its own living from the soil. Finally all of its lunch is gone, but by that time it has leaves and roots and can get its own food.

All seed plants pack such lunch boxes for their children. Many of them do not have two parts like the bean. Plants like the corn have only one part instead of two, but we know that the corn packs much food in the one lunch box for the new plant. Some store up only a little food. If you look at a dandelion seed or a mustard seed you can see that neither of these has very much to start growing. But they have enough, because they do not seem to have any trouble to get started in the soil.

Dr. F. W. Copeland, Ohio University

DANDELION SEEDS MILKWEED SEEDS

Packing a lunch for the young plant is not all that the plant does for the children. If all of them fell right where the old plant lived, they would come up too close together and crowd each other out. The old plants take care of this in different ways. Look at some plants to see how they scatter their seeds about. All of you know the dandelions. How they do grow up in our lawns. One year there may be only a few or none. Or you may cut them out entirely, but next year there they are again seemingly as many as ever.

We all wonder where they come from. While the mother plant is packing the lunch box for the dandelion seed, it is doing something else too. The plant makes a tiny parachute and fastens it to each seed.

This parachute is neatly folded and ready for use. As soon as the yellow blossom dies down, the white round seed heads form on the dandelion. The parachutes unfold and the first puff of wind catches in the tiny hairs of the parachutes and carries them flying away. Away they go through the air, carrying the seeds with them. Wherever the wind goes, there the seeds go. Now they are high in the air. Then down close to the ground. Now up, now down; and finally they find a resting place on the ground. If some bird does not find these travelers, they start to grow and soon there are more dandelion plants growing in some field or lawn.

If you still wonder why there are so many of them, just look at the seeds on one stem. How many there are, and how many stems to each plant, and how many plants there are! It is a wonder that the earth is not full of dandelion plants.

The dandelion is not the only plant that makes a parachute for its seeds. Look at the common milkweed. Open up one of the green pods. How tightly the brown seeds and their parachutes are packed in the pod. The damp hairs do not look as if they would ever do for a parachute. But wait! Soon the milkweed has the seeds' lunch all packed and its parachutes are ready for flying. Crack goes the pod right down the middle and out tumble the seeds. They do not fall to the ground. But as they dry out the parachute unfolds. More and more of the silky parachutes unfold until the whole pod is covered by a

fluffy mass. If we had not looked at the pod we would not have believed that there were so many there. More and more come out of the pod and larger and fluffier grows the mass of seeds. Soon the wind comes along.

Puff and away they all go, dancing and swaying and skipping through the air. Some of them may drop off their parachutes and go tumbling to the ground. The fall will not hurt the seed very much and it soon will begin to grow. Others hang on to their parachutes for a long time and travel far, far away before they come to rest.

None of these fliers is alone because many other plants supply their seeds with parachutes. Each one has a little different kind, but most of them are made of fine hairs for the wind to catch. The iron weed, thistle, the goldenrod, the asters, the cattail, and many others send their seeds out by parachutes.

Some trees do this too. Perhaps you have seen a sycamore tree. The sycamore tree sends its seeds out this way. It does not have a pod like the milkweed. It packs its seeds into a tight ball about an inch in diameter and hangs them all over the branches like ornaments on a Christmas tree. Get one of these balls that is nearly ripe and see what it is made of. It very nearly breaks open when you touch it and what a lot of seeds there are! A puff of wind comes along. As you look at the seeds away they go through the air, to join the dandelion, thistles, and milkweed seeds. There are many other plants whose seeds travel by

Dr. F. W. Copeland, Ohio University

WINGED SEEDS OF THE MAPLE

parachutes, but we cannot find all of them the first time. If you look for them you will find many, many more.

Plants have other interesting ways of sending their seeds out into the world. Some of them give their seeds wings so that they can sail out and away from the parent plant. One of the most common ones of this kind is the maple tree. There are several kinds of maple trees, but all of their seeds have some sort of wings. What fun it is to see the wind shake a maple

tree when the seeds are ripe. Down come the seeds whirling around and around as they come. Hundreds of them whirl down and go skittering along the ground. Every time the wind catches under one of these wings, away it goes until it finds some place to rest. Sometimes there will be great piles of them in one place. Almost always they are too close together and some crowd the others out, but a few of them sail away to some open space and begin to grow.

Two other common trees whose seeds have wings are the elm and the linden. The elm seed wings do not look very much like wings however. If you look at the seed you will see that the thick part in the center is the seed pod. The thin outer edge acts as wings for the seed and makes a space for the wind to catch it and carry it away. The linden tree has a peculiar wing for its seeds. The seeds are fastened to the middle of the wing by a long stem. The stem is fastened on at an angle so that when the leaflike parts break off, the whole thing goes whirling round and round through the air. If you find some of the seeds you can throw them into the air to see them whirl.

We all have seen the winged seeds of two other common trees. The ash tree seed is a great traveler. Its paddle-shaped seeds may be seen in many places in town and country. The catalpa or "Indian cigar" tree carries its seeds in the long pods which many boys nickname cigars. When the pods split open the seeds are caught by the wind and carried about.

With so many plants in the world, one would expect

C. Clarke

TOUCH-ME-NOT SEEDS

them to have interesting ways of scattering their seeds. There is one that causes a sort of explosion in order to scatter its seeds. This plant is called the jewel weed or wild "touch-me-not." It is found usually in shady places. The stems are light green and clear. You can very nearly see through them. The flowers are yellow or orange with brownish spots. When the pretty flower is through blooming the seeds begin to form in the seed pod. Larger and larger they grow, and larger the pod grows too. The outside seems to grow more than the inside. Soon it is ripe. Now comes the explosion. Just a touch and bang! goes the pod. It splits open and the seeds are thrown out in all directions, rolling and tumbling over the leaves to the ground. You can see now why it is called "touch-me-not."

C. Clarke

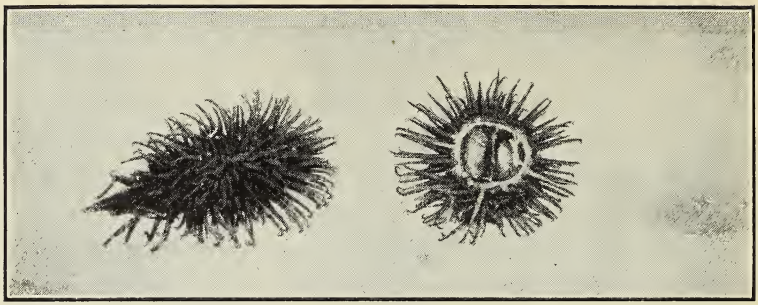
WILD GERANIUM SEEDS

There is still another plant that explodes to fire its seeds out. This is the wild cucumber or the squirting cucumber. When the wild cucumber is ripe the end opens and out come the seeds like the cork out of a pop gun. Other plants that have curious methods of scattering their seeds are the wood sorrel, the wild geranium, and the witch hazel.

One of the most unusual of all the ways that plants have of sending out seeds is by forming a sort of pepper-box for a pod. When the pod is shaken the seeds fall out. One of the most common ones is the butter print or velvet leaf. This plant gets its first name from the

shape of its seed pods, and its second one from the appearance of the leaves. These pods look something like the wooden mould that is used to make butter rolls. The pod is cup-shaped and has holes in the top for the seeds to escape. The stem is stiff and if anything bumps against it, out come the seeds. If you should bend it down and then let go of it suddenly, seeds would be scattered several feet from the plant. Much like this rattlebox pod are those of other plants. The evening primrose has one. The seeds are borne in long pods that fit close to the stem. When the pods are ripe they burst open at the top. Each pod is filled with tiny seeds. As soon as anything jars the plant, the seeds are shaken out. The Jimson or Jamestown weed does this too. You have seen this weed with its long horn-shaped white or blue flowers and big sticky burrs. Each burr is filled with seeds and just waiting an opportunity to rattle out upon the ground.

With all of these we do not come to the end of the ways that plants travel. There are "hitchhikers" in the plant world. Some plants just place their children out where they can hitch a ride from the first animal that passes. Such plants supply their seed pods with tiny hooks or stickers. One of the most common is the burdock. This plant has great large leaves that resemble the leaves of the rhubarb plant. And such sticky burrs! Perhaps you have gathered them to make baskets or balls. If you have, you have helped to scatter the seeds for the plant. Each burr contains many small brown seeds. A dog comes along and the



BURRS

burr grabs hold and "hitches" a ride. As the dog walks along, the seeds are shaken out of the pod and scattered about over the ground. Not only do dogs furnish rides, but sheep and cows and people carry the burrs about.

There are many kinds of burrs too. One of the worst is the "sticktight." It is flat and several of them are fastened together, end to end. How they do cling to your clothes. But sooner or later you will pick them off and throw them away and that is just why the parent burr plant puts the stickers on the burr. If you walk through the weeds in the fields and thickets you will find many other kinds of seeds taking a ride on your clothing.

Nut trees may not be thought of as having seeds that are travelers, but the nuts surely do travel. When they fall from the tree they may roll for quite a distance, or they may fall into water and be carried for a long way. But there is another way that nuts get scattered about. Can you guess what it is?

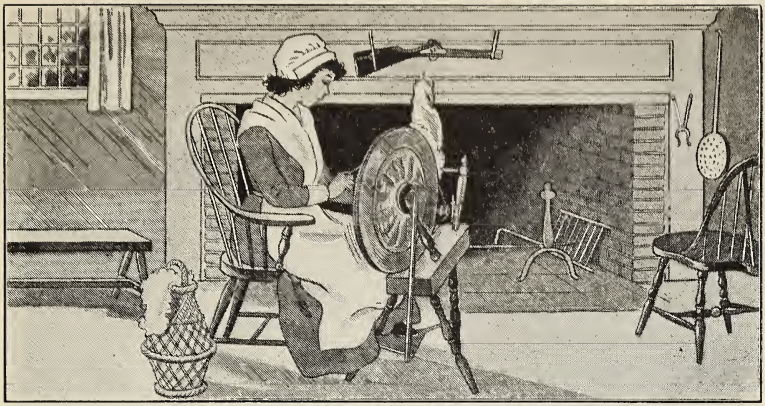
We could find many other ways in which seeds travel. Some of them travel by tumbling. That is, the whole plant breaks off and goes tumbling about, scattering seeds as it goes. Such plants may be blown for miles and scatter seeds over a great many fields. Others have hard indigestible seeds that birds carry away and drop. Such seeds as those of the juniper, sumac, virginia creeper, dogwood, pokeberry, and many others are carried this way.

You can see that plants really do take good care of their children. They not only supply them with food but supply a way of traveling about to help them find a place to grow. And from this you can easily see why plants get scattered about and why we have so many different kinds in our fields and woods.

Things to do

1. Look at a bean seed. Name the parts. Look for food stored for the young plant. Write about the plant's lunch box.
2. Make a collection of seeds with parachutes. See how they travel.
3. Make a collection of winged seeds. Experiment with the flying seeds of the maple, elm, basswood, ash, and catalpa trees.
4. Collect explosive types of seeds, such as the cucumber, jewel weed, and wild geranium.
5. Describe squirting cucumbers and collect some of the seed pods.

6. Collect some of the rattle boxes and burrs. Learn how they travel.
7. How do nut trees distribute seeds? Collect some for your exhibit.
8. How are seeds spread by tumbling?
9. Make a seed and weed collection.



PLANTS THAT FURNISH SHELTER AND CLOTHING

In the early days of our country's history clothing was all made at home. If the pioneer mother did not import cloth from England, she had to use the skins of animals, or use the wool from sheep to make woolen cloth.

Soon these people began to raise flax, a plant they had known in the old world. Flax, you know, is the plant from which linen is made. The flax plant has been said to be the most useful of all of the plants that do not produce food. It is useful for its fiber, from which we make linen, and for its seeds which give us a valuable oil.

The flax plant grows about twenty to forty inches high. It does not require very rich soil. The flax grower sows the seeds so that the plants will come up close together and grow tall.

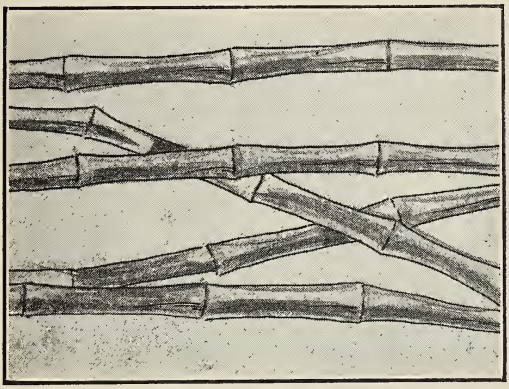
A FIELD OF FLAX

Just before the seed gets ripe, the flax is pulled up root and all. It looks very much like an ordinary weed, and does not look as though fine linen could ever be made from it, but when it has been properly prepared it becomes linen fiber.

After it is gathered it is tied in bundles and placed under water. Dams are sometimes built in streams near flax farms, and the flax placed in the pool thus formed. In Belgium, the canals are used for this purpose. This process is called retting or rotting. The plant begins to rot and the woody part of the plant

gets soft leaving the flax fiber. After about ten days or two weeks the plants are ready to come out of the water. It is time now to drain and dry them. Then they are ready for breaking. They are so treated that the stalks are broken up in short lengths without breaking the fibers. Parts of the woody stalks are broken off and then the flax is ready for the final cleaning of the fiber.

After being cleaned and washed the fiber is ready to be spun into yarn and made into cloth. Linen has been prized for many, many years as a useful fiber. Linen cloth is mentioned in the Bible, and very probably was used in Egypt to wrap bodies for burial, long

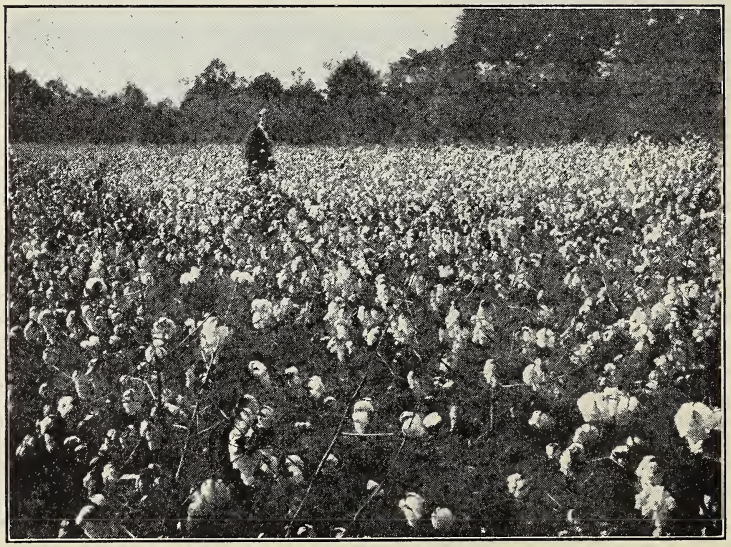


FIBERS OF FLAX

before the pyramids were built. And perhaps before that man used linen for fish lines and other cord. So you see the pioneers of our own country were not the only persons who found this plant useful.

Another very valuable fiber plant is called cotton. Cotton is grown in this country. It has largely taken the place of linen for ordinary clothing. Of course, it is not as fine and valuable as linen, but what would we do without it? Many of our articles of clothing are made from cotton, to say nothing of the hundreds of other things we use it for. Why, cotton is even used to make high explosives.

Have you ever seen a real cotton field? If you live in the South you probably have, because there is where it grows. Cotton grows in great areas over the earth's surface. It is found north as far as forty-three degrees latitude and as far south as thirty-three degrees. Cotton is raised on farms just as wheat, corn,



A FIELD OF COTTON IN BOLL

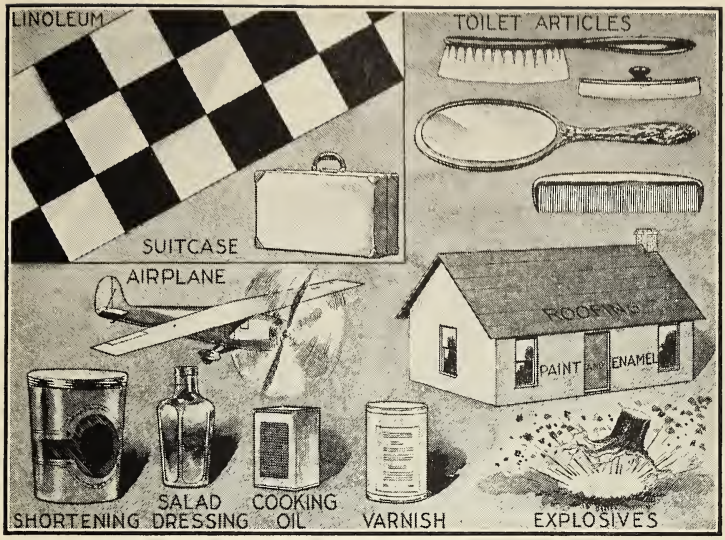
COTTON BLOSSOMS AND BOLLS

and other crops are raised. The seed is sowed in April or May. By June or July the plant begins to open its large white flowers. What a beautiful sight a cotton field in bloom is! The pretty yellowish white flowers soon turn pink and drop off. Then the cotton begins to form.

First a small round boll begins to form from the flower. Inside of the boll are a number of seeds. Each seed is wrapped in a white blanket of fiber. Larger and larger the boll grows, and more and more flowers

form on the plant. Each flower forms one of these bolls. Larger and larger grows the cotton boll, and on the inside the fibers that cover the seed grow also. By September the cotton boll has grown so large it seems it cannot grow any more, so it just bursts open. The fluffy white cotton is seen over the plants like great white flowers. It is then ready to be picked. Pickers go through the field plucking out the cotton. But you remember the cotton is only a blanket for the seeds, and the seeds must be removed. A long time ago the seeds were taken out by hand, but thanks to Eli Whitney we do not have to do that now. He invented a machine called a cotton gin, which separates the seed from the fiber. After the seeds are taken out, the cotton is pressed into great bales for shipping to the mills for spinning into cloth, or to be made into many other things. In fact, even a kind of silk can be made of cotton. Some of the cotton is used in making artificial silk.

