

Spiders



PURPOSE

To provide a badge so boys may learn more about one of the small parts of God's creation and gain a deeper appreciation of it.

LEARNING

1. Differences between spiders and insects:

- Spider bodies are divided into two parts (cephalothorax and abdomen); insect bodies are divided into three parts (head, thorax, and abdomen).
- Spiders have four pairs of legs; insects have three pairs of legs.
- Spiders have more than two eyes; insects have one pair of eyes.
- Spiders produce silk, also making more than one type of silk. Few, if any, adult insects produce silk. Those that do produce only one type.

2. Body parts:

- The cephalothorax (also known as the prosoma) is the front part of a spider's body. Most of the external appendages of the spider are attached here, including legs, eyes, chelicerae and other mouth parts, and pedipalps. It also contains the brain, venom gland, and some digestive organs.
- The abdomen (also known as the opisthosoma) is the rear part of a spider's body. It contains the organs for breathing, circulation, digestion, reproduction, and silk production.

3. Mouth parts:

- The chelicerae are a spider's jaws and are tipped with fangs; they are filled with muscles, and are used to hold prey while the spider injects venom. Some species also possess teeth that can be used to shred and mash its food.
- Located behind the chelicerae are other small mouth parts — the labium and labrum. Along with the chelicerae, these mouth parts work together to direct food into the spider's mouth, which is hidden behind the chelicerae and other mouth parts.
- Pedipalps are like the chelicerae and are also part of a spider's mouth. They are located between the chelicerae and first pair of legs on the cephalothorax. Pedipalps are jointed and look somewhat like small legs. They are used like antennae: pedipalps help the spider sense objects that it encounters. Some spiders also use their pedipalps to shape their webs and to aid in prey capture and feeding. Pedipalps are also used by male spiders to transfer sperm to female spiders.
- Eating: Before its food can enter the digestive system, it must be in liquid form or be reduced to very

small particles. So in a way, a spider "pre-digests" its food by processing and filtering it externally with its mouth parts.

After paralyzing its prey, some spiders may wrap it up in silk to make it easier to transport back to the nest. Some species actually cover the prey in silk before injecting the venom, making it easier to attack. A female spider may carry wrapped prey back to its young spiderlings. Most spiders do not eat their prey whole; instead they expel digestive enzymes onto or into the animal to liquefy it. Some spiders use their fangs to inject the digestive fluid directly into the animal. This sort of spider liquefies the animal's insides, leaving the exoskeleton more or less intact. Then it sucks the liquefied remains into its stomach through hairs on its chelicerae and mouth, which act as a filter. Other species chew their prey up with serrated "teeth" on the chelicerae before vomiting digestive fluid on the body and sucking in the liquid remains.

4. Almost all spiders produce venom. Only two spider families are known to be non-venomous — Uloboridae (a type of orbweaver with an almost worldwide distribution) and Holarchaeidae (only two species known to inhabit the forests of Tasmania and New Zealand). Spiders use venom to paralyze or kill its prey; this makes it safe for the spider to feed without risking a struggle.

5. The vast majority of spiders have either six or eight eyes. Spider eyes are considered "simple" as they do not have multiple lenses and facets as do the compound eyes found on most insects. Their eyes are also fixed, so they can't move them to shift their vision. Some eyes function simply to detect motion, some are much larger and aid nocturnal hunters, and some are only capable of distinguishing shades of light and dark. Eyes are arranged or grouped by their function.

The number of eyes and their arrangement varies by species and were created to match each species' habitat and the food it preys on. Their eye arrangement is often a key to identifying that species. A spider with six eyes might have them arranged with two on an upper row and four on a row just below.

6. All spiders produce silks. A single spider can produce many different types of silk for different uses. Silk is produced through tiny pores in a spider's spinnerets. Most spiders have six spinnerets.

- The spider's abdomen is tipped by spinnerets.
- Spider silk is a protein that is formed as a liquid by silk glands and squeezed out of the spinnerets like toothpaste from a tube. The liquid thread hardens as it leaves the spinneret. Most of the silk threads in a spider web are multiple strands of fine silk lying alongside each other. Spiders produce several types of silk from different types of spinning glands.
- One type of silk is major-ampullate (dragline) silk. This is used for the outer rim, spokes, and lifeline of the spider's web. It can be as strong per unit weight as steel, but is much tougher.

