

WEBS AND THEIR WEAVERS

Among nature's beautiful designs, few can surpass the intricate beauty of a spider web glistening with dewdrops in the early morning sun. And few are so immediately and obviously functional. To watch a fly's unsuccessful twisting and turning in the sticky strands of a web is to observe an effective food-trapping device in action.

To many, spiders are far less worthy of admiration than their webs, but in fact, spiders are marvelous creatures. Some people think spiders are insects, but this is not so. They are related to insects in that both are **arthropods**, having jointed legs and external skeletons, but much of the similarity ends there. Spiders have two body parts (**cephalothorax** and abdomen), and insects have three (head, **thorax**, and abdomen). Spiders have eight legs, but insects have only six. Most insects possess both **antennae** and wings, whereas spiders lack both. Spiders have **pedipalps**, appendages located between the jaws and the front legs, but insects do not. These pedipalps are sense organs that also function as sex organs in males.

Spiders belong to the class Arachnida, as do scorpions, mites, and daddy longlegs (harvestmen). The scientific name is derived from the Greek word for spider, Arachne, which commemorates the name of a legendary Greek maiden who challenged the Goddess Athena's spinning ability and was turned into a spider for her audacity.

The English word spider is a corruption of "spinder," one who spins. Almost all spiders can spin silk and are able to do so from birth. The spinning organs are finger-like projections called **spinnerets** that can be extended, withdrawn, compressed, and to some extent, aimed. They are located near the end of the abdomen on the undersurface. These spinnerets are tipped with many "spigots" from which the silk is released. The silk is produced from glands within the abdomen; as the fluid leaves the spider's body, it hardens quickly to form the

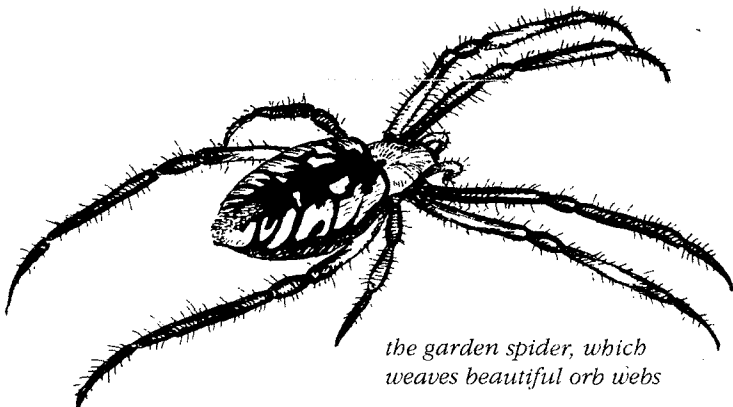
familiar silken thread. Scientists have identified at least seven different kinds of spider silk, each used for a specific purpose.

Spider silk has considerable strength and elasticity. A rope of spider's silk one inch thick would be stronger than a one-inch steel cable. Some of the threads will stretch nearly one-half their length before they break. The thinnest lines are only one-millionth of an inch wide, and thus invisible to humans, but other lines are much heavier.

Not all spiders spin webs, but those that do, use them to catch insects. When an insect is caught in a web, the spider (often hiding off to the side) feels its struggles to escape. A spider can determine from the pattern and strength of the vibration whether **prey** has been caught, a mate is signaling his arrival, or a **predator** is approaching. Generally, if an insect is caught, the spider rushes toward the prey and injects it with venom or throws a strand of silk over it to disable it. Many spiders wrap their prey in silk to trap and store them before eventually ingesting them. Spiders have small mouths and cannot eat solid food. They must either inject digestive fluids into the insect's body or secrete these fluids over it to dissolve the tissues that they then suck in. If an unpalatable insect is caught, the spider will cut the threads around it until the insect drops out of the web.

Webs vary greatly in complexity and structure, but there are a few fairly common and distinctive types. Sheet webs are easily recognized. The principal part of the web consists of a more or less closely woven sheet in a single, usually horizontal, plane. A funnel web is similar to a sheet web, the difference being that a funnel descends from the web to form the spider's hiding place. A large family of common spiders weaves cobwebs. These tangled, irregular webs are sometimes made under or in objects like leaves or stone walls. The black widow spider is a cobweb weaver.