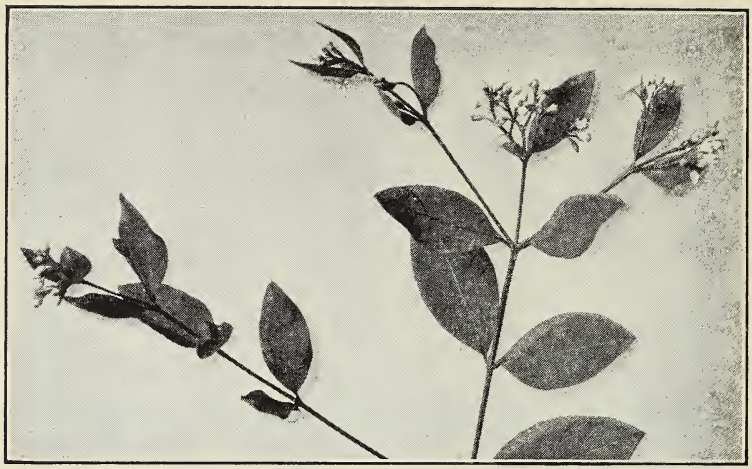
This useful plant supplies you with clothing and food. The seed of the cotton plant has become almost as valuable as the fiber. Many years ago the seed was thrown away or burned but not so any more. We have learned many uses for it. When pressed, the seed yields an oil. This oil is used in cooking and in the manufacture of certain kinds of butter substitutes. The cake that is left after the oil is pressed out is ground up to produce a very valuable food for cattle called cottonseed meal. Even the shells of the seeds are used in various ways. This plant really is a good friend.



ALL OF THESE ARTICLES CONTAIN SOME PART OF THE COTTON PLANT

The Indians found many wild plants which furnished them with fishing lines and nets. There is a plant called Indian hemp that served this purpose. It is a tall plant having long podlike seeds. It is found growing in damp ground along fence rows and thickets throughout a good part of our country. The Indians treated this plant much as we do flax. That is, they rolled out the fiber and then cleaned it. This fiber was strong and would last for a long time. They used it mostly for fish line and nets, but it is said some of them wove it into a kind of cloth.

Many plants produce fiber inside of the bark which can be used. Some of the common nettles were used



Spencer Photo

INDIAN HEMP

as a source of thread. The common milkweed that grows so freely over the countryside yields a strong fiber that is fairly useful. There is no reason why the silky threads that carry the milkweed seed floating along in the breeze could not be spun and used for cord or cloth.

From the yucca plant the Indians of the southwestern United States made a fiber which they found very useful. They made it into ropes and cloth. The leaves of the plant were soaked in water, then pounded to get the fiber. They were washed until no pulp remained. Then the fiber was combed out. The Indians made many useful articles from this fiber. Many wild plants were used before the Indian found out how to use cotton and flax.

Not only do the plants supply you with clothing and food but other things as well. If you will but think of trees as plants, you know they supply us with lumber. Think how much man depends upon lumber. The chair you sit on, or the table you use at home, is made of wood. The pencil you write your lessons with is very probably made of cedar wood. Your houses are made almost entirely of wood. Even brick houses have floors, doors, and other parts made of wood. Did you know that the fancy shaped heels on women's slippers are made of wood on which has been glued a thin covering of fine leather? Models and patterns of most things cast in metal are made of wood. When an automobile manufacturer wishes to put a new car on the market his workmen always make the body of the model car first of wood.

All of these things do not complete the list of the uses you have for plants. They supply you with food, shelter, clothing, medicine, and many other useful and necessary articles in your daily lives.

Things to do

1. Write a story of the uses of fiber. Describe the different kinds of fiber.
2. Write the story of flax.
3. Write the story of cotton.
4. Make drawings of plants that furnish clothing.
5. Find wild fiber plants, and try to get the fiber out of them.

6. Get some raw cotton for study. Get some raw flax for your exhibit.
7. Write a story of lumbering.

HUNTERS OF THE AIR

This is a story about the life of some hunters of the air. It is not about men in airplanes, but some of your feathered friends and foes, such as the owls, hawks, eagles, and buzzards. Perhaps you had not thought of any of these birds as being your friends, or perhaps not even foes.

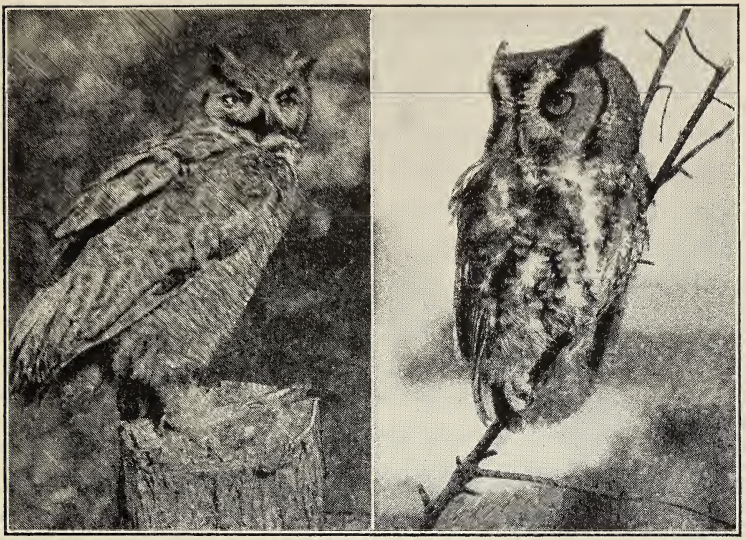
Pick out some nice dark night in a deep woods. Black shadows from all the trees are pointing away from the moon. The leaves rustle in the breeze. Shadows deepen as we walk along. Then out of the blackest shadow of them all comes an irritable, questioning voice: "Who? Who? Who?" it says. You stop in your tracks and little shivers run up and down your spine as you stand there. Shall you answer or run? "Who? Who? Who?" comes that question again. What an awful, serious voice! Just as you decide to run and leave this pirate of the woods to his own domain, there is a

rush of wings. A barred owl flies away out of a tree near at hand and goes about his business of the night. You are not scared now. You know who it is asking "Who?" Now you can follow him and see what he is like. He does not have any ear tufts as many other owls do. He is grayish brown on the upper parts and barred with creamy white bars across his feathers. His face is a gray mask set with brownish black eyes which seem to make him look almost human. His breast is barred and streaked. His legs are feathered almost down to his toes. His beak is yellow. He may get to be nearly two feet tall.

What an interesting fellow he is, and what do you suppose he is doing wandering around at night? Just follow him for awhile. He is a real night hunter of the air. His big eyes let in all the light there is, and he seems to be able to see as well at night as we do in the daytime. There goes a rat moving in the shadows. The rat comes out into the light. Down out of the tree flashes the owl and his sharp claws tighten on the rat. In a twinkling he is away to devour his prize.

Now owls have a peculiar way of eating their food. They do not wait to skin the prey or take the bones out. They devour it usually where they capture it. Nature has cared for that though. The hair, bones, and other indigestible parts are rolled into a ball or pellet and disgorged through the mouth. These pellets can always be found near an owl's nest.

From these pellets much can be learned of the food of the owl. Men have killed owls and examined their



Brownell

GREAT HORNED OWL SCREECH OWL

stomachs. One hundred barred owl stomachs were examined. Three contained chickens, one a quail, one a pigeon, six contained screech owls, one a saw-whet owl, three contained sparrows, one a woodpecker, and two, small birds. They also had some good to their credit. The stomachs contained forty-six mice, eighteen small mammals, four frogs, one lizard, two fish, two spiders, and nine crayfish. Twenty stomachs were empty. You see they do good as well as harm, and are therefore protected by law in many states.

Follow the owl home. Its nest is usually in a hollow tree somewhere. If you go near during the nesting

season, the barred owl is likely to stick her head out and glare at you. The owls may even use an old last year's crow's nest. In the nest they lay from two to four pure white eggs. These eggs may be two inches long and nearly round. The babies hatch out and are covered with white down just as young chicks are. The parents carry food to them and soon they outgrow their home and fly away to make homes of their own. This is only one of the hunters of the night.

Most owls hunt at night. In the daytime they are sleepy. They can see in the daytime but they are not nearly so active. Many times boys catch screech owls which are really too sleepy to be bothered about such a small matter as being captured. They don't seem to mind much.

Of course, if you get too familiar they make a vicious snapping of the beak which warns at once to keep the fingers away. The toes too are not to be ignored. Many a boy has caught an owl in the daytime when it was half asleep, or at least too sleepy to resist. But what a surprise when night came and he tried to pick it up. Such a snapping of beak you never heard! Muscles of steel tighten and sharp talons sink into the flesh. No, it is best to study owls in the daytime when they are too sleepy to fight back.

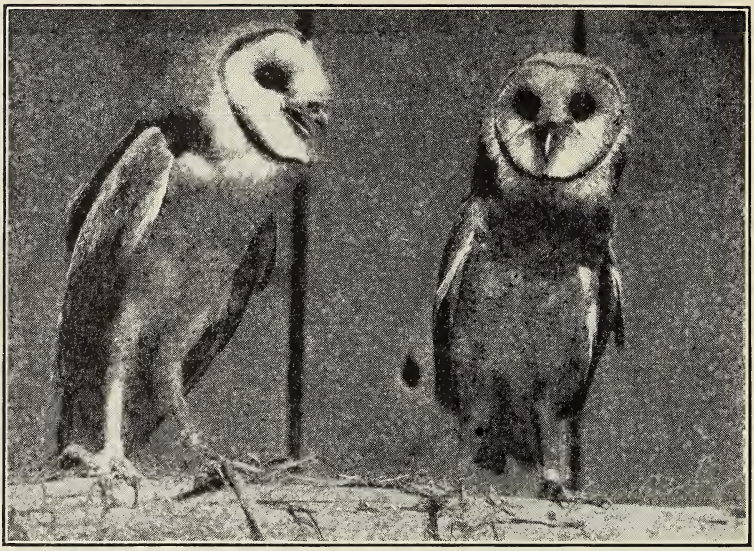
The little screech owl is usually not over ten inches long. It is of a gray color streaked with black. It may be brownish streaked with black. Sometimes they are brown and sometimes gray, and both kinds are often found in the same nest. It is known by its screeching,

quavering call. Starting high pitched it quavers down to nothing. There are many superstitions about the owl. Some people think if the screech owl calls near your home someone is about to die. Of course this is not true. It may be true that a rat or a mouse is about to die, but that is all.

This little owl often nests near your homes. A hole in an old apple tree may be the very place. In this nest the screech owl lays from four to six white eggs. Each one is about an inch and a half long. If you go near, the head of the owner may suddenly appear at the doorway, eyes wide open, and beak snapping, but unless you put your hand in there is no danger. The screech owl may eat a few birds and occasionally a chicken, but it destroys mice and rats in great numbers. Perhaps it is a better friend than we really think.

There is another of these hunters of the night that is a real friend. He is the barn owl or monkey-faced owl, as he is often called. Such a face on a bird! He does look very much like a monkey. He appears to be all head, with two white places scooped out for eyes. In the middle of each white space is a yellow eye. His body is a buff color speckled with black and white. He may be as much as eighteen inches tall.

During the day he hides himself away, because he is a night hunter, and many of his enemies are about by day. His food, which is largely rats and mice, is rather scarce by day too. But when night comes and the moonlight streams through the cracks in the barn, the monkey-faced owl awakens and is off to the hunt.



U. S. Bureau of Biological Survey

BARN OWLS

Perhaps he does not have to leave the barn before his favorite food marches right out under his nose. Such a hungry fellow he is, and if there are babies in the nest much more food is needed. So rats and mice had better hide when this mighty hunter takes the air.

It often nests in hollow trees, in barns, or belfries. It does not seem to be afraid of man. It lays from four to six snow-white eggs in the nest. The young hatch and become nearly as large as the adults before they leave the nests. These good friends are often molested by boys or men who think they have discovered something new to science when they see this funny monkey-face for the first time. You should know that these

owl friends should be left alone so the young may grow and become skillful hunters like their parents.

There are others of these hunters of the night we should know. One of the largest is the great horned owl. It may get to be as much as two feet tall and have a wing span of three feet. It is usually found in the deeper woods. It eats some poultry and is not considered a very good friend. Its call is a loud bass who-hoo-hoo, whooo, whoo! It is a startling sound to hear on a dark night and in a deep wood.

In the prairie region lives the burrowing owl. It may be found in prairie dog towns or other holes in the ground. It does not have to depend upon the prairie dog to dig its hole, because it is an expert digger itself.

There are other kinds of owls, many of them good friends and some of them enemies, but all are interesting. The owls, however, are not the only hunters of the air; so far we have talked only about the night hunters, but there are even mightier hunters of the day.

Perhaps you have never seen a golden eagle, except on some piece of money or on some government document. But here is a real hunter, not always polite about his hunting but a mighty one just the same. A lamb or small fawn is none too big for him to attempt to carry away. Soaring about aloft, his eye catches a movement on the ground. Down he drops like a stone, spreads his wings in time to avoid a crash, sinks his talons into his victim, and soars away with it to his

BALD EAGLE

VULTURE

nest or perch. His nest he builds in an out-of-the-way place almost impossible to reach. The nest consists of bushels of sticks and twigs piled in the tip-top of the highest tree he can find. Wherever the eagle is found he is willing to fight for his rights and defend himself against all intruders.

A more common hunter does not eat live things at all. He is a scavenger. A scavenger is an animal that cleans up refuse or dead things. This hunter of dead things is a vulture, often called the turkey buzzard.

What a wonderful flier he is! He seems to use no effort to keep himself in the air. He is the original glider. Far up in the air he sails and sails and sails. Something tells him that there is a dead sheep below.

Perhaps it is his eyes. Down he sails and sure enough it is a dead sheep. How his eyes snap when he sees this fine meal. You think it is awful, but not Mr. Buzzard; that is just what he has been looking for and all he hopes is that none of his friends have seen the feast.

Look at him closely. He does look much like a bald-headed turkey. Such an ugly creature! He is not greatly alarmed at your approach. He merely flies to a nearby post and blinks at you. He knows very well that you do not want his nasty mess of carrion. As soon as you are gone, he returns and feasts until he can hardly fly. What a stupid, gorged, dirty thing he is. But still he is our friend, because he and his family clear up dead animals from our fields and roadsides. Sometimes a whole flock will be found about a dead animal, fighting and screaming and tearing at each other as they pick the bones clean of every sign of meat. Not very nice in their habits, but they are friends just the same.

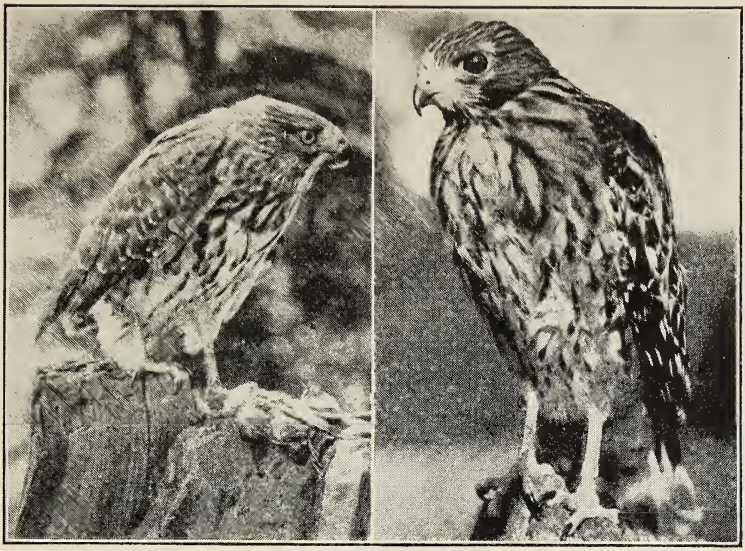
The buzzard nests on rocks and hillsides in out-of-the-way places. Sometimes the nest is placed in a crevice in the rock or one may find a tree stump or log in the woods for a nest. The eggs are about the size of turkey eggs, creamy white, blotched with brown. It is best not to get too close to buzzards during the nesting season. Both young and old birds have the disgusting habit of emptying the contents of their stomach in front of any intruder. And since you know what they eat it is well to avoid them.

There is another group of hunters that have been called enemies. They are the hawks. Let us see if all of them are enemies. To be sure, hawks do sometimes make away with chickens from the farmyard, but they may also do some good.

The chicken hawk or red-shouldered hawk is not as black as we think. A farmer sees him sailing about in the sky uttering his terrible scream and runs for his shotgun. While he is gone a Cooper's hawk comes swooping down and steals a chicken. The Cooper's hawk gets the chicken and the red-shouldered hawk gets the blame. The so-called chicken hawk lives more in the woods where he catches mice and frogs. Of course, he eats a few other birds occasionally, but we kill rabbits and squirrels and fish for food and think nothing of it. Perhaps the hawk should have some pay for the good he does.

The sparrow hawk is another that is not as black as painted. He kills birds and often nestlings but he does some good. His cry of Killy—killy—killy! is not meant entirely for birds. Out in the fields are grasshoppers to be caught. These he feasts upon whenever the opportunity offers. From a high perch he keeps lookout, and when he sees his prey away he goes, catches it and then returns to devour it at his leisure.

The pigeon hawk is not such a friend. He feeds almost entirely on birds. He does not earn his keep and should be considered an enemy. Not many of us would want to see him entirely killed off however. He is rapidly disappearing.



Brownell *Wright Pierce*

RED-SHOULDERED HAWK RED-BELLIED HAWK

The sharp-shinned hawk is no friend. He catches song birds in thickets or wherever he finds them. He loafs along fences, waiting for rabbits and only once in a while does he help by killing mice.

There is a long list of hawks we could study. You can find out many things about them. They are not all enemies and some of them are really more friends than enemies. We should learn to know our friends better and be able to protect them.

The owls, the hawks, the eagles and the buzzards are all great hunters. Some of them hunt at night and some by day. Whether we are awake or asleep some of these hunters are about, protecting our food from such enemies as rats and mice.

American Museum of Natural History

DUCK HAWK AND YOUNG

Things to do

1. Make pictures of owls.
2. Draw pictures of eggs in natural size.
3. Describe the food, hunting, nest, eggs, beaks, claws, and feathers of owls.
4. Note all the ways owls help us.
5. What does the eagle eat, and what kind of a nest does it build?
6. Describe the buzzard and its nest. Tell what good it does.
7. Make plaster casts of the eggs of the buzzard.
8. Describe several kinds of hawks.

Photo by the author

JERUSALEM ARTICHOKES

HOW THE INDIAN FOUND FOOD IN FIELDS AND THICKETS

Just suppose for a little while that you are an Indian and that you cannot go to a store to get what food you wish. Everything that you eat must be collected from the fields and thickets. You have no gun or any means of killing animals for food.

What would you do? The Indian knew how to get his food direct from nature. He killed game for meat. He had bread, fruit for dessert, and even a salad if he cared to collect it.

If we are to be good imaginary Indians we will have to learn how the real Indians found food. How do you suppose the Indian did this? The answer is that he knew many plants that produced food and from these he got his food supply. Let us see if we can learn enough of these common plants that furnished food

for the Indian to furnish food for us if we cared to collect it. For a long time you have been tramping over the fields, through the woods, and on these tramps you have been walking over much useful food. The Indian knew which roots were good to eat.