Capture-spiral silk is used for the capturing lines of the spider's web. It is sticky, extremely stretchy, and tough. The stiffest silk is tubiform (aka cylindrical) silk which spiders use for protective egg sacs.

Aciniform silk is used by spiders to wrap and secure freshly captured prey. It is two to three times as tough as the other silks, including dragline.

Another type of silk is minor-ampullate silk which is used for temporary scaffolding during web construction.

- Silks have many uses that vary by species, and sometimes even by a spider's maturity. The most common use of silks is for building webs, but spiders also produce silks to wrap egg sacs, wrap prey they have paralyzed or wish to restrain, line burrows or tunnels, or to conceal themselves or their young. Spiderlings (usually not adults) can also use silk to engage in ballooning or kiting to move from one location to another.
7. Not all spider species build webs in the strict sense of the word; some only spin silk to line burrows or wrap egg sacs. The wolf spider is one family that hunts for food instead of trapping it in a web. Most webs are built to capture prey for food. Some are built to rear young, hide from predators, or to restrain captured prey.

One of the common type of webs is a form of "orb," a shape of concentric circles. Others are named after the shapes they resemble, such as funnel or tunnel, sheet, bowl or hammock, and random or tangled webs (cobwebs). Some "webs" may only be a single strand of silk that is used as a trip or snag line.

8. Male spiders fertilize the eggs of the female spider and the female spider deposits the eggs when they have matured. Spiders do not give birth to live young.

Both the male and female reproductive organs are at the rear of the abdomen, but spiders do not mate by coupling these organs. Instead the male deposits some sperm onto a small web, picks it up on the end of his pedipalps, and then deposits it into the female's genital opening when she is in position. The female stores the sperm in receptacles near the ovaries. When she is ready to lay her eggs, sometimes months later, she uses the sperm to fertilize them. Some spiders may lay hundreds, or even thousands of eggs at one time.

Many spiders die after completing the reproductive cycle. In northern climates, they die at first frost. Some species capable of surviving freezing climates can live as long as two or three years. Some tarantulas and trap door spiders (found mainly in southern and tropical climates) can live six years or more in the wild. Some tarantulas have lived up to 20 years in captivity.

9. You may be able to find this information online, from a university extension service, or maybe even a pest control company in your area.

10. Example from Michigan: The black widow spider (*Lactrodectus hesperus*) is the only indigenous species that has venom toxic enough to cause a severe reaction in people of all ages and health. There are unsubstantiated reports of brown recluse spider (*Loxosceles reclusa*) sightings or bites, but it cannot survive temperatures below about 40°F (4°C), so it is not considered indigenous. This will be true of most northern climates that experience many months of cold and freezing temperatures. This climate generally limits the growth period, which limits the overall size, so therefore the amount of venom that can be produced. Most dangerous species will be found in southern North America and in tropical climates.

11. Although the harvestman (daddy-long-legs) and spiders both belong to the class Arachnida, harvestmen are in the order Opiliones. Therefore, they are not spiders, which are members of the order Araneae. Both have eight legs, simple eyes, and two segments to their body.

Harvestmen segments are very broadly divided and give the appearance of a single oval structure and they only have a single pair of eyes. They also do not produce venom or silk. Harvestmen can also ingest solid particles of food and not just liquid like true spiders.