The large conspicuous webs often seen on tall grass or suspended between dead tree branches during the summer are orb webs. These resemble large wheels and sometimes have a zigzag band of silk running through the middle that is thought to serve as a lure for flying insects because it reflects ultraviolet light just like a flower. The characteristic design of this kind of web includes a number of supporting spokes made with dry and inelastic silk on which has been spun a spiral of sticky elastic thread. The spider does not become entangled in its web because it steps only on the dry spokes and not on the sticky lines. Also, many web-spinning spiders secrete an oil that prevents them from sticking to their webs.



the garden spider, which weaves beautiful orb webs

One of the most familiar orb weavers is the black and yellow garden spider. Some species of orb spiders such as this one remain at the center of the web. Others hide in a nearby retreat where they can feel the vibrations of struggling prey along a so-called trap line that is stretched tightly from the center of the web to the den. The sensitivity of the spider to these vibrations, and its ability to interpret them, is remarkable.

Despite the effectiveness of silken webs for catching food, some spiders do not build webs, but instead stalk or ambush their prey. Wolf spiders, jumping spiders, and fishing spiders all go out and hunt their prey, whereas crab spiders wait in ambush for unsuspecting insects.

During the late summer and early fall, web-spinning spiders are apt to make or repair their web every day, as large insects, once entangled, quickly destroy the webs. Most of this activity takes place around sundown. Often spiders will eat the old web before spinning a new one.

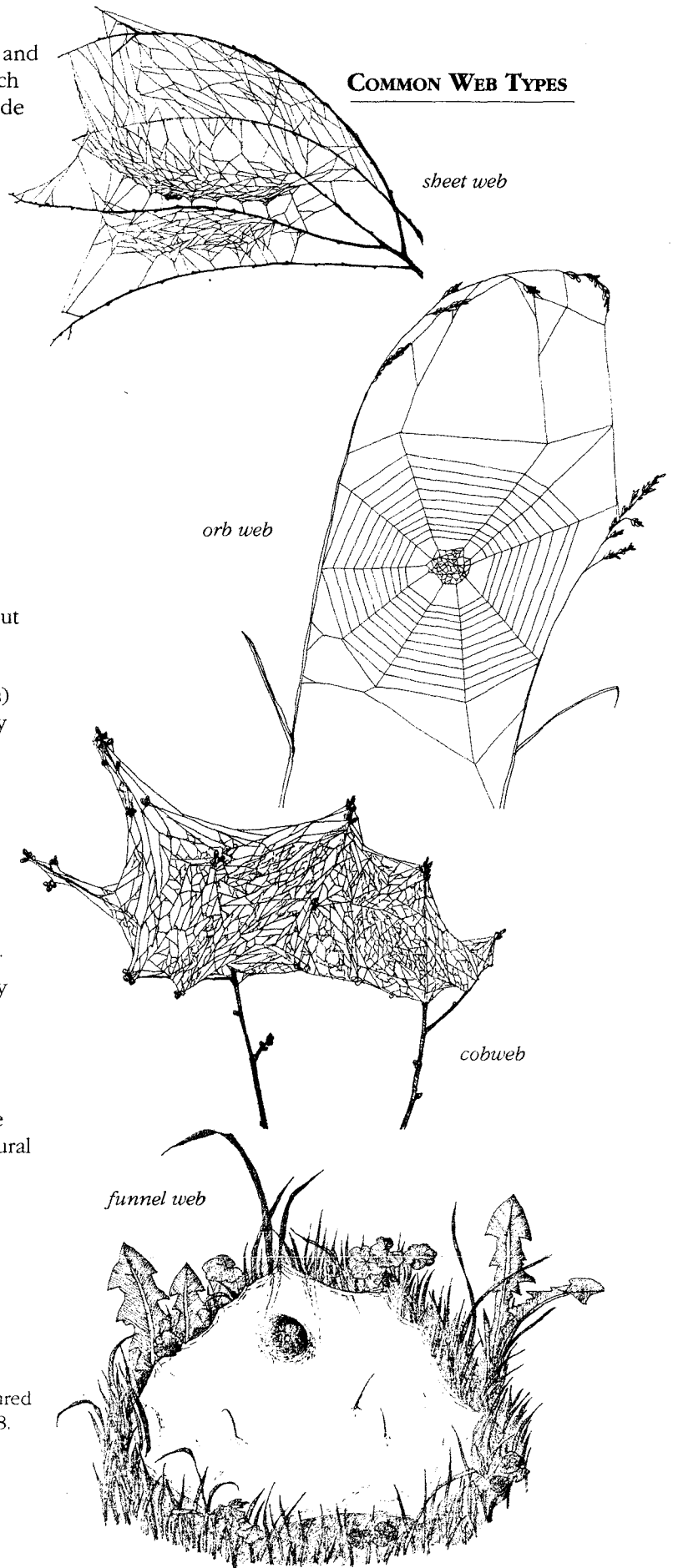
Besides being used for webs, silk is also used for draglines. Wherever the spider goes, it always plays out a silken line that acts as a securing thread, preventing falls and helping spiders to escape predators. Young spiders of most species (and adults of very small ones) spin unattached draglines in conditions of warm, fairly still air. Rising air currents lift the dragline and carry it away with the spider in tow. This is called ballooning, and it helps spiders reach new habitats. Additionally, some spiders use silk as a coating around their egg masses. Others line their burrows with silk. Some water spiders even use silk to trap air under water.