Did you ever hear of a plant called the Jerusalem artichoke? It is really a kind of sunflower and grows wild over a great section of our country. In fact it is generally known as a common weed. It has a pretty yellow flower in late summer and looks like a small sunflower. Down under the ground this plant bears a number of large tubers, some of them as large as hens' eggs. The Indian learned this and dug them for his food. The oily seeds were collected, ground and used for food.

Early explorers found Indians eating the roots of this plant, and the French people were quite taken with its flavor and began cultivating it for food. We have not cultivated it at all. In fact, we have ignored it but the Indian knew it as a valuable food. He dug it in the fall and stored it for winter use. This is only one root that the Indian knew. There are many others. Let us continue our search and find some wild plants that would furnish us food if we had no other way of getting it.

Did you know that there were wild sweet potatoes? Perhaps not, but the Indian knew it. It is quite probable that you have seen wild sweet potato vines and did not know it. The flower of this plant looks like a kind of white morning glory with a crimson

Brownell

WILD SWEET POTATO

throat. The leaves and stems also resemble morning glory vines. All during the summer the leaves are busy making plant food. This food must be stored some place, and the Indian learned the wild sweet potato's secret. Down deep in the ground, sometimes as much as three feet deep, the plant has an underground food storehouse. This food storehouse is a giant sweet potato, sometimes weighing as much as twenty pounds. Just think of that! Almost as heavy as a small sack of flour and almost as large.

The Indian collected this giant potato, which he called "the man of the earth." While other plants made better food, the wild sweet potato was very good when properly cooked. How do you suppose the

Indian cooked the sweet potatoes after he found them? Or perhaps we should say "she," because the squaws did the work. There were no stoves in those days so she used another method of cooking. The Indians made an oven for baking the many foods they gathered. First they dug a hole in the ground. This hole was made large enough for the food the squaw wished to prepare. It was then lined with rocks to make an oven. When this had been done carefully, the oven was ready to heat. A wood fire was built in the hole until the rocks and the ground about were quite hot. Then the fire and ashes were taken out and the oven cleaned. Damp leaves or grasses were next thrown into it. Now she was ready to put in her roots or potatoes and meat. Those she laid on the damp steaming leaves. More leaves were put over the roots, and then the hole was completely filled with fresh earth. This oven did not need any attention. It could not get any hotter, so there was no danger of burning the food. The ground held the heat for a long time and the water in the soil and leaves formed steam that thoroughly cooked the food in the oven. Sometimes the oven was opened in a few hours, or perhaps it would be left for a day or so according to the kind of food to be cooked. But whenever the oven was opened, there were the roots and other things cooked to perfection and ready to eat.

The Indian knew of many roots that could be used for food. Another one was the ground nut or wild bean. This is a climbing plant with a fleshy root that

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TRAILING WILD BEAN WILD ONION

keeps growing year after year. Each leaf is made up of five to seven leaflets. The plant has flowers something like a small purple-brown clover blossom that smell like violets. There are numerous tubers on the roots which look like a string of large beads. This plant could not hide its secret store house from the Indians for very long. It was soon discovered, and in some sections the Indians raised these plants in gardens and stored the tubers for winter use. You could use the same plant for food if you cared to. In fact it would be a useful plant to cultivate. It is said that the ground squirrels and field mice learned the secret, and gathered its tubers for their winter stores.

The Chufa, a kind of grasslike plant called sedge, also furnished food. This plant has a three-cornered stem and leaves like grass. On the ends of the roots it bears small tubers in great numbers. These tubers have a nutlike flavor and are quite nourishing. The plant is sometimes cultivated now. While these small tubers might well be used for food they are not always so welcome. The plants spread through the fields quite rapidly, and once they get beyond control soon become a bad weed. It is then very hard to clean them out of a piece of land. Of course, this never bothered the Indians with all their land.

Many were the vegetables that the Indian found growing wild. It seems as though he had very nearly as much variety as we have with all our modern methods of cultivation. Wherever he happened to be he found food. Even in the desert there were cactus plants and other plants that furnished food. The Seminole Indians of Florida found arrowroot, a large root from which they made bread and puddings. The Indians of the prairie region found prairie potato or prairie turnip. Plants one would least suspect often yield food. The common cattail in the swamps furnished roots rich in starch from which flour could be made. The arrowroot leaf furnished large tubers which were cooked by the same process as sweet potatoes. The ordinary spring beauty, the small flower you find early in spring carpeting the field, has a small bulb on the end of its root. This too was used. Not only that, but the terribly hot root of the Jack-in-the-Pulpit,

sometimes called Indian turnip, was food for the red men. Every boy and girl knows that the root of the Indian turnip is very "hot." If you put it into your mouth it will burn and burn. The Indian cooked this fiery turnip and it is said that it lost its fiery taste and became an edible vegetable. These we have heard of here and other roots could be found for the vegetable part of the Indian's meal. But let us see what else he ate for variety day by day.

Many plants yielded seeds which he ate raw or made into flour. Many common grasses that we see about us yield seeds which could be used for food. The wild rice of the swamps was a favorite with many Indians. This rice was gathered and threshed. The Zunis of New Mexico found wild millet or sand grass which furnished them with abundant food when their crops would fail. The mesquite bean of the desert was also gathered and used for food. The Aztecs of Mexico found a plant called "Chia." This was and is still used as food.

Now for a salad! Of course the Indian did not think of a salad, but he found many green plants that could be used cooked or raw. In the marshy places he found the tender cattail shoots. These were often eaten. He also found water-cress which could be eaten raw. Many other plants, such as wild onion, wild garlic, wild mustard, added flavor to the plants he found.

For dessert, the Indian found many kinds of wild fruit. The common blackberry and raspberry were used in the summer time. These plants are found

Brownell

WILD STRAWBERRY BEACH PLUM

growing in open places along fences, and on the edge of woods and thickets everywhere. The huckleberry was found on the hillsides and in the woods. These plants seem to grow well on burned-over ground. The Indians have been accused of starting disastrous forest fires just to clear ground for the huckleberry.

In the fields the dewberry and wild strawberry were found in great numbers, and the service berry furnished rich purple berries. In the thickets were wild plums, wild cherries, and wild grapes, haws and wild crab apples. The papaw furnished a variety in the way of fruit. This fruit is rich and sweet, and compares favorably with the banana in food value. The

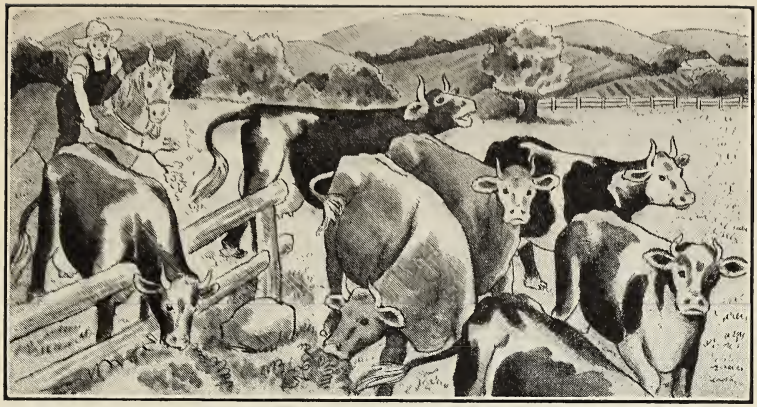
persimmon trees were loaded with fruit in the fall. This fruit is not really good until after frost. As the fruit has a tendency to hang on the tree, it furnished the wandering hunter with a welcome tidbit far into the winter. In the desert region the cactus plant bore abundant fruit for the red men who lived there. So you see that nature provided many wild fruits for dessert.

For drinks many roots and berries could be used. The root of the sassafras tree furnished a drink of fine flavor. The twigs of the spice bush and the leaves and berries of the wintergreen or teaberry when boiled made a delightful drink. Many others were doubtless used.

We can even find a substitute for coffee. This plant is called chickory. It was not used by the Indians because it was brought to our country by the white man. It is a common weed the leaves of which look much like the dandelion. It grows tall stalks that are covered with blue flowers. The root is used often to adulterate coffee. If the root is parched or baked, it can be used as a substitute for coffee. Many more useful plants could be named, but you can find them for yourself. You see there are many common plants in the fields and along fences that the Indians once used for food. We do not think much of them now because we have such a variety of other things. But you see if you really were the Indian you imagined yourself to be in this story, you would be able to find enough food to live on. This was especially true in the days of long ago when the Indians roamed at will over North America.

Things to do

1. Find the plants used as food by the Indians.
2. Many new plants have become common weeds since the Indians' time. Find these.
3. Make a menu of foods that you could find now out in the woods or the fields.
4. Make a collection of such plants and foods for the school museum.
5. Make drawings of these plants.
6. Write a story about how the Indians cooked some of these plants.
7. Write about how they gathered food and stored it for the winter.
8. Make a list of the wild fruits found near your home.
9. Make a census of your county to find out how many wild fruits there are.
10. Write about food found on the desert.



FARM ANIMALS

You could not go along many roads or through many fields without seeing a real farm. What is a farm for anyhow? Why does a farmer raise corn and hay and oats? Of course, you will say to sell and to feed people who are hungry. Did you ever stop to think how much you depend on the farmer and what he raises? If it were not for him, people who live in the cities would starve to death. Their vegetables, meat, bread, milk, butter, cheese, and many other things come from some of these very farms we see along the roadsides.

Have you ever visited a real farm? What fun it is to jump and tumble in the hay and ride the horses after the cows.

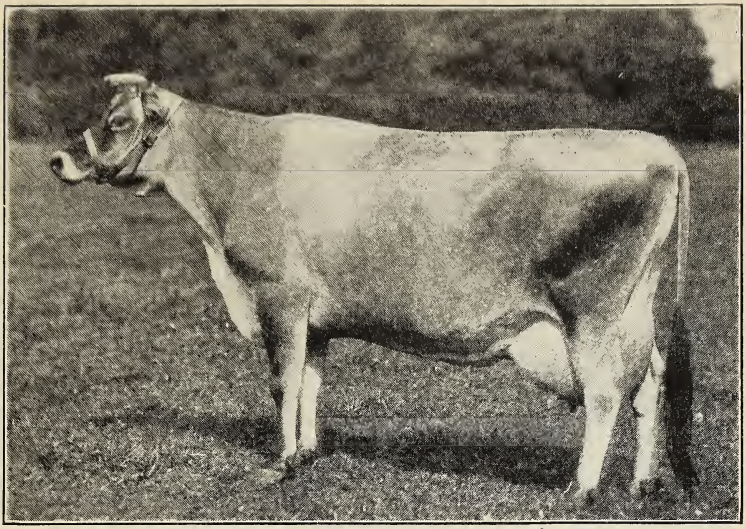
Almost all of the milk we use comes from cows. In some countries they use goat's milk and sheep's milk more than they do cow's milk. The cow makes the

milk in her body from the food she eats. In her udder are many small glands that work all of the time, changing hay and grain and other feed into milk.

Several times a day the farmer milks his cows. Usually he milks twice each day but sometimes oftener. Some great milk producing cows are milked four or more times each day. Some of these champion cows give as much as thirteen or fourteen gallons of milk each day. One champion Holstein cow gave thirty-seven thousand three hundred and eighty-one pounds of milk in one year. That is about four thousand four hundred and eight-seven gallons, or eighteen and a half tons. Most cows do not give such large amounts however.

The farmer may raise two kinds of cattle, the one called beef cattle and another called dairy cattle. The beef cattle are large and heavy. They must be heavy because they are sold for meat. They do not give much milk. In the West on the great ranches, the ranchers allow their cattle to roam about over the country, getting what food they can. When they are ready for market they are fed until they become heavy and fat, then they are sold to the packing houses. Milk cows are not very heavy. They are usually thin and not so chunky. Their job is to give milk rather than to build big bodies for beef.

There are many breeds of cattle for the farmer to choose from. Among the common ones are the Jersey, Guernsey, Holstein, Ayrshire, Durham, and many others. These cattle are usually named for the country

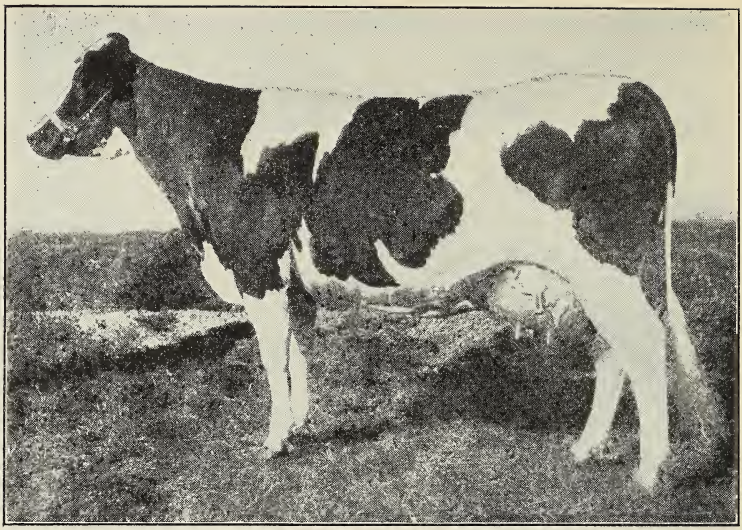


Courtesy of A. V. Barnes

A JERSEY COW

in which they were first raised. For instance, the Jerseys came from the Island of Jersey off the coast of England. The Guernseys came from the Island of Guernsey. The Holstein came from Holland. The Ayrshires came from the county of Ayr in Scotland.

The Jersey is fawn colored and sometimes spotted with white. The Guernsey is of a light fawn color with white markings. The Holsteins are black and white and the Ayrshires are white and red. Some farmers like one breed better than another, and in our country many different breeds make up the dairy herds. The dairy barn must be a very clean place. Great care must be taken to see that milk is always kept clean. Cows must have proper care at all times.



A HOLSTEIN COW

Usually there is a place called a stanchion which keeps the cow from walking away while she is being milked. This stanchion is directly in front of the manger where the cow's food is kept. While she is being milked she eats her food.

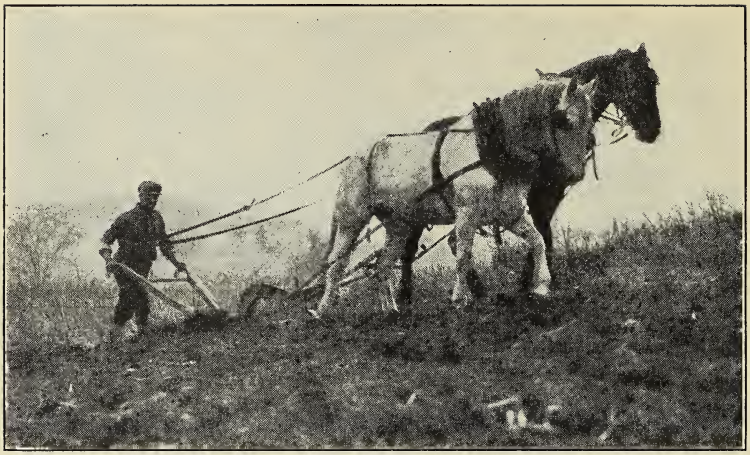
The cow is an eater of herbs; that is, she eats plants. Most of her time is spent eating grass. She does not have any teeth in front on the upper jaw but does have teeth on the lower jaw. Her tongue is rough as a file. If you let a cow lick your hand you can feel how rough it is. So with her lower teeth and her tough tongue she can pull up the grass to eat.

She does not chew her food before she swallows it. She gathers it up in big lumps and swallows them

whole. The food goes into a special stomach called a paunch. Later on, when the cow is lying down under a shade tree, she brings the grass back up into her mouth and chews it. This is what is meant when we say the cow is chewing her cud. When it is swallowed again it goes into her stomach where it is digested much the same as our food is. Sometimes you see calves with a herd of cows. Young calves are funny, wobbly creatures. The mothers are fond of them and watch over them closely. After a while the farmer takes the calves away from the mothers. Then they must learn to drink milk from a pail until they too, begin eating grass and other food as cows do. They grow rapidly and are soon running about with the herd.

Cows can run rather swiftly. If you have ever tried to catch one, you will know they can run and dodge

CALVES



HORSES ARE STILL USED ON MANY FARMS

about. And if a cow takes a notion to jump a fence, over she goes. They do not like to jump and fences easily keep them from wandering away.

There are other animals on a farm besides cows. You would naturally expect to see horses.

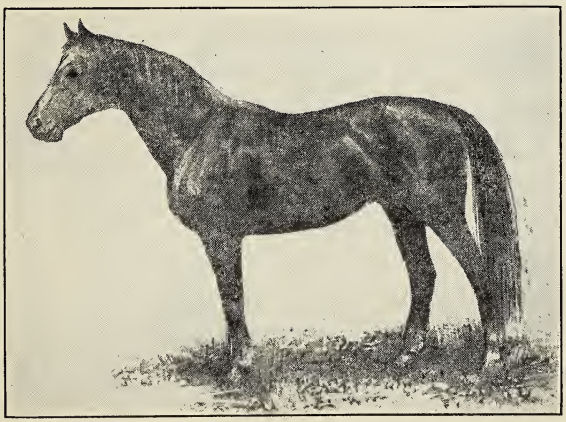
The horse has been man's friend for a long, long time. Just when man began to use horses we do not know but it was a long time ago. Horses are mentioned in the Bible and we know they have been used for many centuries.

The farmer uses the horse to pull his plow, cultivate his crops, and haul the many loads he has to move. There are two kinds of horses usually found on the farm. One is the work horse. These horses are big and heavy so that they can do hard work. There are others such as saddle and coach horses which are used

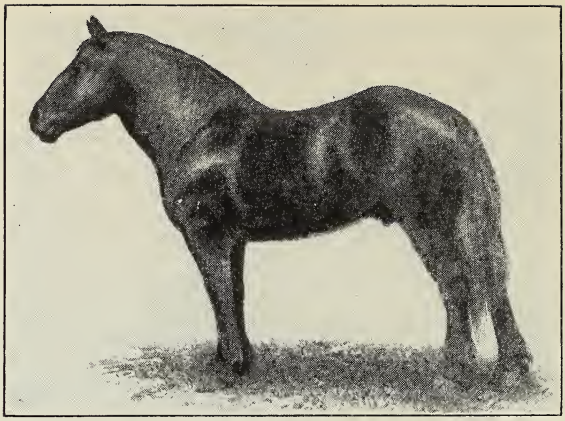
as riding and driving horses. Most farmers have just work horses and use their automobiles instead of saddle and coach horses.

In some sections of our country wild horses are found. These horses roam the plains in great herds. Each herd is made up of females or mares with a stallion as leader. The leadership of the herd is gained by fighting, so the leader is usually a fine, strong fellow well able to take care of the herd of mares he rules. These wild horses are descended from tame horses brought to the country by the Spaniards many years ago.