DOING

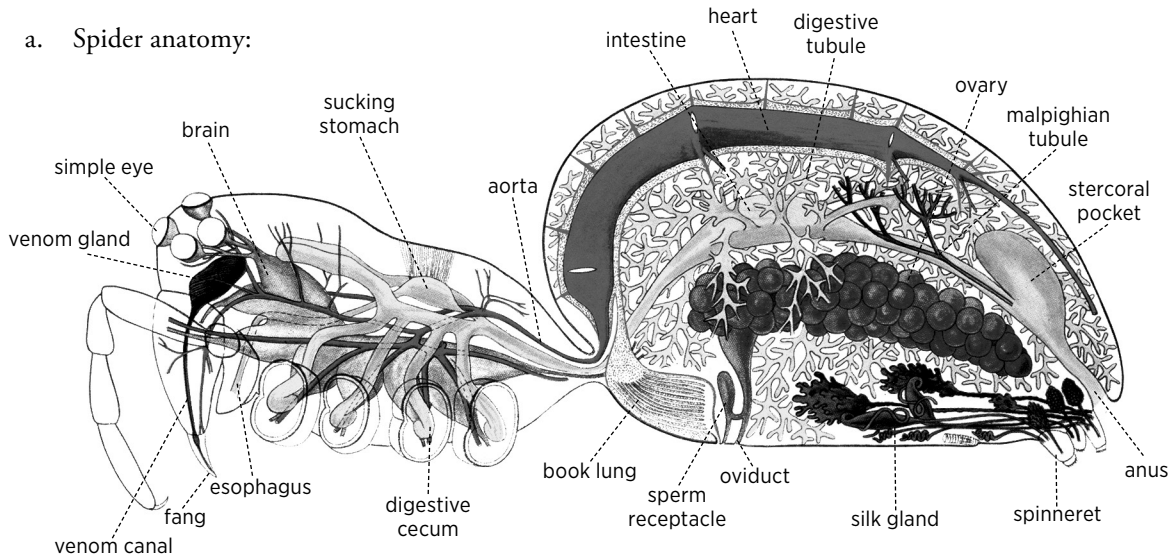
1. Spiders that are not harmful to humans can be beneficial because they prey on small insects and pests and they can prevent these critters from invading your home. Shiny orb weavers and house spiders both feast on insects like crickets, flies, and other small, flying insects. Wolf spiders are more likely to hunt insects that may invade the garden. A cellar spider can be beneficial because it hunts black widows, one of the types of spiders that is dangerous. Even the black recluse has a benefit — it will eat cockroaches and other larger insects.

In fact, in absolute terms, spiders eat more insects than birds and are better at pest control (they chow down on the little insects that are too small for birds and on young insects that haven't bred yet).

Surprisingly, spiders can actually be beneficial to the health of humans! Many of these insects the spiders prey on could be disease-carrying insects. Spiders preying on them could prevent them from spreading that disease. Meanwhile, spider venom is not always a negative thing. Spider venom has been researched for years by neurological experts. Spider venom can often be used to prevent brain damage in stroke victims.

However, there are numerous very poisonous spiders in the world. The affect of their venom can pose a serious danger to health and even be life-threatening. Besides the venom, a spider bite can, under certain conditions, also transmit diseases. Far less a threat, and mainly just a nuisance, is the fact that spiders can create minor housekeeping problems because their webs collect dust, remnants of their meals, and old egg sacs.

2. a. Spider anatomy:



b-d. Self-explanatory. Some samples are shown below.

Brown Recluse Spider (*Loxosceles reclusa*) is also known as the violin spider. It is most commonly found in the Midwestern and southern states of the United States.

Usually found in secluded, dry, sheltered areas such as underneath structures, logs, or in piles of rocks or leaves. Indoors they may be found in dark closets, shoes, or attics.



The brown recluse spider cannot bite humans without some form of counter pressure, for example, through unintentional contact that traps the spider against the skin. But the brown recluse is known to be aggressive. Bites may cause a stinging sensation with localized pain. A small white blister usually develops at the site of the bite. The venom of a brown recluse can cause a severe lesion by destroying skin tissue (skin necrosis). This skin lesion will require professional medical attention.



Black Widow Spider (Western black widow [*Latrodectus hesperus*], Southern black widow [*Latrodectus mactans*], Northern black widow [*Latrodectus variolus*]) are found throughout North America, but are most common in the southern and western areas of the United States. Usually found

in undisturbed areas such as woodpiles, under eaves, fences, and other areas where debris has accumulated. They may also be found living in outdoor toilets where flies are plentiful. Black widow spiders build webs between objects, and bites usually occur when humans come into direct contact with these webs. A bite from a black widow can be distinguished from other insect bites by the two puncture marks it makes in the skin. The venom is a neurotoxin that produces pain at the bite area and then spreads to the chest, abdomen, or the entire body.

Hobo Spider (*Tegenaria agrestis*) is found throughout the Pacific Northwest, they build funnel webs in holes, cracks, and recesses. They may be found in retaining walls, and in foundations, window wells, and stacks of firewood and bricks. Indoors they can nest between boxes or other storage items, on window sills, under baseboard heaters or radiators, behind furniture, and in closets. Hobo spiders do not climb like most spiders but are fast runners. These spiders are much more likely to attack if provoked or threatened.

The bite of a hobo spider may go unnoticed; however a moderate to severe, slow-healing wound will develop.