It would seem logical that spider silk, being so abundant and strong, might be used commercially by humans. It is usable as fabric material in the same way as the silk of the silkworm. Although using spider silk has been tried, it was found to be impractical. One of the main problems is that spiders are cannibalistic, making it difficult to rear and feed large numbers in a small space. Therefore, you will have to observe these creatures and their wonderful silk creations in the natural world, or perhaps in your very own kitchen corner.

Suggested References:

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COMMON WEB TYPES



Spiders and Webs

ACTIVITIES

FOCUS: Spider webs are beautifully designed to carry out their food-trapping function, and so are the spiders that make them.

OPENING QUESTION: *What are some of the special characteristics of spiders?*

PUPPET SHOW

Objective: To learn some of the differences between spiders and insects.

Perform, or have the children perform, the puppet show. Afterward, discuss the differences between spiders and insects.

SPIDER SPYING

Objective: To observe a variety of live spiders and examine the design of their bodies.

Bring in a variety of live spiders (only one per jar) for the children to look at closely. Have the children use hand lenses to examine the various parts of the spider's body. Notice the number of legs, eyes, and body parts, the coloration, and the hairiness. Have them look for the spinnerets (on the underside of the abdomen) and the pedipalps (on either side of the mouth parts). Is the spider male or female? (mature male spiders' pedipalps have bulbous tips) Make sure the children examine a number of different spiders to note similarities and differences. Look for silk in the jar, draglines, or silk threads coming out of the spinnerets. Remember to release the spiders back where you found them.

Materials:

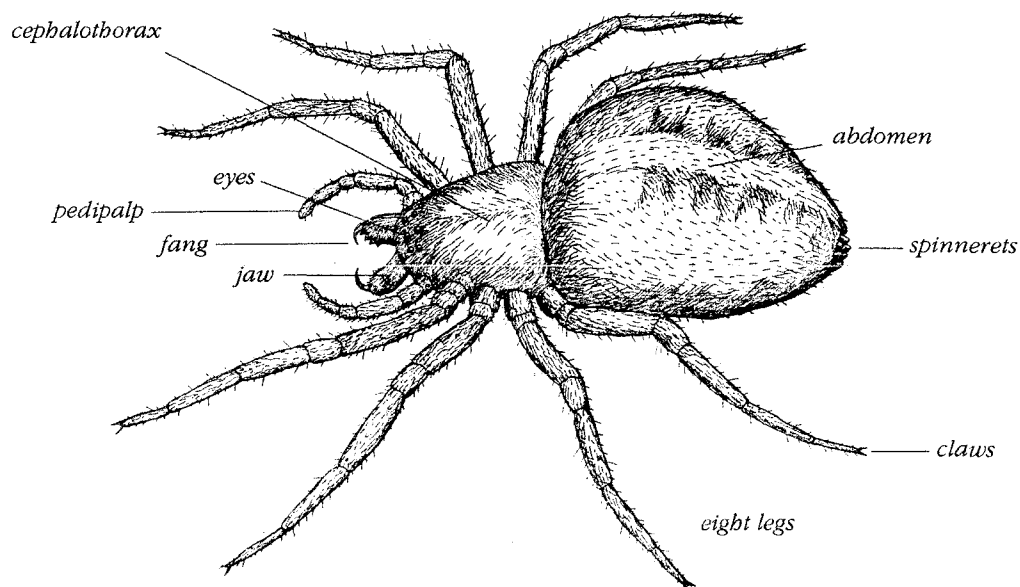
- script
- puppets
- props

Materials:

- live spiders in clear jars with perforated lids, one spider and a moist cotton ball in each jar
- hand lenses

Note: Some people are afraid of spiders. Encourage but do not force the children to hold a spider jar; perhaps you could hold it. If appropriate, discuss some common fears about spiders and the facts or fictions behind these fears. Explain that learning about something often helps people to overcome their fears. If poisonous spiders live in your area, give the children information they should know about these species.

PARTS OF A SPIDER



FELT BOARD SPIDER

Objective: To review the special features of a spider's body.

After the children have had an opportunity to view live spiders, have them work in small groups to build a model of a spider using a felt board and cutouts. Groups may want to re-examine some live spiders as they work. When all are finished, use a spider anatomy diagram to review the structure of spiders and the functions of the various body parts.

SPIDER SENSATIONS

Objective: To experience how web-spinning spiders use their sense of touch to detect motion made by prey captured in their webs.

Ahead of time, make a "web block" for each group by hammering a staple into a block of wood and tying five six-foot lengths of yarn to the staple. Divide the children into groups of six and give each group a web block to put on the floor in the center of their circle. Designate one child to be the spider; the remaining five will be insects. Have the spider crouch next to the web block with eyes closed while each insect takes one strand of the yarn. Insects should spread out so the strands radiate in all directions from the web block; the strands are held taut, next to but not touching the ground. The spider's hands rest lightly on top of the five strands in order to feel any vibrations. The leader points to one insect who plucks its strand once. The spider crawls to the end of the strand that vibrated and, if correct, changes places with the insect. If incorrect, the spider gets another try.

SPIDER SUPPER

Objective: To learn the process by which many web-spinning spiders capture and eat their food.

In small groups, gather around a spider web wheel. Explain that children are going to act out the process by which spiders capture and consume their food. The leader provides props and assigns a stage in the process to each child. Have the children act out their part (sound effects encouraged!) as the group addresses the following questions.

For our spider, the story begins when:

Child #1 Places spider on web

Child #2 Places fly on web

Child #3 Makes spider pounce on fly

Child #4 Wraps fly in yarn

Child #5 Places second fly on web

Child #6 Helps second fly escape from web

Child #7 Acts out spider eating first fly.

Question:

Where do spiders sit on the web?

Why doesn't the spider get stuck in the web?

Why pounce on a trapped insect?

Why do spiders wrap their prey?

How do spiders eat their prey?

What challenges do some spiders face as predators that the use of a web helps them overcome? (small, wingless, poor eyesight, relatively slow compared to winged prey) What about the spiders that don't build webs – how do they capture prey?

Materials:

- felt board
- spider anatomy diagram (*see Parts of a Spider*)
- felt cutouts of spider body parts: cephalothorax, abdomen, eight legs, eight eyes, pedipalps, spinnerets

Materials:

- blocks of wood (about 2" x 4" x 6") with five six-foot lengths of yarn tied to a large staple in the center

Materials:

- bicycle wheel with yarn woven in concentric circles through the spokes
- 1 spider (made of pipe cleaners)
- flies (decorated clothespins work well)
- pieces of yarn

SPIDER SCAVENGER HUNT

Objective: To observe a variety of spiders and webs in the natural world.

Introduce the different web types using illustrations or photos. Divide older children into pairs, younger children into small groups with a leader. Each group receives a Spider Hunt card. The children should search for as many of these items as possible, within set boundaries and a given time limit. On dry days, misting the webs with water makes them more visible.