Wild horses are very swift runners and are able to take care of themselves. Not many animals will attack a herd of horses, on account of their sharp hoofs and ability to kick. Wild horses have been tamed for use but most horses are raised on farms.



SADDLE HORSE



WORK HORSE

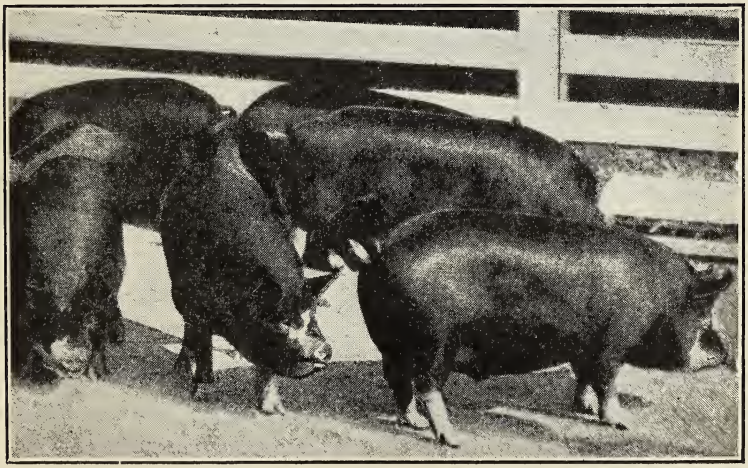
The horse eats only plant food such as hay and grass. The farmer places a small measure of grain in the horse's feed box which is soon eaten. Then the horse begins to eat his hay. What a great amount of enjoyment he seems to get from munching away at it. He needs much food to keep him happy and in good health. If he is not well he cannot work. The horse's coat is kept sleek by currying and brushing. Good farmers take care of their horses and keep them looking sleek and clean.

The farmer also raises hogs. What is funnier than an old hog wallowing in the mud? A hog is not truly a dirty animal though. He really likes a clean place to stay. Some farmers are very careful about their hog pens and keep them dry and clean. The hog likes to wallow in the water or mud on hot days. This wallowing keeps the flies and fleas from biting, so

you see the hog has a real reason for rolling around in the mushy mud.

The hog likes to root in the ground too. His tough nose makes a good plough. Around over the hog lot he goes, grunting and rooting. What do you suppose he is digging for? Lots of things come to him as he roots along. Here is a nice root that is tasty, and occasionally he turns up a nice fat worm or grub that is to his liking. Pigs will eat animal food as well as plants, yet most of what they eat is plant food.

When the farmer gets ready to sell his pigs, he begins to feed them on corn. He stuffs them with all they will eat. The pig never seems to know when he has had enough. He eats and eats and eats. The more he eats the fatter he gets, until finally he is so fat he can scarcely wobble around. When the hogs are fat



CLEAN AND HEALTHY HOGS

enough, off they go to the packing house or the butcher. And soon they are turned into hams, bacon, and pork chops for your table.

The farmer raises sheep also. Sheep are kept in big flocks. They graze over the land and do not need very much care. They crop the grass so closely sometimes that they kill it out entirely. The farmer raises sheep for two purposes, wool and mutton.

The wool of the sheep is very valuable. From it we get most of our woolen cloth. The wool grows thick on the sheep's body to protect it from the cold. In the spring the farmer catches the sheep to shear them. Each one is taken in turn and the wool clipped. The farmer uses big shears that cut the wool off close to the sheep's body. Then the fleeces are sold to wool buyers, who in turn sell them to manufacturers.

There are several breeds of sheep. Some of them are raised for their wool and some for their meat, which is called mutton.

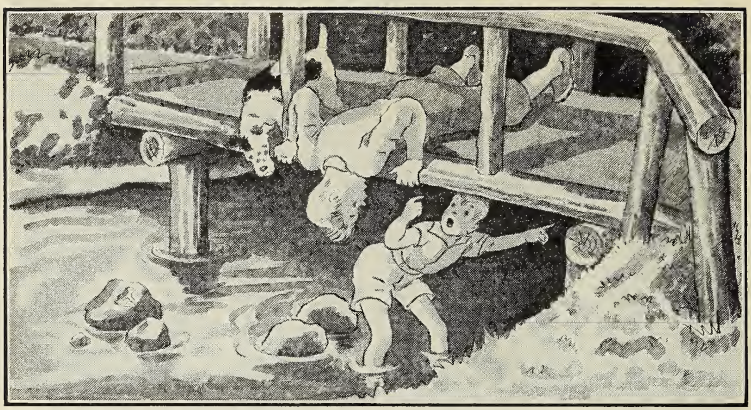
In the spring the lambs are born. Usually each ewe has only one lamb, but sometimes there are twin lambs born. What funny, awkward looking little creatures they are. But they do not stay that way long. Soon they are racing and playing around over the pasture fields. They seem to have some sort of games which they play. Sometimes they see which one can jump the farthest or which one can stay on a rock the longest without being pushed off. The farmer may let them grow to increase the number in his flock, or he may sell them to the butcher for spring lamb.

A FLOCK OF SHEEP

The farm is an interesting place. You hardly realize how dependent we are upon the farmer for food and clothing. If you stop to think about it, you will see that we could not get along without farms and farmers.

Things to do

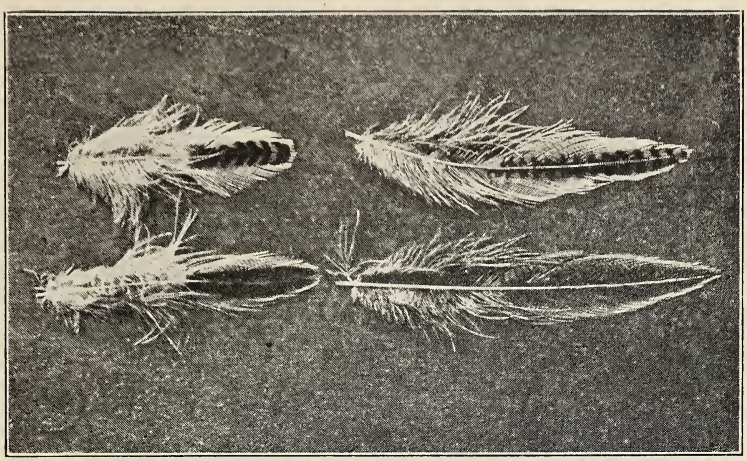
1. Find out about the breeds of cattle.
2. How do we depend upon cows?
3. Tell about the breeds of horses.
4. Describe several kinds of horses.
5. Tell how a pig eats.
6. Describe bacon and lard type hogs.
7. Look up kinds of sheep.
8. Tell how sheep are shorn.



SOME COMMON BIRDS AND THEIR HOMES

Did you ever stop to think how birds differ from all of the other animals? Perhaps you would say it is because they fly. But you can see this would not be true, because insects and bats fly. You might say because they lay eggs. But that is not true either, because some snakes, turtles, and insects lay eggs. Perhaps we should just give the reason rather than to guess. It is because birds are covered with feathers. Think of all the animals you know and you will see that there is not another one that is clothed with feathers.

If you were to study the birds' clothing of feathers, you would find it very interesting. Each feather overlaps the others like shingles on a roof. Each part of the feather is made so that it overlaps another, and in this

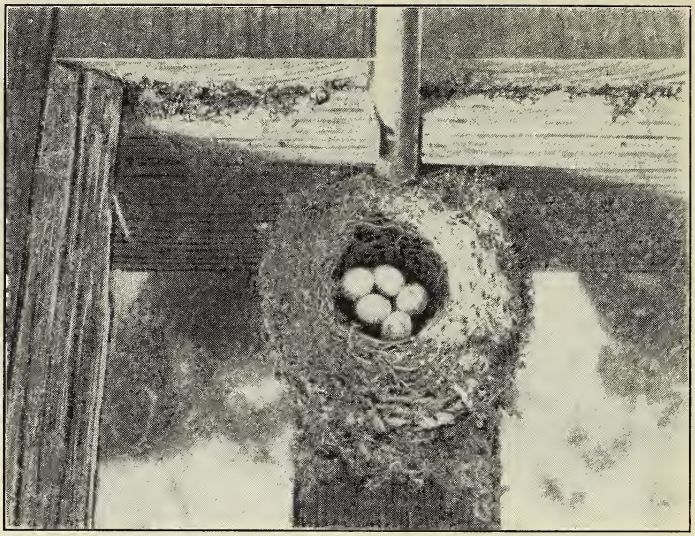


BIRD FEATHERS

way the feathers protect the tender skin of the bird. If the feathers become ruffled, the bird draws them through its beak and straightens them all out.

The feathers have other uses too. The long feathers of the wing and tail spread out and make the large surface needed by the bird flying through the air. The bird flies by pressing down on the air. This is done so quickly that the air does not have a chance to flow out from under the wings, so the bird is pushed upward or forward. The tail acts as a rudder and helps the bird to guide itself in its swift flight.

The feathers also give the bird its color. If you look at a bird you will see the feathers are of different shapes and colors. Some of them are mottled or speckled. These feathers are arranged to give to each bird its characteristic color.



THE NEST OF A PHOEBE

Birds are also interesting because of the homes they build. Some of them build their homes near our houses, some in thickets, and some in the deep woods. Most of them have ideas of their own as to the building material to use. Some are good builders and some are poor builders. Let us visit some of them in their homes.

As we wander along the road we come to a bridge across a small stream. Many folks would walk right across, or if they stopped at all it would be only to peek over the side. But most boys know something else about a bridge. The phoebe, a small gray bird about the size of a catbird, often builds its nest under bridges. Usually she gets up so close underneath the

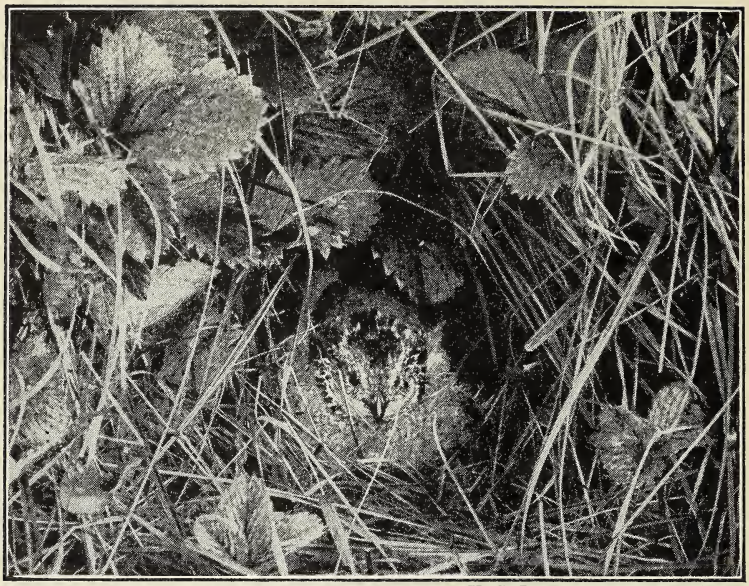
floor that there is just room for her to fly into the nest. And sometimes it is necessary to place a mirror above the nest to be able to see the eggs. There are usually five white eggs to a nest.

The phoebe builds her nest of mud and lines it with feathers or soft grass. On the outside of the nest phoebe makes a covering of moss collected from the woods near by. Sometimes it is damp and the moss starts to grow, covering the phoebe's house with living green.

The phoebe is one of our real friends. Such a pleasant bird it is, as it sits on a twig and calls "phoebe—phoebe—phoebe." But that is not all. The phoebe destroys many harmful insects. It sits upon a branch and when some insects come along out it darts and catches them. When there are young to be fed many insects are destroyed.

Let us next visit the home of bobwhite, the quail. Of course you know what the quail is. There are few country boys and girls that do not know his cheery call, "bob-white, bob-white, bob-white." We will not find bobwhite's nest under a bridge, but a spot out in some open field will be a more likely place. Grain and hay fields are chosen by the bobwhite for nesting places. They are also found nesting along roadsides, fences, or near the edges of woods.

The nest is built of grasses and placed on the ground. It is usually arched over with grass to make it hard to find. You will be surprised at the number of eggs in a nest. The bobwhite lays from ten to twenty white



U. S. Bureau of Biological Survey

A QUAIL ON ITS NEST

eggs. Usually there are only about twelve or thirteen to a nest. They are closely packed together with the pointed end downward. The mother manages in some way to cover this whole mass of eggs. It is said that the mother bird will leave the nest if it is disturbed, and never return. Perhaps it is not a good thing to handle the eggs or disturb the nest too much.

The young quail can hide easily. If you should happen to see a flock of young quail trailing behind their mother, be sure to keep your eye on them. They have a way of hiding that is nothing short of magic. At a signal from the mother they stop and stand as still

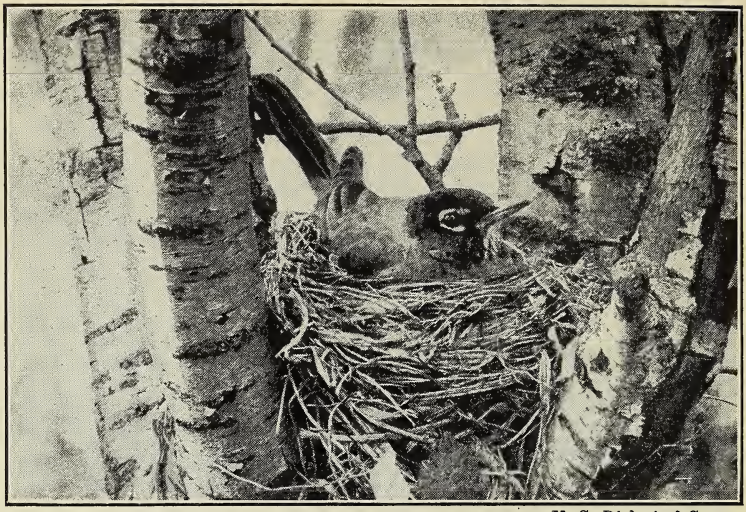
as a statue. Find them if you can! As soon as you are not looking away they go.

Quail live together in flocks called coveys. One male bird seems to guide and guard the covey. If one is lost he will call "Owee chee—owee chee" until the lost one returns to the covey. If surprised, they fly up with such a sudden whirring of wings that even old woodsmen are often startled by it.

The bobwhite is one of our best friends. He destroys many insects and eats weed seeds. Of course, he eats some grain, mostly gleanings, but even if he does eat some grain every laborer should be worthy of his hire and we should not expect to get his services for nothing. He eats potato beetles, cucumber beetles, wire worms, weevils, chinch bugs, grasshoppers, and caterpillars. These he destroys by hundreds. So you see he is really a friend. But he has many enemies.

He is prized as a game bird; that is, people like to shoot quail for food. In Ohio the quail is protected by law. Many of his enemies would repeal the law if they could, but if we realize what a friend he is he will be safe from hunters for a long time.

Let us next hunt for a robin's nest. The mother robin returns from her winter home in the South sometimes before winter is entirely gone in the North. At least she arrives before the mud is all gone. She does not mind a little mud however. In fact, she rather likes to find mud, because it is the principal building material for her home. First she gets some weeds or grass and places them for a foundation. On this she



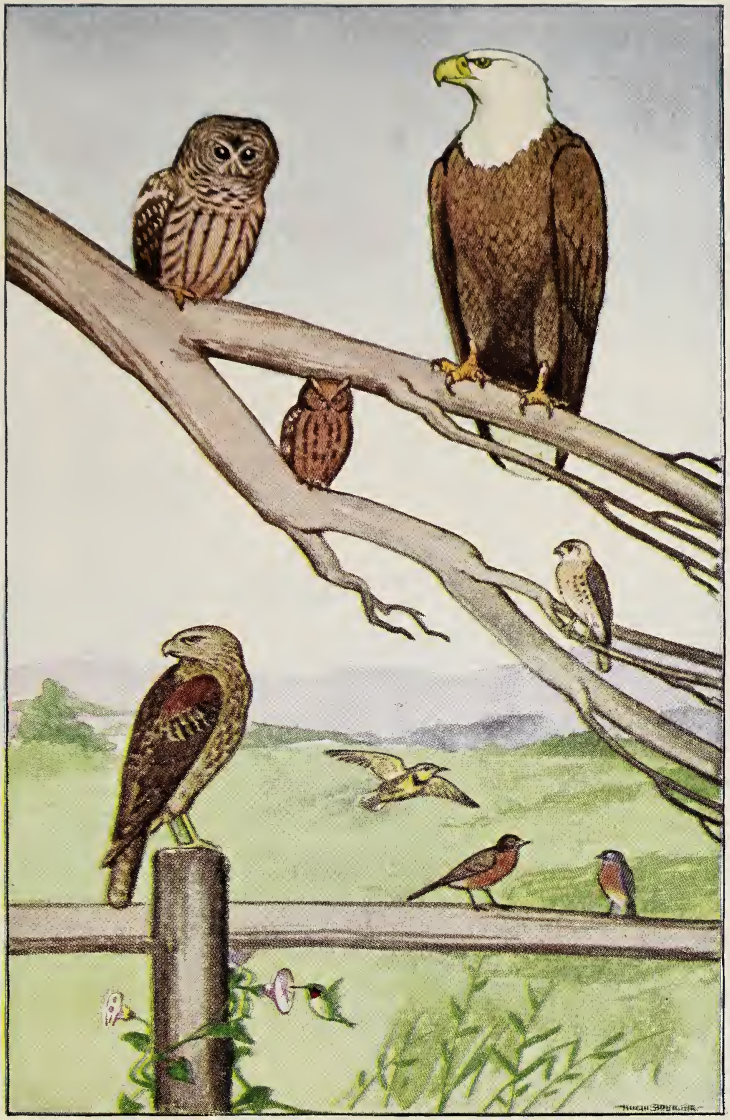
U. S. Biological Survey

A ROBIN ON ITS NEST

begins to build, carrying grass and mud as she needs it. Each load is tramped down with her feet and as the nest grows she shapes it by getting inside and moving her body round and round. When the nest is finished she lays three or four pretty blue eggs in it.

What a bustle and hurry there is when the eggs hatch. Hungry, naked babies stretch up their yellow-lined mouths to be filled. What a lot of work for the parents as they go about hunting food. Insects, earthworms, anything to fill those hungry mouths.

