

But Why: A Podcast for Curious Kids

[Why Don't Spiders Get Stuck In Their Webs](#)

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[Jane Lindholm] This is *But Why: A Podcast For Curious Kids*, produced at Vermont Public Radio. I'm Jane Lindholm and I love learning about all of the topics we cover on this show.

You send us the questions and we find the answers and then we all get to learn something in the process.

Today, we're covering something that almost everyone has some experience with: spiders. But a lot of people have the wrong idea about spiders. They think they're creepy or scary or out to bite you just out of spite, but not you, you curious *But Why* listeners. You've sent us lots of questions about spiders that make it clear you are eager to learn more about these remarkable creatures. Here to help answer your spider questions is Catherine Scott. She's an Arachnologist.

What is an Arachnologist? Why, it's someone who studies arachnids, of course. But what's an arachnid?

[Catherine Scott] An arachnid is an animal that has eight legs. And that's the main defining feature.

Spiders are arachnids, so all spiders are arachnids. But not all arachnids or spiders. There are several other kinds of animals that also have eight legs that are closely related to spiders but aren't spiders.

There are other arachnids like scorpions, like mites and ticks, and there's a bunch of other ones as well.

[Jane Lindholm] So most of our questions, well, all of them really, are about spiders which are probably the most famous arachnid. Why do you study spiders?

[Catherine Scott] I study spiders because their behavior is fascinating. I also think they're really beautiful and everything about them is interesting. But I'm particularly interested in their behavior and how they communicate with one another. Basically, what I study is how spiders talk to each other, but they don't talk to each other like we do. They use chemicals called pheromones and they also use vibrations and other ways of talking to each other.

[Jane Lindholm] I always think of spiders because I guess that's how I see them as solitary animals. They're by themselves. They do, though, communicate to one another?

[Catherine Scott] You're right that most spiders are solitary and they spend most of their lives alone, but all spiders reproduce sexually, so they at least have to get together when they want to make offspring. So in order for a male spider to find a female spider, they have to communicate somehow. He has to figure out where the female is. And so that's where these chemicals called pheromones come in. The female basically has to produce like a perfume that she produces that the male can smell from some distance away in order to find her. Not all spiders rely only on chemicals to find each other. Some spiders

have good vision and they can just see each other because they're wandering around all the time. But your typical solitary web building spiders, you know, the female is sitting on her web and she basically stays there her whole life. So in order to mate and reproduce, a male spider has to come to her. And so she has to communicate where she is in order for him to find her.

[Jane Lindholm] So that perfume says, "Hey, I'm over here, I'm ready to make babies."

[Catherine Scott] Exactly.

[Jane Lindholm] All the questions about spiders are really interesting but let's start with the first one from Sasha because this is a fundamental question, Catherine.

[Sasha] I'm seven years old. I live in New York City and my question is, Why do spiders have eight legs and eight eyes? Can't they just handle four legs and two eyes like most predators or two legs and two eyes like a few other predators?

[Catherine Scott] I really like this question. It's a little bit hard to answer, but I'm going to try. So having eight legs gives spiders some advantages. For example, if a predator grabs them by their leg, the spider can actually drop their leg and run away and survive. And then they can get around just fine with only seven legs or even fewer. So I've actually found some spiders running around with only four legs because they have dropped the other ones when a predator was trying to attack them. They bit the leg and then the spider is able to go like, "Well, I'm just going to leave that leg behind and run away to survive". And the thing about spiders having eight eyes, it's true that most spiders have eight eyes, but not all of them do. Spiders can actually have eight eyes, six eyes, four eyes, only two eyes like we do, or even no eyes at all. So some spiders live in caves and they spend their entire lives in the dark so they don't need eyes, so they don't bother with them.

[Jane Lindholm] While we're talking about eyes, let's listen to this question from a three year old in California.

[Jonah] My name is Jonah. My question is how do spiders see?

[Catherine Scott] The number of eyes and how well spiders see depends on what kind of spider you're talking about. Hunting spiders, like jumping spiders and wolf spiders, have one pair of really large eyes that allows them to see prey and each other really well. But many spiders that live in webs can't really see images with their eyes like we can. They can only detect things like light and dark and movement. And so they rely much more on their senses of touch, smell and hearing than on its eyesight.

[Jane Lindholm] Does having eight eyes, the ones who do have eight eyes, give them an ability to either see in more directions than we can see or see differently than humans see?

[Catherine Scott] Yes, so for jumping spiders, for instance, they have eight eyes and they're spaced all around their head.

So that means that they have almost 360 degree. Like if we had eyes on the back of our heads, we'd be able to see behind us as well as in front of us. So having eight eyes spaced out definitely does give spiders some advantages.

[Jane Lindholm] Some human parents claim that they have eyes in the back of their head and they can see what's happening when their kids are behind them, but spiders really do in some cases?

[Catherine Scott] Yes, some spiders actually do have eyes on the back of their heads.

[Jane Lindholm] The other thing that everybody knows about spiders is that they build webs. But I think maybe not all spiders. But let's listen to some of our web questions.

[00:06:33]

[Niko] My name is Niko. I'm five years old.

[Jolie] My name is Jolie and I am eight years old.

[Melie] My name is Melie and I'm eight years old.