SPIDER HUNT CARD

See if you can find:

A messy web (a cobweb)

A web shaped like a sheet

A web shaped like a sheet with a funnel on one side

A web shaped like a wheel

A spider on a web

An insect caught in a web

A captured insect wrapped in silk

Part of a web that is sticky (look for liquid beads on the web, or lightly touch it)

Part of a web that is not sticky

A web near the ground

A web in a tree or bush

A spider egg case

A spider not in a web

Materials:

- illustrations of different web types
- Spider Hunt cards
- clipboards
- (optional) water mister

WEAVING A SHARING CIRCLE

Objective: To allow children to reflect on and share information about spiders.

Have the children sit in a large circle. Give a ball of yarn to one child who then completes this sentence: "One special thing about spiders is ____." That child holds on to the end of the yarn and rolls the ball to another child. This second child then shares one special thing about spiders, holds on to the string of yarn, and rolls the yarn ball to another child. Continue until you have created a messy sheet web on the ground and all have had a chance to speak.

Materials:

- ball of yarn

ACTIVITY STATIONS:

- 1) Felt Board Spider & Spider Spying
- 2) Spider Sensations
- 3) Spider Supper

EXTENSIONS

Diary of a Spider: Ask each child to find and watch one spider over a period of days or weeks and keep a journal of its activities. Suggest they go out at night with a flashlight to watch their spider constructing a web. Encourage the children to record their observations through illustrations, photographs, or videos.

Model Spiders: Provide recycled materials (foam balls, pipe cleaners, egg cartons, map tacks) for the children to use to construct a model of a spider. Younger children could hang theirs on a large bulletin board web.

Spider Sketching: Give each child a live spider to draw as if it were magnified to fill the paper. Use field guides to identify and research the spider.

Spider Folktales: Spiders are characters in the folktales of many cultures. Have the children read a variety of these stories and then create one of their own.

Web Design: Have the children construct pictures of different web types (orb, sheet, funnel, tangled) on paper. They should first draw the design in pencil, then cover the lines with glue and yarn or just colored glue.

Spiders and Webs

PUPPET SHOW

Characters: Benjy Bear, Charlotte Spider, Rhonda Robin

Prop: suitcase

Benjy Bear

Aren't you excited about tomorrow's big celebration, Charlotte? I can hardly wait!

Charlotte Spider

What celebration, Benjy Bear? The news hasn't made it to my corner of the woods.

Bear

We're having a big party to thank the Earth Fairy for this wonderful season. All the animals of the woods are doing something special for her.

Spider

Great! What are the spiders doing?

Bear

Well, all the insects are going to fly in a big parade in the air!

Spider

Fly?! But spiders can't fly.

Bear

Oh my, you can't? I don't understand it. I thought all insects could fly!

Spider

Well, most insects can fly, but spiders aren't insects. Everyone thinks we are, but we belong to a different class all together. We're called arachnids.

Bear

I never knew that. I always thought you were insects.

Spider

No, no. We're really very different. Spiders have no antennae and no wings, and we have eight legs. Insects only have six legs.

Bear

Eight legs! Let's see if that's right. *[Bear counts to seven]*

Spider

No, no, Benjy. You missed one, I'm sure. Now count again.

Bear

OK, OK, but I could use some help. Will someone please help me count? *[all count to eight]* Goodness. Eight legs and no wings! You really are very different from insects. I don't know what you spiders are supposed to do. If you don't have any wings, you can't very well be in the air show.

Spider

You mean no one has come up with anything special for the spiders to do! *[whimpering]*

Bear

Well, uh . . .

Spider

Why does everyone forget about us spiders? *[crying]*

Bear

Now don't cry, Charlotte. It's not that we forgot about the spiders; we just thought you were insects. I'm sure we can think of something special for you spiders to do. What else can you tell me about spiders?

Spider

Well, most of us have eight eyes. How many animals do you know with eight eyes?

Bear

Eight eyes! I hope you never need glasses.

Spider

Well, it wouldn't matter so much if I did. I can always hunt for my food by feeling it.

Bear

Hunt for food by feeling it? But you must have to catch it before you feel it.

Spider

Oh, we do. We catch our food and we know we've caught it when we can feel it.

Bear

Charlotte, I'm confused! What **are** you talking about?

Spider

Many of us spiders spin a web – a sticky silk web. Mine is shaped like a wheel, but other spiders spin different designs. Then we sit and wait.

Bear

Wait? For what?