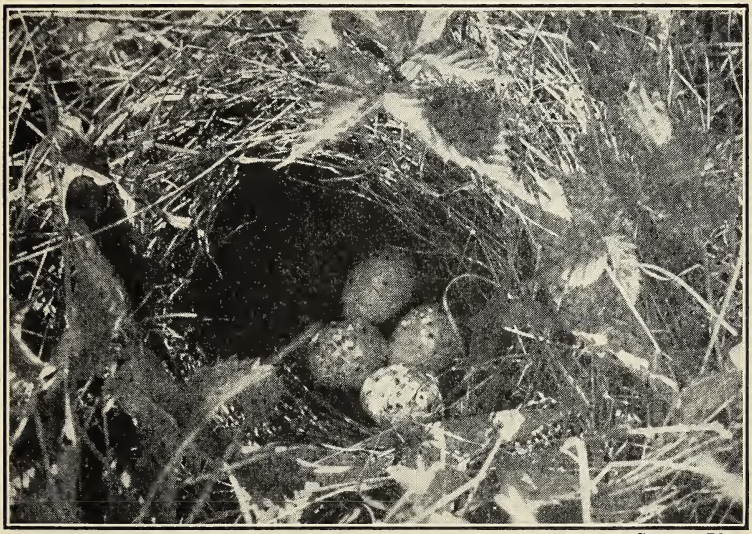
If you approach the nest what a clatter the old birds raise, darting at you as if to tear your eyes out and squalling at the top of their voices. Timid intruders are scared away at once. Soon the young ones are



CAN YOU NAME THESE BIRDS?

able to fly and may be seen hopping about, head cocked to one side as if listening for the earthworms crawling about below them.

On such a trip through the fields we are likely to come upon the home of the meadowlark. It is built upon the ground and cleverly concealed by arching it over with grass and weeds. Often the meadowlark builds its nest in a hay field. This would be a good place, but sometimes the farmer is ready to cut his hay before the young are ready to leave the nest. So in this way the nest is often destroyed. The eggs are white, specked all over with reddish brown. The meadowlark lays from four to six eggs in a nest.



Spencer Photo

THE NEST OF THE MEADOWLARK

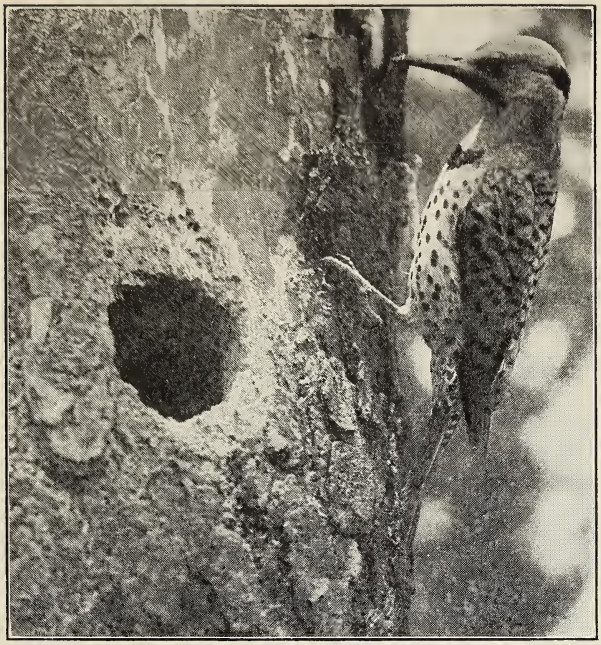
You will probably hear his clear call as he sits on a fence post near by. It sounds as though he were saying "pret-ty day" and it seems he always picks out pretty, sunshiny days to do his singing. He is about the size of a robin, with a long pointed beak. You can recognize him by his pretty yellow breast and the black bib under his chin. You will not mistake his song once you learn to know it.

In searching for the nests of birds that build on the ground, you must remember it is usual for them to be hidden by grass arched about them or covered with dead grass. You must also remember that few birds fly up directly from the nest. Usually they leave the nest, run a little way and then fly up. This is true of the song sparrow.

The song sparrow builds a nest upon the ground also. It is usually covered over so that it cannot be seen. The nest is made of grass and weeds and lined with softer grass or hair. The song sparrow lays three or four bluish white eggs splotched all over with different shades of brown.

When the young hatch they are not as large as the end of your little finger. What helpless little things they are! The mother starts out after insects and soon the babies grow until the nest is crowded. Then some bright day out they all go.

In a dead tree near by a flicker has built her nest. First she drilled a hole about two inches in diameter well into the dead trunk of the tree. Then she hollowed out a place on the inside about eight inches deep and



Brownell

A FLICKER AT ITS NESTING HOLE

three inches in diameter. She did not need to get soft material to line the nest. She used some of the chips that fell into the nest as she worked.

In this wooden house she lays five or more glossy white eggs. The mother sits on the eggs until they are hatched. Then feeding begins. What a large number of insects it takes to feed the babies! But the parents know many good places to find insects so the babies do not often go hungry.

You can recognize the flicker by his call of "wick—wick—wick," repeated until you would think he would

be completely out of breath. He is larger than a robin and has a brownish back with a patch of red on the back of his neck and a broad black crescent under his throat. The wings and tail show yellow flash colors when he flies.

We could hardly pass through any field without seeing a crow. His saucy "caw—caw—caw" is heard on all sides. Let us visit his home. He places it in a tree on the hillside or in some woods. What a bundle of stuff it is, made of roots, ropes, scraps of paper, dried grass, or whatever comes handy. It is a foot or more across and just the kind of home you would expect him to come from. If there are any eggs in the nest, and there usually are about four, they are of a dirty green color marked with brown. And such large eggs they are, nearly half as large as hens' eggs.

When the young begin to grow they just about fill this big trash pile of a nest. And such a family! No manners whatsoever! When the parents arrive the big black beaks open up and such a squawking you never heard. Crowding, pushing, squawking, each one tries to be fed each time the parent birds arrive. The young birds are nearly as large as their parents before they leave the nest.

If you could get some young crows just about the time they are ready to leave the nest, they make very nice pets. They will eat almost anything. Bread, meat scraps, worms, insects—all are devoured greedily. They soon learn to come when called and you need not have any fear of the pets leaving you. They seem to know

U. S. Biological Survey

YOUNG CROWS IN THEIR NEST

when they are well off. Sometimes neighbors get tired of their noise or mischievous tricks and it is necessary to get rid of your pets.

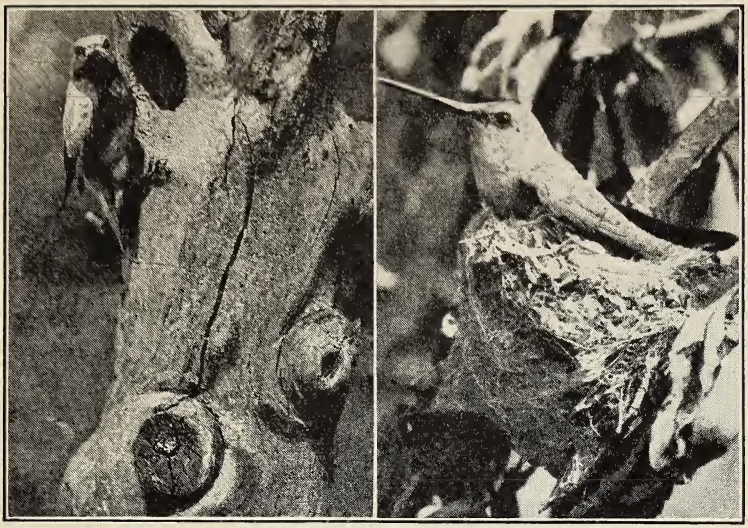
The crow does not have many friends. The farmer tries to scare him away with a scarecrow placed in the fields. But the crow often uses the scarecrow for a roost while he watches over his fellows feeding in the farmer's cornfield. They do pull up some corn when they feed, but they also eat many insects as well. In fact the crow would rather have the insects than the corn. He is also accused of robbing birds' nests. This

may be true, but if he does it is only to get food, not because he wishes to steal or kill. We cannot be sure he is an enemy just from what we have heard. He may do some damage, but fields and roadsides would not be quite the same without his saucy "caw—caw—caw" and let us hope that he never entirely disappears.

In an old woodpecker hole in a tree or fence post we may find a bluebird's nest. This pretty blue-backed, red-breasted songster is one of our most beautiful birds. No one doubts but that the worst of winter has gone when his cheery call is heard early in the spring.

Into the home they carry some grass or straw for a lining. There are usually three or four small bluish eggs in the nest. The food consists of insects, and when the eggs hatch both parents are kept busy carrying food to the hungry nestlings. The food of the nestlings consists entirely of insects, so you see the bluebird is another helper. He makes friends easily and does not have much fear of nesting near our homes. A bird box put out for him in the spring will often find a tenant.

Probably the most beautiful home of the bird world is the humming bird's nest. Few people ever think of the humming bird as having a nest. But she does and what a nest it is! It is built largely of plant fuzz or down and held together with spider web. But the humming bird is not satisfied with just a nice comfortable home. She must have a beautiful home as



Brownell *Wright Pierce*

BLUEBIRD HUMMING BIRD

well as a comfortable one. So out she goes to rocks and trees and collects lichens. You have seen lichens growing on trees and rocks. They are of a greenish gray color and spread out into roundish patches on the bark of trees and on rocks. She gathers these lichens, which she fastens to the outside of her nest, until it is entirely covered with them. The whole nest is not much larger around than a half dollar.

In the nest the mother lays two tiny white eggs, not much larger than white soup beans. What tiny eggs and what tiny babies when they hatch! They look more like insects than birds. The mother takes the food into her own crop and partially digests it before feeding it to her young ones. She gathers nectar

from the flowers and also the tiny aphids or plant lice to feed herself and her young.

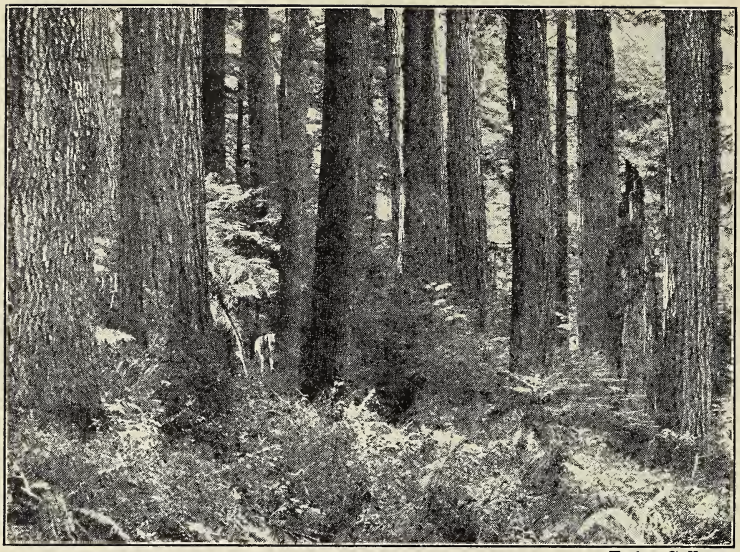
Humming birds are attracted to flowers about our homes. You can attract them by artificial flowers made with a small bottle in the center. Fill the bottle with sweetened water or honey and place it outside. Very likely it will have a ruby-throated visitor before very long.

There are many other bird homes that we might visit, but that must be left for other trips. Since you have learned of these friends and how to find them, you will not have trouble in becoming acquainted with a great many more.

Things to do

1. Feather study. What is the color and shape? How are the feathers made up? Of what use are they?
2. Beak study. What is the shape? How does the bird use its beak?
3. What is the difference in the shape of birds' feet?
4. Try to find an old phoebe nest. Draw a picture of it.
5. Learn the phoebe's call.
6. Learn the bobwhite's call. Describe the eggs and nest.
7. Describe the robin's eggs and nest.
8. Learn to know the meadowlark's call. Try to find its nest.

9. Tell how a flicker builds its nest.
10. Write a story about the crow.
11. Tell how to attract bluebirds to your home.
12. Describe the humming bird's nest.
13. Gather information about how the coloring of birds helps them escape their enemies.
14. Read some stories about birds to your classmates which tell interesting beliefs people have held about how they came to get their different colors and songs.



Ewing Galloway

UNDERGROWTH ON THE FOREST FLOOR

OUR SHRUBS AND HOW WE USE THEM

Did you ever stop to think that a forest is not made up entirely of trees alone? Of course, trees are necessary in a forest but many other plants are necessary, too. The small plants that make up the carpet of the forest floor must be there or the forest would be a dull place. The open spaces in the forest where there are no large trees must be filled in also. The plants that just seem to fill in the right place and make the fields, fencerows, and hillsides look more attractive are the shrubs.

Do you know the difference between a shrub and a tree? Of course you know what a tree is but some-

times it is a little hard to tell a shrub from a tree. Here is the principal difference. Trees nearly always have just one stem to hold their branches and leaves up above the ground. This big stem we call the trunk of a tree. It is made of wood and is strong enough to hold up the whole tree, leaves, branches, fruit, and all. The shrubs are different. They have woody stems too, but they have many of them. Instead of one trunk to hold up the leaves and stems they have many stems. So you see they cannot grow so big and strong as the tree, which has only one stem to feed and take care of. This makes them spread out into a bush and that is the principal difference between a tree and a shrub. In other words, a shrub is a kind of bush that has a lot of stems and spreads out instead of growing straight up like a tree.

What useful plants they are, filling in all the open places through the forest and along the roadsides. They are useful to the birds, too. Every boy and girl knows where to look for birds' nests. These useful plants make fine homes for many birds. As you look around in a thicket out hops a bird and goes fluttering and chattering away, trying as best it can to attract your attention away from the nest. There are other uses for shrubs also. Most of these shrubs bear fruits and seeds. In many cases these fruits hang on all winter. What bird could ask more? Along most any roadside, stream, or forest edge is an outdoor cafeteria just waiting for a hungry bird to come along and select the kind of food that pleases his fancy. So you see the

ATTRACTIVE PLANTING ABOUT THE HOME

shrubs are friends of the birds as well. In the winter they furnish cover which affords protection for the birds that stay over.

We make good use of shrubs around our homes. We have learned that a forest is not all trees. We plant trees and flowers around our homes, but we also plant shrubs, some of them to cover up the foundation around the house. Others, for borders along walks and drives, and some just to fill in places as they do along the roads and in the woods.

Did you ever notice that the plants out in nature never follow in straight lines? They just seem to grow

in little clumps as though they wanted to be together to keep each other company. And all of a clump are not always of the same family, except shrubs like the sumacs and elders. They seem to be rather clannish and want to stay together, but some of the others are more sociable. However, they mostly grow in clumps or small groups. This should tell you something about how to plant young shrubbery. These two rules are good: avoid straight lines, and plant in clumps.

There is still another rule. If you travel through the woods you will notice that there are open spaces. It is more noticeable in a field than along the roadsides. Shrubs are growing everywhere but there are many open spaces where there are no shrubs. This rule you should add to the other two and you have the best rules for planting around your home.

Perhaps you live in a city. If so what are some of the common shrubs you find in yards in the city? One of the most common is the privet. This shrub is used mostly for hedges or fences. It grows quickly and will stand much cutting. In formal plantings the privet is cut and trimmed to all sorts of fancy shapes. Mostly it is boxed up square for a wall along a drive or for a fence around a home.

You will likely find spirea also. There are many kinds of spirea. One of the most common kinds is Van Houttei. It shows its pretty white flowers in May, and in places where it abounds, its beautiful mass of snowy white flowers makes an attractive sight.

The first to bloom in spring is the forsythia or golden bell. Its brilliant yellow flowers show up like a mass of gold and are a welcome sight in the early spring.

The Japanese barberry is also used freely. It has small yellowish flowers in early spring and is used because it makes a pretty green hedge. Its brilliant red berries hang on all winter and add color to the landscape. The birds like these berries too, so it is useful as well as beautiful.

In the South you see the crepe myrtle. This is one of the most beautiful of our shrubs. At a short distance the flowers appear to be made of crepe paper. Their bright color aids the attractiveness of this shrub. It does not winter well in the North.

The old-fashioned snowball and sweet-scented shrub are still quite common. The snowball is known for its ball-shaped clusters of flowers. The sweet-scented shrub is known by its sweet fragrance. Not many boys who have grandmothers living on a farm have failed to learn about this shrub. Its maroon colored flowers give off the odor of delicious pineapple, vanilla, and the fragrance of rare perfume all rolled into one. There are many other shrubs that are used around our homes, such as lilacs, flowering almond, syringa, flowering quince, and hydrangea.

Now let us go out where shrubs are growing in nature. One of the most common ones to be found is the elder. It has thick stems filled inside with pith. The leaves are compound, that is, each leaf is made

Spencer Photo

LEAVES AND BLOSSOM OF THE HAZEL NUT

up of a rib to which are attached several smaller leaves. The flowers come out in great rounded clusters. The white flowers soon change to green berries about the size of small shot. These ripen into the purple elder berries that most of you know. It is a pretty shrub and covers much ground that is good for little else. Sometimes farmers have to grub it out of their fields.

In many places the "shoe make" or sumac is a common plant. Most people recognize it by the red fruit clusters that are seen in the fall. They look something like stag horns which gives it the name of stag-horn sumac. Very early in the fall its leaves turn a brilliant red. Most farmers consider it a weed, which

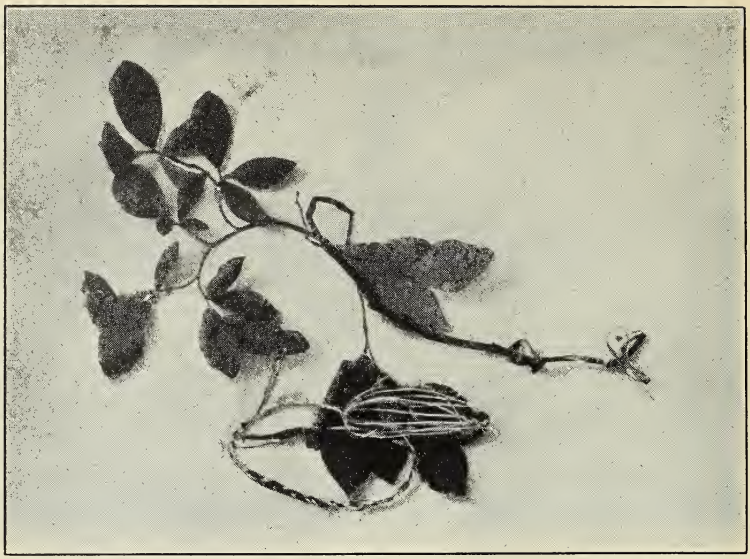


Photo by the author

LEATHERWOOD

it is no doubt. But it also fills in some places that should be covered up and makes the countryside beautiful, especially in the fall.

The hazel nut bushes grow by the roadside too. They make pretty shrubs and every boy should know about the nuts that are hidden away in the brown leafy wrappers which form the fruit of this shrub. The nuts are smaller, but compare very favorably to the filberts that you buy at the stores. Perhaps if we were to cultivate this shrub it would produce as good fruit as its European cousin which produces the filberts.

Along the edge of the woods is the spice bush. It is especially noticeable in spring on account of its small

yellow flowers. It is sometimes called the yellow bud. If you taste the twigs or berries you will know at once why it is called spice bush. It is said that in colonial times when spices were scarce the colonists used these berries and twigs for spice. It is also said that they used the twigs to make tea. Many people use the twigs for this purpose even now.

Here, too, will be found the leatherwood. This is a very unusual shrub. The leaves are fairly large, something like a papaw leaf. The wood and bark are very tough. You can tie it into a hard knot without breaking the twigs. If you try to break them off they just knot up and refuse to break. Its bark is a kind of natural string. The Indians knew about it and sometimes used it for bow strings and fish lines. If you were out in the woods and needed a string for a bow drill to make fire, it would be well to remember the leatherwood.

The common mountain laurel is a shrub worth knowing. It is evergreen, and grows on hillsides and rocky places. Its bright evergreen leaves add much to the hillsides in winter. Its pretty pink clusters of flowers make the hillsides beautiful in spring. The rhododendrons add much to the countryside where they are found. They too are evergreen. The leaves are larger than those of the laurel. The entire plant is large, sometimes growing five or six feet tall.

These are only a few of the shrubs that are found about us. There is one more which is an enemy and should be mentioned. It is the common American

barberry. This is not the same as the Japanese barberry which we usually have in our yards. The margin of the leaf of the American barberry is notched while the margin of the Japanese barberry leaf is smooth. The berries on the Japanese barberry are usually in pairs. On the common barberry they are in larger clusters.

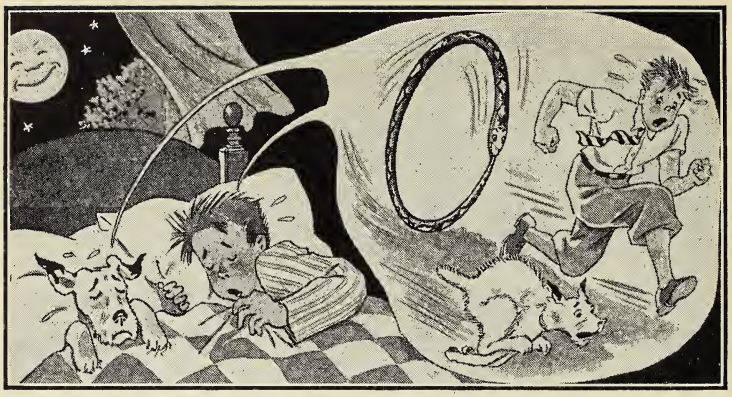
The common barberry acts as the home for a small fungus plant called the wheat rust. This fungus plant lives for a while on the barberry, then is blown about by the wind and finally lands in a wheat field. It attacks the stem of the wheat and causes it to produce poor grain and to break down. You can see that this shrub is an enemy, or at least it shelters and takes care of one of our enemies which is just as bad. So it should be dug up and destroyed whenever found.

There are many other shrubs for you to learn about. These are only a few of the most common ones. But you can see that they have a real duty to perform. As our roadsides are already planted with shrubs, perhaps we could help beautify the roadsides if we took as much care of our natural shrubs as we do of those about our houses.

Things to do

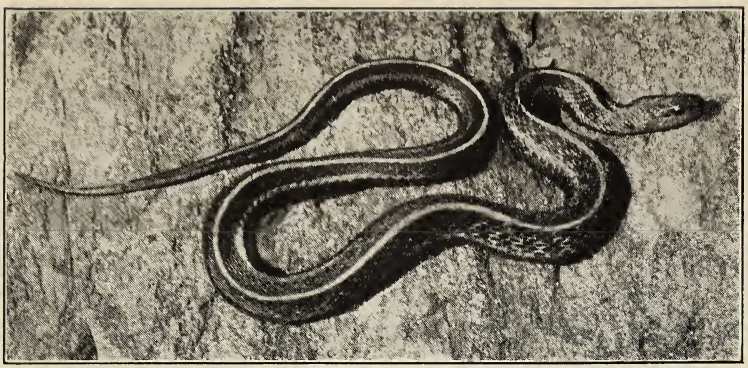
1. Make a planting plan for your home.
2. Learn what shrubs are commonly used around homes. See some nursery catalogs.
3. Make drawings of several kinds of wild shrubs.

4. Make a collection of twigs and leaves of common shrubs.
5. Write a story on the use of shrubs at home.
6. Write about the use of shrubs in nature.
7. Make some leaf prints of leaves of common shrubs.
8. Write about beautifying the roadsides.
9. Write about our enemy, the common barberry.
10. What shrubs are found in the woods near your home?
11. Tell how the shrubs help the birds.
12. What shrubs are found in the open fields?



REPTILES OF HILLSIDES AND FIELDS

Are you afraid of snakes? Most boys and girls are, because they do not know very much about them. Snakes are not really as bad as some people think. Foolish people have told stories about them until most boys and girls are willing to believe anything they hear. Did you ever hear of a hoop snake? The hoop snake exists only in some people's imagination. There is a story that the hoop snake has a long stinger in its tail. When it gets ready to go any place it takes its tail in its mouth and begins to roll about like a hoop. One story tells about a hoop snake that ran into a tree and stung the tree. The tree withered and died at once. Can you imagine such a snake rolling around a field chasing some poor country boy? Just such stories as this, which are not true at all, make people afraid of snakes. As far as anyone really knows the hoop snake never existed.



A HARMLESS SNAKE

You may have heard another story which is untrue. Many people believe that the mother snake swallows her young ones if any danger threatens them. The story is that she opens her mouth and in go all the little snakes like one of these tape measures that work on a spring. When you press the button the tape all runs inside. Just think how foolish such a notion is. A common garter snake may give birth to as many as thirty young ones in a litter. Suppose each snake is six inches long. Altogether that would be fifteen feet; fifteen feet of snake to crawl into the mother's body. Suppose that one snake gets in each second, it would take a half minute for all of them to get in. There would be a line waiting outside that could easily be captured before they get in. Such stories are foolish, but many people believe them.

Snakes are not slimy either as some folks think. The body of a snake is dry and covered with scales. If you

touch one you will feel at once that it is dry. The darting tongue is not the snake's fangs nor does it carry poison. The snake darts out its tongue for about the same purpose that an insect uses its feelers. The tongue is a sort of sense organ by which the snake tests out its surroundings. Only the poisonous snakes have long piercing teeth called fangs. And, as there are only a few kinds of poisonous snakes in the United States, we should not be afraid.

Snakes live in holes in the ground also often in crevices in the rocks. A hidden, rocky hillside would be a good place to look for them. Here they are free from disturbances. On warm sunny days they come outside to lie in the sun. They are cold-blooded animals and seem to enjoy the bright sunshine very much. In winter they go into the ground in some convenient hole down under the rocks. Here the frost cannot reach them and they sleep the long winter away. When spring comes or even a warm day in late winter they come out to enjoy the warm sun.

Some snakes live only on cold-blooded animals, such as frogs, toads, salamanders, crayfish, and earthworms. Others catch birds, squirrels, chipmunks, rats, and mice. Some of them are really your friends because they destroy rats and mice. The snake does not chew its food but swallows it whole. The teeth inside the mouth point backward, which helps the snake to swallow its food. The jaw has a sort of double hinge which lets the mouth open wide enough to swallow a rat or young rabbit. The snake does not need to eat

A RATTLESNAKE

every day. It eats when food is plentiful but one feeding lasts for quite a while. When they are kept in captivity, they will not eat very often.

How do you suppose that a snake is able to run? It does not have feet or legs as many other animals do. You could really say that a snake walks on the end of its ribs. The ribs are fastened to the scaly plates on the under side of the body. By moving these plates, which catch on the ground, the snake can glide swiftly and smoothly along. When in the water it wriggles its body and swims very swiftly.

Many snakes lay eggs just as birds do. These eggs are laid in old rotten logs, sawdust piles, manure heaps, and other similar places. The eggs are soft shelled and oval shaped, sometimes an inch or so long. The young snakes are six or eight inches in length when they hatch out. They start out at once to get food for

themselves. The mother snake does not come back to take care of them. Some snakes, such as the garter snake, the water snake, copperheads, and rattlesnakes, are born alive just as baby kittens or puppies are born. They often remain near the mother for some time, but she rarely takes much interest in them, and never swallows them for protection as many people believe.

All snakes are not poisonous. You can tell a poisonous snake usually by the shape of its head. In most cases the poisonous ones have arrow-shaped heads. The pupils of the eyes are oblong instead of round, and they have a pit between the eye and the nostril. They also have long fangs or teeth for injecting the poison into the flesh when they strike.

If you are bitten by a poisonous snake, remember to do the following at once:

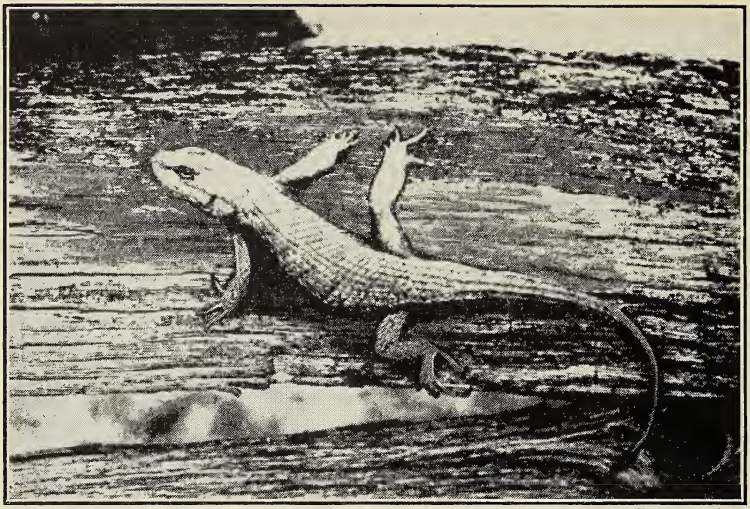
1. Get to a doctor as soon as possible.
2. Cut the wound to make it bleed.
3. Tie a bandage above the wound and twist it with a stick to tighten it.
4. Loosen the bandage every few minutes for just a few seconds.

Very few people in the United States die from snake bites, so we do not need to fear snakes in most sections of the country. You should learn to know some of the snakes when you see them. The rattlesnakes can be recognized by their rattles. They are usually short and stubby, with diamond markings on the back. They are really dangerous snakes. The copperhead is also

a short, stubby snake. It has a copper-colored, arrow-shaped head. Its body color is like copper, with darker dumb-bell shaped marks across the back. It, too, is a dangerous snake. The other two poisonous snakes are the coral snake found in the South and the water moccasin. Both of these are very poisonous and should be avoided. Some of the common, harmless snakes are the garter snake, the milk snake, black snake, puff adder or hog-nosed snake, grass snakes, and common watersnakes. You can learn to recognize them from their pictures, for they all have some marks you can remember.

A relative of the snake is the lizard. We say a relative because it is a kind of reptile. The reptiles are covered with scales. Lizards are quite common along old fences. One of the most common ones is the small swift or fence lizard. If you ever see it move, you will know why it is called a swift. It can run so swiftly that you scarcely see anything other than a gray streak disappearing along a fence.

It has another trick too if you try to catch it. As soon as you approach, it dodges to the other side of the fence. If you try to follow, it moves back to the other side. It may play hide and seek with you for a long time before it scurries away. If you wish to catch one, you must be very quick. When it dodges to the opposite side of the fence is your chance. Go quietly up to the fence and reach quickly on the other side. You may catch the swift but you must move like lightning, because the swift does not want to be caught.



Spencer Photo

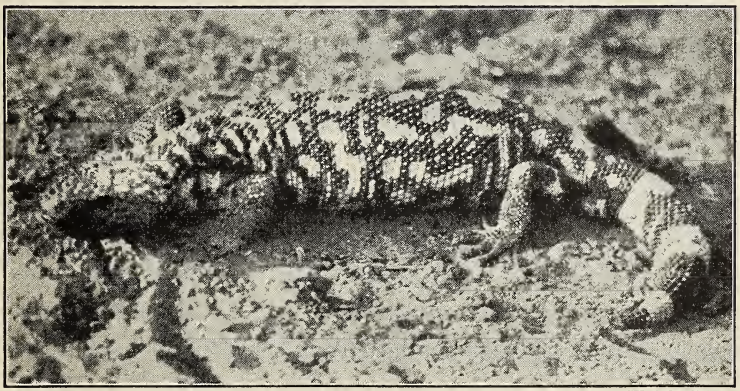
THE FENCE LIZARD

You may get a good surprise too. You may grab the lizard and feel it wiggle under your hand. When you open your hand you have only the lizard's tail which is still wiggling. Sometimes when they get scared they drop the tail right off of the body and run away and leave it. This helps the swift to deceive its enemies. It drops the tail and the pursuer, thinking he has the lizard, stops to investigate the wiggling tail while the swift scurries off to safety. Later a new tail grows on to take the place of the old one. The swifts are found often around old fences or saw mills where they lay their eggs in logs. There the young ones find plenty of insects and insect larvae to eat. They eat very little except insects.

There are many kinds of lizards. Another swift that is quite common has a blue mark under the throat. It is larger than the small fence lizard which rarely gets longer than five inches. It is a great bluffer and hisses loudly to frighten you, but it is not dangerous. The little chameleon that can change color from dark brown to green is often seen in Florida and other southern states. Sometimes they are sold at circuses.

Some lizards like the giant iguanas grow very large, often reaching a length of six feet or more. They are found mostly in tropical countries. There they are used for food. They are sold in the markets of Mexico and other southern countries for food.

Lizards are not dangerous as most people think. There is only one poisonous kind found in America. That is the Gila monster, found in the southwestern United States and Mexico. It has in its mouth glands



Wright Pierce

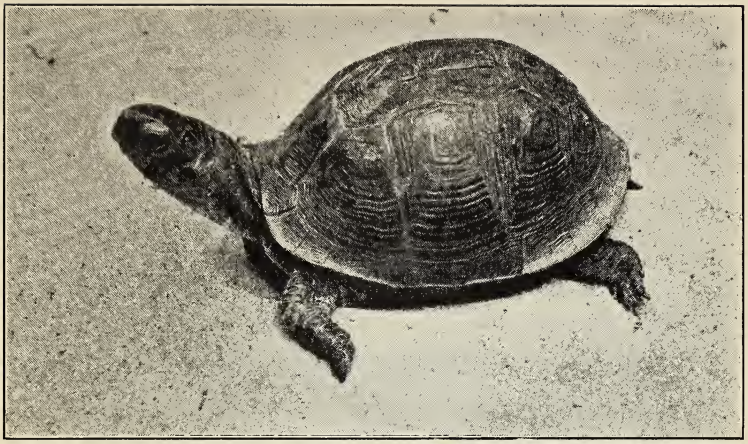
GILA MONSTER

which produce poison. You can play with most all of the small lizards if you do not let them bluff you out by their hissing, but the Gila monster should be avoided.

Another friend of the hillsides is the common box turtle. Almost every boy and girl has seen the box turtle trundling along carrying its house with it. If it gets scared, it just pulls in its head, feet, and tail and closes up the house. And how tightly it can close this house! So tightly that you couldn't get a piece of paper in the cracks around the shell. As long as you handle it, it stays closed up in its house. But let it down on the ground and be quiet and soon the shell opens a little bit. Then more and more it opens, and out comes the nose, then the head. If the coast is clear, four legs are stuck out and Mr. Turtle picks up his house and away he goes.

He lives in the woods and fields and eats berries, snails, worms, slugs, and insects. If you have one for a pet he might eat bananas, berries, mushrooms, or earthworms. The box turtle lays eggs in the ground. These eggs hatch out into young turtles. The young ones are hardly ever found. Perhaps they hide away until they are big enough to take care of themselves better. Maybe they are hard to find because they do not look much like their parents.

The box turtles live to be very old. Some people carve dates on the shell and find them many years later. This is not a very good way to tell the box turtle's age. Here is a better way. The turtle's shell is



American Museum of Natural History

THE BOX TURTLE

made up of different sections that look something like tiles in a floor. If you look closely you will see that each one of these sections is made up of scaly ridges. Begin at the center of the section, count the ridges to the edge, and you have the box turtle's age. Each year as it grows a new ridge is added to each one of the sections. Some of them have been known to live for sixty years or more.

There are many other friends waiting for us along the roadsides. How many of them there are and how much there is to know about them! All of them have their work to do and most of them are our friends because they feed on such enemies as rats and insects. There are many kinds of reptiles other than those we have described. To know them we must get away from the roadsides and hillsides, and seek them out

in the deep forests, the swamps, and even on the hot sands of the desert.

Things to do

1. Learn to know poisonous and non-poisonous snakes.
2. Get a garter snake to study. Observe its scales, eyes, nostrils, mouth, teeth, color.
3. What is the treatment for snake bite?
4. Write about common snakes of your locality.
5. What do snakes eat?
6. Draw pictures of several kinds of snakes.
7. Describe the common swift.
8. Catch a swift and make a home for it. What do they eat? Does it have scales? What do its feet look like? How does it run? How does it eat?
9. Draw pictures of the swift.
10. Catch a box turtle and build it a home. What do they eat? Describe its feet, eyes, and shell.
11. Write a story about the box turtle.
12. Write about any other reptile.
13. Draw a picture of a horned toad.
14. Draw a picture of a box turtle.

MUSHROOMS AND TOADSTOOLS

You have seen mushrooms growing in the fields. If you are like most people you know of two kinds: mushrooms and toadstools. The toadstools are supposed to be poisonous and many of them are. However all of them are mushrooms. Mushroom is a name we give to all the group of larger fungus plants. They may be umbrella-shaped as the common field mushroom and the toadstools. They may be shelf-shaped, cup-shaped, or appear as tiny birds' nests, and in many other forms.

Someone found these plants growing in the open fields where toads abound. Perhaps they thought the toads used them for chairs or umbrellas. The mushrooms have long been thought of in connection with fairies and witches. As toads are often thought of in the same connection perhaps that is why we call some of the mushrooms, toadstools.

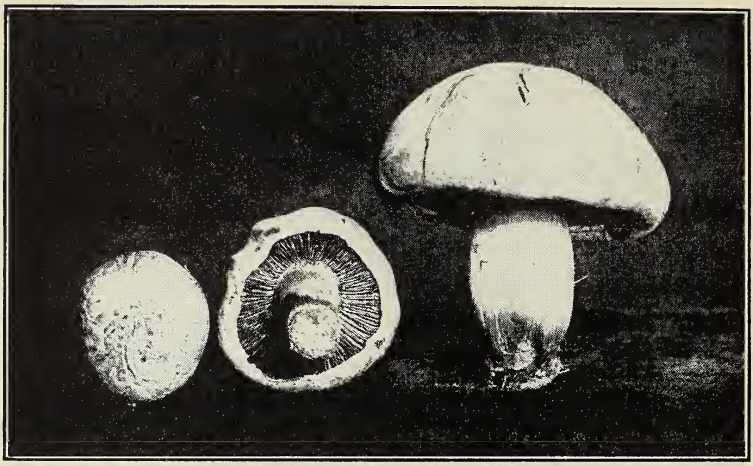
THE "FAIRY RING"

Did you ever see a fairy ring? Fairy rings are found in grassy fields during wet weather. The ring may be a few inches in diameter or ten to twenty feet. What a sight they are showing their white heads against the green grass. Where do you suppose they came from? On the inside of the ring is a narrow path where the grass dies out. A long time ago people thought this was caused by fairies. They supposed that the fairies danced in the fields, and as they danced in a circle their tiny feet trod down the grass and made the path. When they tired of their dancing they sat down upon the mushrooms to rest. No one could catch them at their dancing because fairies cannot be seen by ordinary people. Some thought that the fairies caught the colts in the fields and drove them around and around

these fairy circles. Many people were afraid to walk inside the rings, for to do so was to put oneself in the power of the fairies. All of these are stories and do not explain what causes the fairy rings.