Spider

We wait for dinner time. When little insects like flies and moths fly into the web and get caught, we feel something moving. Then we rush out, wrap some silk around whatever is caught, and eat it.

Bear

Boy, you sure use a lot of silk. That must get expensive.

Spider

Expensive! Ha, ha, ha! We don't buy the silk, Benjy. We make it.

Bear

Spiders can make silk? Wow, I wish I were a spider!

Spider

But don't forget. If you were a spider, everyone would be calling you an insect. Oh, it's so depressing. I guess I'll just stay at home in my web during the big celebration. *[Spider walks off]*

Bear

Poor Charlotte! It's tough being a spider.
[Robin enters]

Rhonda Robin

Oh, Benjy, I'm glad I found you. I need your advice.

Bear

What's the problem, Rhonda?

Robin

I've been trying to find someone to decorate the forest for our celebration, but everyone is too busy.

Bear

Decorate the forest? What kind of decorations do you want?

Robin

Oh, you know, we need some white doilies and lacy garlands to hang in the trees.

Bear

Gosh, I wonder where we're going to get doilies and lacy garlands. Maybe somebody could make them for us. But who?
[pause; hopefully audience will suggest Charlotte the Spider] Charlotte Spider? Of course! The spiders could weave the decorations with their silk. It will solve our problem and make Charlotte so happy. The spiders will have something special to do for the big celebration.

Robin

What a great idea, Benjy. I'll go tell the Organizing Committee right now!
[Robin leaves; Spider re-enters carrying a suitcase]

Bear

Charlotte, Charlotte, where are you going with that suitcase?

Spider

The spiders just had a meeting. We can't stand the thought of a big celebration in which we have no part. So we've decided to move on to another forest. No one here will even miss us spiders.

Bear

But Charlotte, you can't leave. We **will** miss you, and besides, we **do** need you spiders. The spiders must make the decorations for our celebration! We need beautiful white doilies and lacy garlands to hang in the trees. Can you do that in time for tomorrow's festivities?

Spider

Of course! We spiders often spend our evenings spinning silk. Tonight we'll all work on spinning and weaving decorations. We could even string glistening beads of dew on each strand! Oh, Benjy, thanks so much for thinking of us.

Bear

Oh, no need to thank me, Charlotte. I'm just happy you'll be here to help us celebrate.

Spider

Well, you've made a lot of spiders very happy. I'd better go tell the others, Benjy, and then get right to work. We'll want to make sure this celebration is one that the Earth Fairy will never forget. Bye, bye, Benjy.

Bear

Bye, Charlotte. See you at the grand celebration.

Bear
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Spider
Expensive! Ha, ha, ha! We don't buy the silk, Benjy. We make it.

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Bear
Bye, Charlotte. See you at the grand celebration.

SPIDERS

SPIDER SPYING

Well ahead of time, scout out the location of a number of different spiders, so you'll be able to capture plenty to take in for your workshop. After you teach, release your spiders where you found them within about 24 hours.

Rather than making holes in jar lids, replace the lid with a piece of plastic wrap with small holes punched in it, gauze, or stocking, held on with a rubber band. Do include a stick or stiff grass stem for the spider to hang onto, as well as a damp cotton ball for moisture.

FELT BOARD SPIDER

Provide one of the teams with felt parts for a male spider (pedipalps with balls on the end) and the others with females (pointed pedipalps). After all spiders are complete, tell the group you can see that one group has a male spider. Ask the children to look at all the felt board spiders and figure out how you know.

SPIDER SENSATIONS

Make a transition to this activity from Spider Spying by asking students to look for hairs on the legs of the spiders. These are sensory and help the spiders catch their food. "Let's see how well you do at catching your food by feeling it."

SPIDER SUPPER

Rather than lugging around those bicycle wheels, right after Spider Sensations give each child (still seated around their block yarn webs) a plastic insect and a length of yarn. As you describe the process, have children act out how spiders locate, attack, and eat their prey.

Don't forget to mention wandering spiders, such as wolf, crab, jumping, and fishing spiders, that locate prey using their quite good eyesight.

WEAVING A WEB SHARING CIRCLE

Have children raise up the sheet web they've made while sharing and create a tangled cobweb, by moving their hands around.