Perhaps this is a better explanation of how the rings are formed. Mushrooms grow from tiny spores something like the ferns and mosses do. These tiny spores are not seeds and do not grow into the mushroom plants at once. The spore finds a damp place where there is plenty of decaying vegetable matter and begins to grow. First the spore sends out a white thread, then more and more of these threads are sent out to form a circle. These threads gather the food from the soil and make new growth. All of the food for the mushroom must be gathered by these tiny rootlike threads. As you know the mushrooms do not have any of the green chlorophyll that is found in other plants and so cannot make their own food. These roots take up the food near the surface of the ground where the ring is formed and the grass cannot grow well for lack of food. As the ring spreads the grass in the center again grows thick and green. So the grass in the fairy ring does not grow well because the mushrooms have taken up the food from the soil and not because fairies danced in the grass and wore a path there.

Another reason why mushrooms were thought of along with witches and fairies was on account of the places they grew. Many mushrooms or fungus plants prefer to grow in dark, damp places. They are often found growing deep in the ground in coal mines and



Dr. F. W. Copeland, Ohio University

COMMON FIELD MUSHROOM

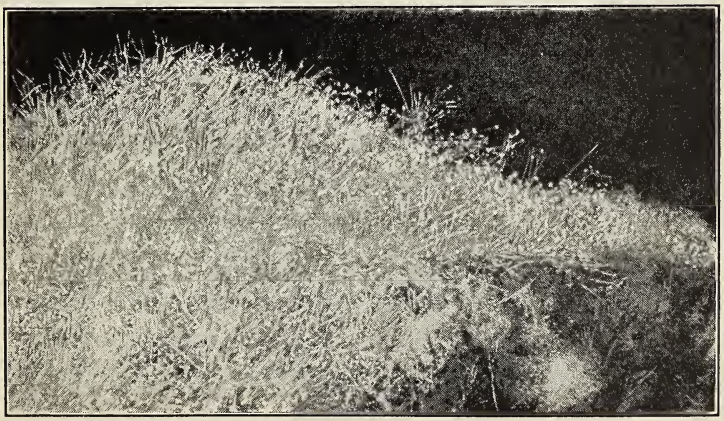
caves. When you read about ants you learned of how they built their fungus gardens deep down in the ant hill. You find mushrooms deep in the woods, growing on rotten logs and leaves. So you see from the very places they live they get a bad name.

Let us look at a common field mushroom. This is the one you often find sold for food in the market. It is best not to try to pick any mushrooms to eat unless you are absolutely sure they are not poisonous. This common field mushroom is of the umbrella-shaped kind. There is a stout stalk and a cap. Look at the underside of the cap. You see it is made up of many small partitions called gills. On these gills the spores are formed. The gills are pink at first, but as the spores ripen the gills become darker in color. When

the spores are ripe they fall out and are carried away by the wind to grow somewhere else.

There are many kinds of mushrooms or fungus plants. Probably one of the most common ones is the bread mold. This is the hairy, fuzzy stuff that forms on old bread when it is kept in a dark, damp place. Spores of the mold are always present in the air and if they happen to get on the bread, as they usually do, they start to grow at once. Soon from these tiny spores the whole loaf of bread is a mass of mold. This mold forms many spores which are sent out into the air to infect other bread or food.

The fungus plants often cause live trees to decay. You have seen fungus plants growing on dead wood. If you look closely you will find them on live trees as well. If a tree is wounded in any way so that the bark is broken it is just the same as when you cut your



BREAD MOLD

finger. If you put something on it to kill the germs and keep them out it gets well; if not, it gets sore and causes trouble. The same is true of a tree. If the wound is painted with tar or paint as soon as it is made, the spores do not get a chance to grow and so the wound heals. If left open the spores get in and before long may even kill the tree. This is something to remember when you would like to carve your initials on a tree or hack it with an axe. Each wound may be a place for spores to enter which may cause the death of the tree.

The mushrooms are enemies in other ways. Many of them are extremely poisonous. You should never pick them to eat unless you are absolutely certain that they are not poisonous. It is best for children to let them alone.

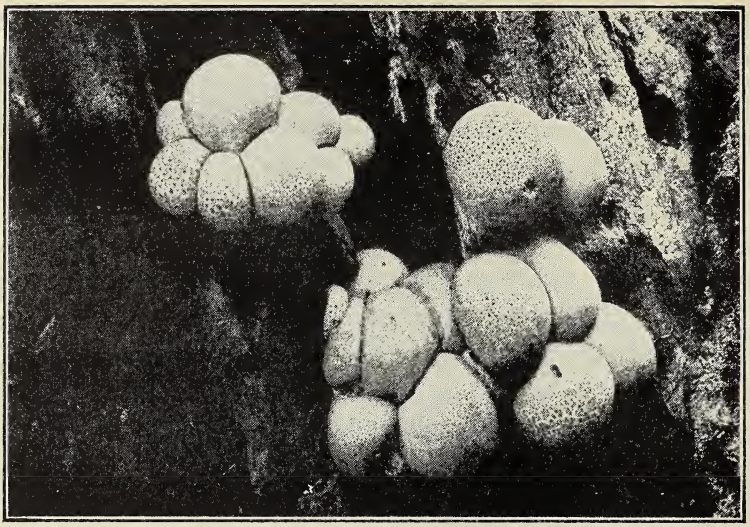
The mushrooms do good as well as harm. Did you ever stop to think what would happen if living things did not decay? Just think what a tangle our forests would be if every branch or plant that fell did not break up or rot away. Soon the forest would be impassable and new growth would be choked out. But that is not the most important part. Soon all of the plant food would be taken out of the soil and plants could not grow. These fungus plants attack dead plants and leaves, causing them to decay and form new soil. In this way the soil is built up and the forest is kept free from this waste that would otherwise gather under the trees. There are many other uses for fungus plants. The Indians and early settlers dried puff balls

and other fungi for use as tinder. Tinder was the dry powdery substance that was used to start a fire from flint and steel. If you could get some dried puff balls and puff some of the spores at a lighted match, you would see that it burns like powder.

Mushrooms have been used as food for a long time. In France, there is a kind known as the truffle. It grows a few inches under the surface of the ground. To find them is quite a trick. Pigs and dogs are trained to find them and dig them out. The pig likes the truffles to eat, so to keep the pig from eating them the truffle hunter straps the pig's mouth shut. When the pig roots the truffle out, the hunter takes it and puts it in his basket.

Another kind of mushroom that is often found in the fields is the common puff ball or smoke ball. You have seen them in the fields and woods. At first they are white and the flesh is solid. In this stage they are good to eat. Later they turn brown, dry up and spores form within the ball. They are often found in this stage and when kicked they give off a cloud of smoke. This smoke is made up of tiny spores of the plant. Just try to imagine how many of them there are. If you could take one tiny puff from the puff ball and look at it under a microscope you would find that you had thousands of spores. Since there are so many it is not hard for them to get scattered about.

People often wonder how puff balls and other mushrooms grow so quickly. At night a field may be clear and the next morning covered with them. Here



Dr. F. W. Copeland, Ohio University

PUFF BALLS

is the mushroom's secret. Down under the ground the tiny spores start to grow and form threadlike roots that gather food. After a while a bud forms on these threads. Now the plant does its real growing or the making of the plant takes place. Very secretly the whole plant is built up underground and carefully packed into tiny bulblike plants, called buttons. The whole thing is folded together more tightly than an aviator's parachute. Large cells are formed for holding water. Now the plant is ready to grow into what we call a mushroom. When the first rain comes along these large cells begin to soak up water just like a sponge. Bigger and bigger the mushroom grows as it soaks up water. It bursts through the ground and still

grows bigger and bigger by soaking up more water. Some puff balls may grow as large as a bushel basket. When full grown, the mushroom produces its spores and dries up. But, you see, mushrooms do most of their growing down under the ground and only expand with water when we see them.

The morels are one of the best of the mushrooms to use for food. They look like pieces of sponge held aloft on a stout stem. They are often found in old apple orchards and sometimes along creek banks. But if you are not sure of them it is best not to pick them to eat.

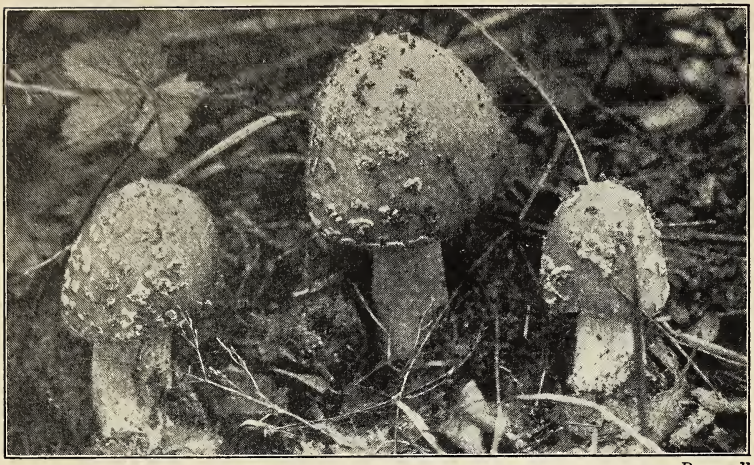
Dr. F. W. Copeland, Ohio University

THE MOREL

Mushrooms take many shapes. You have probably seen the shelf mushrooms that grow on old stumps. They appear as a fan-shaped shelf, usually brown on top and white underneath. They continue to grow for several years adding a layer on the bottom each year. In this way they form a ring on the top each year. If you wish to know the age of the fungus just count the rings. The white under surface can easily be scratched with a stick and some boys and girls like to draw pictures on them. If you would look at this surface with a magnifying glass, you would see that it is made up of thousands of tiny holes. In these holes the spores are formed. These fungi are called polypores which means many pores.

You have also seen the tiny funnel-shaped fungus that looks like a bird's nest full of eggs. They grow down under the grass, usually on dead twigs or on decaying plant matter. Many boys and girls find this fungus and think that they have found fly eggs. But they have nothing to do with flies, they are a form of plant life or a kind of fungus growth.

In the woods you often find a very beautiful cup-shaped fungus attached to sticks. The outside of the cup is white and the inside a bright scarlet. Most any boy or girl would be attracted by its pretty bright colors. This one is called pezizza. It has a peculiar way of shooting out its spores. If you should take it home and put it under glass you could observe this. Every time anything moves or disturbs it there is an explosion in the cup and out come the spores like a



Brownell

POISONOUS MUSHROOMS

small cloud of smoke. It will repeat these explosions many times.

You may happen upon another mushroom that has a rather bad reputation. It is the stink horn fungus. It is several inches tall and about as big as a clothes pin. On top is a red shiny head. They grow from buttons that look much like snake eggs. You would have no trouble recognizing this fungus if you should find it, because of its bad odor. But there is a purpose for even this bad odor. Flies are attracted to the stink horn and while there the spores stick to the flies' bodies and are then carried about from place to place. It would seem that the stink horn could find some better way of distributing its spores.

There are many other kinds and shapes of fungus. Some appear like coral and others like pieces of

leather or jelly. Some form the witches' brooms that you see in hackberry trees. Some of them do good and others do nothing but harm. But for many ages mushrooms and toadstools have been a mystery to people. Now we are beginning to know more about them and the work they do.

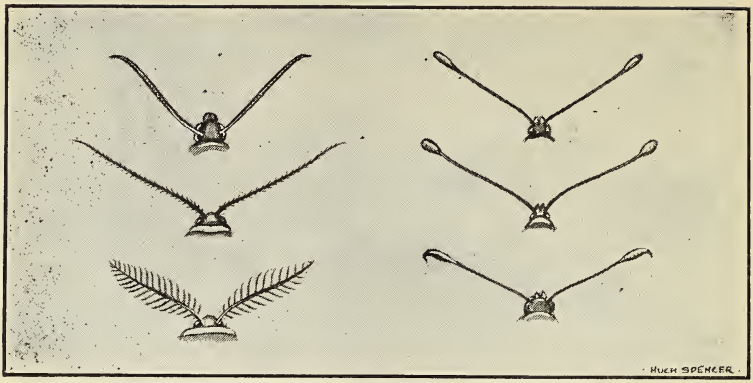
Things to do

1. Collect and name some specimens of mushrooms.
2. Draw pictures in color of those you find.
3. Look up some of the fairy stories about mushrooms.
4. Collect some puff balls and look at the spores.
5. Find out how mushrooms are grown for the stores.
6. How could you start a mushroom garden?
7. Make a spore print by turning the head of a mushroom lower side down on a paper. Let it stand over night and remove carefully, leaving the spore print.
8. Cut a polyporous open and see how old it is.
9. Find the threadlike roots under bark and under dead leaves.
10. Write a story about the good mushrooms do.
11. Tell of what harm mushrooms do.
12. Tell how mushrooms destroy trees.

BUTTERFLIES AND MOTHS

Most of us have chased butterflies at one time or another. What fun it is! How they can fly and dodge from one flower to another. Perhaps you have caught one with your hat. What a fluttering when you reached under the hat after it. Then when you got it how the colors had faded. Perhaps your hand was covered with dust of the same color as the butterfly.

If you would look at a butterfly wing under a microscope you could see what that dust is. The butterfly wing is made of a framework covered with scales. These scales lie on the wing over-lapping each other like shingles on a roof. These scales give the butterfly all of its pretty color. Now you have really learned a valuable fact, because that is one of the ways to tell butterflies and moths from all other kinds of insects. None of the others have scales on their wings. Now let us find a way of telling butterflies and moths apart.



CAN YOU TELL THE MOTH FROM THE BUTTERFLY BY THEIR ANTENNAE?

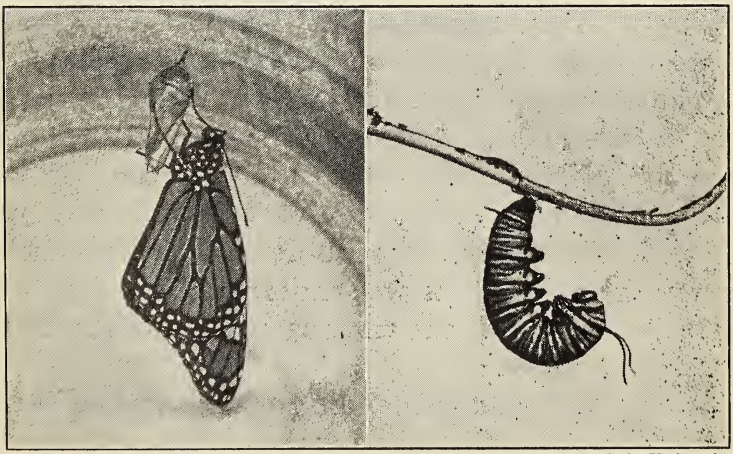
For the most part butterflies are day fliers like robins and sparrows, while the moths fly at night like owls and bats. That is not really a very good way to tell, because some moths may fly in the day time. Here is a better way.

Do you know what the antennae are? They are the long feelers on an insect's head. Perhaps you have always called them feelers, and that is not a bad name because that is how the butterflies and moths use them. The butterfly's antennae have little knobs on the end. The moth's antennae are either straight, without a knob, or are shaped like a feather. Now you have one of the best ways of telling a moth from a butterfly.

Where do you suppose all of these butterflies and moths come from? You have learned something about insects, now it would be well to know more

about how they reproduce. Most of the insects go through the same process of reproduction.

The mother insect lays her eggs in a place where the young can find the food they like when they hatch out. The monarch butterfly lays her eggs on the milkweed; the cabbage butterfly lays hers on cabbage; and the clothes moth lays hers on our woolen clothes. We do not like this very well but the mother moth does the best she knows how. This is a very wise thing for her to do because she never stays to take care of her children. Usually the egg hatches out into a worm-like form. It is not really a worm though. It is called a larva. You have seen tomato worms and woolly worms and many other kinds. This tomato worm is the larva of a large moth. This moth lays her eggs on



Dr. F. W. Copeland, Ohio University

ADULT BUTTERFLY EMERGING FROM THE CHRYSALIS

CATERPILLAR READY TO MAKE ITS CHRYSALIS

the tomato plant. Soon the eggs hatch out into very small larvae. These larvae begin to eat tomato leaves at once.

Soon the larva begins to feel crowded in its skin just as you would feel in clothes that were too small. It is time for a change. The skin splits down the back and out the larva comes with a new and larger skin. It eats and eats and eats, and soon this new skin is too small and it sheds this for a new and larger one. This process of shedding the old skin we call moulting. The larva moults several times before it is ready for the next stage in its life.

When the tomato worm gets big enough it crawls down off the plant and burrows into the ground. Now a wonderful change takes place. It makes a brown case called a pupa case, and seemingly goes to sleep within it. This stage of its life is called the pupa stage. Some larvae spin a cocoon and some make what is called a chrysalis. During the pupa stage a great change takes place. The ugly fat larva is changing to a pretty moth. Slowly this change goes on. In the spring the pupa moves toward the surface of the ground. The brown case splits down the back and out comes the moth. It is wet and crumply at first, but the wings soon dry out and straighten and the moth goes flying away.

All insects do not go into the ground. Some of them make a house of silk called a cocoon. This silk is made within the body of the larvae. In fact all of the real silk we get is made by the larvae of insects.

There are a few insects that do not hatch out into larvae. The grasshopper and some others hatch out into nymphs. The young nymphs look something like their parents. They moult their skin several times and finally become full grown. Now you know that the eggs of most insects do not hatch out into the forms we see flying about. If you collect some of these larvae and feed them you can watch them complete their life processes.

There are many kinds of butterflies. One of the most common and beautiful is the large brown one with black stripes on its wings. This is called the monarch. The monarch is very interesting even though it is so common.

Let us watch one to see if we can find out why it flits from flower to flower. On the under side of the head is a long coil that looks like a watch spring all curled up. When the butterfly lights on a flower it pokes its long nose down into the flower. What do you suppose it is doing? It is not smelling the flower but pumping out the nectar which it uses for food. As you probably know, the butterfly does not take care of its young as the bees and wasps and ants do, but just lays the eggs and leaves them to hatch. All during the season the butterflies flit about with nothing to do but visit the flowers and drink nectar. Here is something of much interest about this butterfly. In the fall the monarchs migrate much the same as birds do. They gather in flocks and can be seen in great numbers making their way southward. If you look on the

milkweed plants you will probably find the green and black striped larva. The chrysalis, which is of a light green color studded with golden spots, may also be found there. This chrysalis has been called "The green house with gold nails."

Another butterfly that we often see as we wander over the fields is the swallowtail. It is called swallowtail on account of the long tail-like ends of its wings. If you look at the tail of the bird called the swallow you will know why this butterfly is called a swallowtail. This is one of our most common butterflies. There are several kinds but the most common is the one striped with the white and black stripes. Its real name is Ajax. The larvae of the swallowtails have a peculiar way of protecting themselves. If you have ever found one you know what it is already. The larva has two orange-colored pockets in the front of its head. The lining of these pockets is covered with a nasty smelling stuff. If this larva is disturbed it turns these pockets wrong side out and they stick out like horns. Woe be unto a puppy dog who sniffs at one, because the evil smelling stuff stays on a long time and the pup must do a lot of scratching and rooting to get rid of it. But the larvae are not in much danger from dogs. They must protect themselves against birds. Most birds would let them alone, because they very probably do not taste any better than they smell.

The most common butterflies of all are the cabbage butterflies. Though whole groups are often called cabbage butterflies, a better name for them is sulphur

butterflies. They are of different colors, white, yellow, and orange, often spotted with brown or black.

The real cabbage butterfly is white. It lays its eggs on cabbage plants. The eggs hatch out and the worm-like larvae begin to eat the cabbage. It has been proved that an insect larva often eats its own weight or more in twenty-four hours. At the same rate of eating, a nine-pound baby would have to drink about ten pints of milk every day to keep up with the larvae.

The people who grow cabbage do not like this butterfly very well. In fact they do all they can to kill it. They put poison on the young plants which the larvae eat. This poison kills many of them. If something were not done, these insects would completely destroy the cabbage crops.

Now we might look for moths instead of butterflies. You already know how to tell the difference between the two. But as the moths are night fliers we may have to hunt for them at night. However, if you learn where they hide in the daytime you can catch them. They are often attracted to lights at night.

One of the most common ones is the luna. Luna means moon and if you look at this insect you will see why it is called the luna or "moon moth." Its color is a beautiful light green. The edges of the wings are tinted with a light purple and upon each wing is an eyelike spot of the same color. Each wing ends in a long tail something like those of the swallowtail butterfly. These tails are of some use to the moth. In the daytime the moth hangs wings down on the underside

Spencer Photo

POLYPHEMOUS MOTH

LARVA MOTH

of leaves. These tails look like the stem of the leaf. As the moth itself is green, the whole insect looks very much like its surroundings and so escapes the eyes of most enemies that might try to find it. Learn to know the larvae and the cocoon of this insect. Perhaps you can collect a larva or a cocoon of this moth and watch it develop.

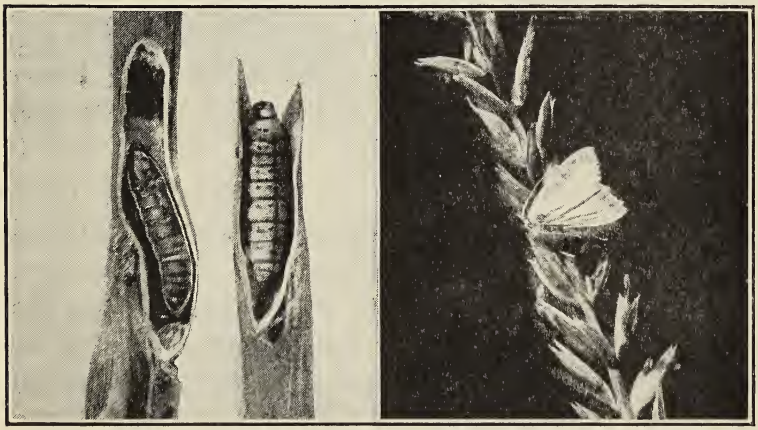
The cecropia moth is often found and brought to school. The cocoon is most often found. You will know it when you find it. It is hung like a hammock on the under side of a twig on orchard and shade trees. Sometimes it is found on low bushes and even on weeds in the fields.

The moth is very large, sometimes being as much as six inches across when the wings are spread. The body color is a reddish brown and the wings bear uneven lines about a half inch from the edge. The outer edge of the wings is a yellowish color and on each wing is a moon-shaped mark.

The larva is of a green color and covered with several rows of knobby stickers. This larva is often called the American silk worm. In fact it was raised for that purpose in this country at one time.

In 1840 there were about sixty thousand eight hundred eleven pounds of cocoons produced in this country. Much of this was produced in the northern states. Connecticut led in production with about seventeen thousand pounds. Pennsylvania produced seven thousand pounds; Virginia, three thousand one hundred ninety-one pounds; and Ohio, four thousand three hundred seventeen pounds.

In an insect book written about 1859 Mr. B. Jaeger speaks of purchasing two silk handkerchiefs at Wolf's Economy Store, eighteen miles below Pittsburgh, Pennsylvania, on the Ohio River. He says that these



Spencer Photo

EUROPEAN CORN BORER

PUPA AND LARVA MOTH

handkerchiefs were of fine quality and made of silk raised in that vicinity. So you see we produced some silk at one time.

There are many other moths for you to study in the fields and woods. We must look at the corn borer too. The corn borer is a moth that lays its eggs on the corn plant. The larvae bore into the stalks of the corn and weaken it. Then when a heavy wind comes along the corn blows over and does not produce corn. This pest is found in many states in the corn belt. If you drive a car through a region where they are common, you may be stopped by a United States government official whose duty it is to see that you do not carry any infected corn with you. Sometimes the corn borer gets into the ears of corn. If people were allowed to carry corn into places where there were no corn borers, you can see what would happen.

Tent caterpillars are interesting because they live in a sort of tent that they make of silk in the trees. Every day they go out on the tree to feed and at night they return to their tents to sleep.

All of these insects have their enemies. Birds eat a great many of them. A robin or thrush may carry as many as fifty to the nest during a day. And when you think of all of the birds that are working during the nesting season you can see that many are eaten by birds. You have learned that some of the wasps eat the larvae of insects and feed them to the young wasps. So you see the butterflies and moths have a hard time raising their families.

Sometimes these insects become a great nuisance and must be controlled. However most of us like to see the butterflies flitting about over the flowers in the fields. Many a happy hour is in store for the boy or girl who takes a net or his hat and goes into the fields to catch butterflies.

Things to do

1. Write a story and description of different kinds of butterflies.
2. Make drawings of each kind.
3. Make collections of each kind.
4. Make a collection of insect larvae.
5. Keep some larvae until they spin cocoons. Try to unravel the silk.
6. Collect cocoons.
7. Write the story of silk.
8. Tell how insects spend the winter.
9. Look at the wings with a magnifier.
10. Write about the woolly bear.
11. Look up the coddling moth and how it gets into apples.
12. Study the enemies of butterflies.
13. Look for pupae cases.
14. Make a list of places where insects feed.
15. Build a breeding cage.

ANIMALS THAT LIVE UNDER THE GROUND

The farmer boy and his dog were walking through a field. The dog jumping along ahead spied a mound of fresh earth. Off he went as fast as his legs would carry him. The farmer boy saw it too and ran toward it. Of course the farmer boy and his dog knew what this mound of earth meant as soon as they saw it.

Have you guessed what it is? It is the front door of a woodchuck or groundhog's home. The dog began to dig fiercely throwing dirt back of him in a shower. The boy just laughed because he knew about digging out woodchucks. Only the year before he had tried that. He had dug and dug only to find the woodchuck always kept ahead of him and finally got away.

Let us look at one of these woodchuck holes. It is a mound of earth with a hole six or eight inches across

leading down into the ground. It goes down for a little way, then turns upward. At the end the groundhog hollows out a room for a home. This room is lined with grass to make a nice soft bed. In this home the woodchuck's family lives.

Sometimes there is a back door. This back door is for emergencies. That is, if you would get too close or try to drown or smoke the woodchuck out, he would take to his heels and disappear out the back door. The back door is not so easily seen as the front door. There is no mound of earth to tell every boy and dog, "Here I am, come dig me out." Nothing like that. It is cleverly hidden away where few would notice it. There may be more than one back door to the burrow. So you see the farmer boy could well laugh at his dog for working so hard for nothing.

If we watch a burrow from a distance, we will likely see the woodchuck when he comes out to feed or lie in the sun before his door. He is as large as a big tom-cat and has brownish fur with long, coarse gray hairs in it. His legs are short, the back ones longer than the front. Both pairs are equipped with strong digging claws. When he makes his burrow he uses the front feet to dig with and the hind feet to throw the dirt back. The tail is short and when the woodchuck sits on its hind legs the tail acts as a prop to hold it up. The head is roundish and the ears are easily seen. The teeth are something like those of a rat, the long ones in front for gnawing and fighting, the larger ones in the back for grinding his food.

THE WOODCHUCK HAS HIS DINNER

When the woodchuck wants something to eat he goes to the nearest clover patch and begins to eat. Clover is one of his favorite dishes. He may make a mistake once in a while and take a meal from a farmer's garden, but if wild plants are plentiful he will likely satisfy his appetite nearer home. He comes out of his burrow in the morning and evening, and on these trips he is often seen. He cannot run very swiftly and is often caught by boys and dogs. If cornered, he will put up a fierce fight, grinding his teeth in terrible rage. As soon as he gets a chance to run away he goes.

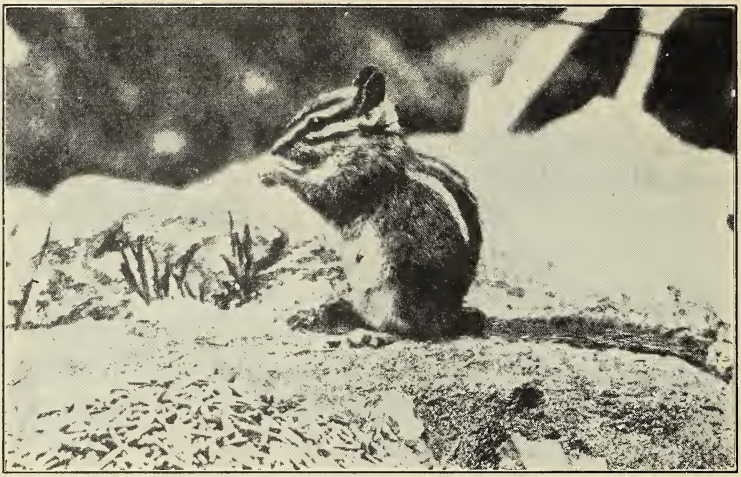
The young woodchucks are born early in the spring. There are usually four or five to a family. By June they are large enough to follow the mother about. If you could catch a young one it would become very tame and make an interesting pet. By the time fall comes the young ones leave the nest and make nests

for themselves. All through the summer the woodchuck is busy storing up food. It does not store up food in its burrow as the ground squirrel does. Where do you think it stores its food? Under its skin in the form of fat! All summer the woodchuck eats and eats and grows fatter and fatter. By the time fall comes he is fairly rolling in fat. Then he goes to sleep for the winter. He may come out on warm days to hunt for food, but if he does not get out, he has enough fat stored up in his body to last over the winter. When spring comes he wakes up and comes out hungry. We say hungry as a bear because the bear also sleeps the winter away and comes out hungry in the spring.

There is an old saying that the groundhog comes out of his burrow on February second. If he sees his shadow he will return to his burrow and sleep for another six weeks. If he does not see his shadow, he can be assured of good weather and need not go back to his bed. Of course we know that this does not have anything to do with the weather. Many people believe in such "signs" and think that the groundhog is a real weather prophet. The fact is, he is not as good a prophet as you are.

The woodchucks or groundhogs are interesting animals and make good pets. They do some damage to crops but they can be controlled by poisons if they become too bad. Let us hope that there will always be a few about for us to see.

We will find another ground dweller probably on the same farm. He is the little chipmunk. "Chippy"



U. S. Biological Survey

A CHIPMUNK

is a happy active creature and always sure to attract attention. His soft brown fur with the black stripes on the sides is quite attractive. As he sits on a log and saucily cries, "chip—chip—chip" every boy at once gets the idea of catching him. But approach one step farther than he thinks you should, and he disappears.

He usually makes his home near rocks. It is a hard matter to dig away rocks to get at him. Sometimes he builds in open ground or near fences. The roots of a tree offer a safe hiding place for him.

Into his burrow he takes his winter food supply. Corn, seeds, nuts, all are good food for him. Many are the busy days he puts in carrying food in his cheeks to his home. Between times you may see him sitting up on his hind legs gnawing away at a nut.

When winter comes, the chipmunk is well prepared and goes into his home with a well-stocked pantry for the long winter. The scientific name of the chipmunk is Tamias. Tamias is a Latin word which means "the steward."

He is a sociable chap and great numbers of them are often found living together. It is said that several pairs may live in one burrow over the winter and share the same stores. There are usually four or five young to a brood and perhaps two broods each season. By late summer the young are grown large enough to take care of themselves.

The chipmunk does not leave any big pile of dirt to mark the opening of its burrow. Quite the contrary; the entrance is often well concealed. A long crooked tunnel leads into the home. The excavated dirt is carried some distance away, so that it will not expose the location of the burrow.

At the first signs of spring out they all come as if awakened by some magic word. Hopping, chipping, frisking about they go.

There are other dwellers under the ground that we must find. Of course you know what a ground mole is. Perhaps one has gotten into a flower bed or a garden at home. The mole travels under ground near the surface humping the dirt up in ridges as he goes.

Most people think the mole is an enemy, but if the truth were known he does some good. To be sure he digs up the flower beds and gardens but not to get roots. In fact a mole will not eat roots unless they get

C. Clarke

A MOLE ON HIS TUNNEL

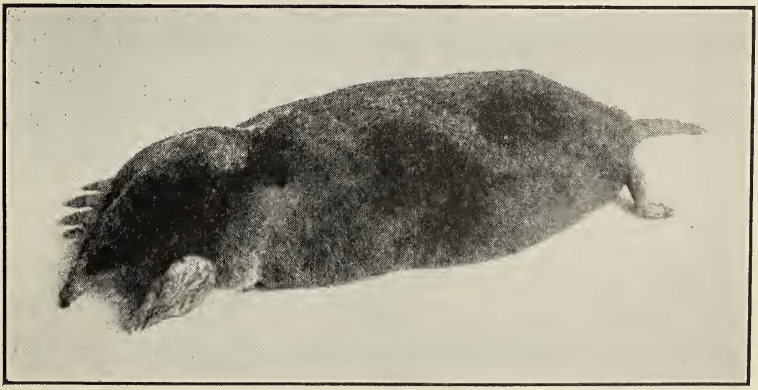
in his way as he digs along. What do you suppose he is digging for? He is hunting for insects and worms. Now here is where he is our friend. He goes through the ground and hunts out all the insects he can find. He devours each one and searches for more. What an appetite he has and how he works to satisfy it!

It would be interesting to observe this little miner at close range. He has a short, stubby, ratlike body. His fur is grayish and as soft as silk. Look for his eyes. He is blind. Down under the ground where he lives he does not need eyes. His legs are very short and are equipped with strong feet for digging. His nose is somewhat pointed and his tail is so short as to scarcely deserve the name.

Down deep in the ground, probably under the roots of a tree, he makes his real home. This home is reached by a number of entrances. Each entrance has a number of blind alleys leading off it to fool the unsuspecting. If you could see the real home, you would see that it consisted of a number of galleries surrounding the nest chamber. He has it arranged so that he can make his escape if he is forced to leave in a hurry.

The fur is sometimes used for coats and trimmings. One skin is not very valuable, bringing only a few cents. Think how many of those small pelts it would take to make a fur coat. If you get an opportunity to study the mole at close range do so. You will find he is an interesting creature and a very industrious one.

Under a corn shock a field mouse has her home. Sometimes she builds it in the ground, but under a



U. S. Biological Supply

GROUND MOLE

U. S. Biological Supply

A FIELD MOUSE

fodder shock is a better location, for there it is nice and warm and food is close at hand. Every country boy knows about the field mice under the fodder shocks. At husking time many are killed when the shocks are torn down to husk out the corn. The field mouse makes an interesting pet. If kept in a box of moist earth or sand it will soon dig a burrow for itself. Any food given to it, such as corn and seeds, will be stored away in the burrow. Sometimes it digs a hole into the ground with an enlarged chamber at the end. Here the young are raised. Several broods are raised in one season with four or five young in each brood.

It would seem that there would soon be too many of them. But they have many enemies. Owls, hawks, shrikes, and other birds eat them. Skunks, weasels, foxes, and other large animals eat them also, and if there is a house cat about it too will enjoy a meal of meadow mice. In fact her enemies are so many that the meadow mouse does well to keep going at all.

The meadow mouse has a short thick body. The color is dark brown above and grayish beneath. The legs are short with mouselike feet and the ears are also short. If you can find one for your schoolroom you can learn many interesting things about it.

There are many more dwellers under the ground. The common rabbit often digs a burrow for a home where the young are born. The rabbit may take up abode in some used groundhog hole, but if necessity demands it digs a burrow of its own. If you lived in the prairie country you would find the prairie dogs. These interesting animals live together in great numbers. The whole group is spoken of as a town. If too many of them get together they will ruin the land. So they must be controlled. This is usually done by putting out poison bait or putting poison gas into the burrow.

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THE PRAIRIE DOG

One of the worst criminals of the animal world lives under the ground. It is the weasel. This long, tawny snakelike animal goes about killing all of the ground dwellers he can find. If he satisfies his hunger, he kills for the love of killing. He is much feared by the animals that dwell beneath the soil.

There are many other dwellers under the ground. However with this start you can find many more and perhaps you can learn to know as much about them as the farmer boy and his dog.

Things to do

1. Find a woodchuck hole.
2. Describe the woodchuck and tell how he gets food.
3. Draw a picture of the woodchuck and his nest.
4. Tell about groundhog day.
5. Learn of his food value.
6. Get a groundhog for a pet. What sound does a groundhog make?
7. Describe the chipmunk.
8. Tell what a chipmunk eats.
9. How does the chipmunk make its home?
10. Describe the mole and draw his picture.
11. Write a story to tell what the mole eats.
12. Describe the field mouse's home. Get one for a pet. What does he eat?
13. Describe the prairie dog's home.
14. Describe the gopher. Where do gophers live?

NAME THESE FURRY FRIENDS

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(Boldface numbers indicate pictures)

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