[Niko, Jolie & Melie] We all live in Los Angeles, California and our question today is, How do spiders make their webs?

[Anera] My name is Anera. I live in Atlanta, Georgia. I'm seven years old. I want to know, How do spiders make spider webs?

[Silvia] My name is Silvia. I am four years old and I live in Boston, Massachusetts. My question is, How do spiders produce their silk?

[Catherine Scott] First, let's talk about how spiders make silk. So they have storage facilities called silk glands in their abdomens. The abdomen is the back end of the spider and they store the building blocks of silk in liquid form in these silk glands. So when the spider wants to make silk, the liquid moves out of the gland through a valve that's controlled by the spider's muscles. And then it's released out of tiny openings called spigots on the spider's spinnerets, which are located at the tip of their abdomen. So the liquid silk then turns solid as it leaves the spider's spinnerets.

[Jane Lindholm] It's kind of like silly string? Is that right? I mean, if anybody's ever played with silly string, it's kind of like a liquid or, you know, not solid inside the can. But as soon as it comes out, it turns into a solid. That's what spider silk is like?

[Catherine Scott] Pretty much. Yeah, they've got this can of liquid silk inside of their body essentially and then a valve. And yeah, when they want to make silk it's like pressing the button on your silly string can and it becomes solid as it leaves the can. That's a great analogy.

Exactly how the process of turning that liquid silk into solid silk is still a bit of a mystery. Scientists have actually been trying to build silk making machines for a long time. And although we do know the recipe for the liquid silk, so far only spiders are actually able to turn it into solid silk. So they're able to make this really strong, solid, elastic thread that they use to build their webs. It's a really cool material and humans can't replicate it yet.

[Jane Lindholm] But I can walk through a spider web and break it. I always hear that spider webs are so strong and yet I walk through them no problem. So how are they supposed to be strong?

[Catherine Scott] Yes, so you might have heard that spider webs are stronger than steel. Silk threads that spiders make are sort of strong for their diameter. And also it's not just that they're strong like, yes, you can break them, but if you put your finger into an orb web, for instance, it's going to resist, right? And it's kind of like an elastic band, like it'll take a while before it actually breaks. So it's strong and elastic. And so it has properties that are really useful for humans. And depending on how you kind of combine the silk and make things out of it, there are some people who are working on trying to make bullet proof vests from blackwidow silk. And it's not like one strand of blackwidow silk is going to stop a bullet, but a lot of these silk strands together can be really, really strong and really flexible.

[Jane Lindholm] The other thing that people know about spider webs, because it happens when we get caught in them, is how sticky they are.

[Elias] Hi, my name is Elias. I live in Bozeman, Montana and I have a question. How do spiders not get stuck in their webs?

[Nora] Hi, my name is Nora. I am five. I live in Fort Worth, Texas. My question is, How do spiders not get stuck in their own spider web?

[Max] My name is Max. I am seven years old. I live in Mesa, Arizona. My question is, How do spiders not stick to their own webs?

[Catherine Scott] How do spiders not get stuck to their own webs? So first of all, there are lots of different kinds of spider webs and not all of them are sticky. But usually people are thinking about the orb webs that spiders in your garden build that have this sticky spiral that is used to capture flying insects. The spiders that build those webs have to move around on their web, right? So while they're walking around on the web, they can just avoid the sticky lines because not every single strand of the silk in that web is sticky. But they do have to touch the silk with their legs while they're building the web and they manage not to get stuck to it. So the way that they avoid getting stuck to their own silk is that their feet, which scientists call tarsi, are covered with tiny hairs that decrease the amount of surface area that makes contact with the silk. And they also have a kind of non-stick chemical coating on their feet that helps the bits that do touch the silk, not get stuck to it. And they're also just really careful about where they put their feet.

[Jane Lindholm] Here's something cool that spiders, some spiders at least, can do is that they can walk on walls. I mean, we all know Spiderman can walk on walls, but he got that skill from somewhere and it's the spiders. So here are a couple of questions about that.

[Elias] My name is Elias. I live in Bozeman, Montana and I am five years old. My question is, How do spiders stay on the walls and ceilings and not fall off?

[Memphis] I am five years old and my name is Memphis and I live in Edmonton, Canada and I want to learn about, How do spiders climb on the walls?

[Catherine Scott] Before when we were talking about how spiders avoid getting stuck to their silk, it was all about having hairs on their feet, right? So how spiders are able to walk on walls and ceilings is also about increasing surface area with hairy feet. So some spiders, the ones that don't build webs, have something called claw tufts on their feet. So these are basically super hairy pads that help them stick to flat, smooth surfaces like walls. So the spider's foot is covered with this dense tuft of hairs and then each of those individual hairs is covered in hundreds of thousands more, even tinier hairs. So this means

that the spider has a huge number of tiny points of contact with the wall. And the way that they stick to the wall is through something called Van der Waals forces. Van der Waals forces work when two molecules are really close to each other and are attracted to each other. So these are really weak forces, but a lot of them together can be really strong. So the attraction between millions of tiny hairs on the spider's foot and the wall allow the spider to stick. But it's also not so sticky that they can't walk around. So it's basically kind of like the spider having post-it notes on their feet that are sticky enough to stay on the wall, but easy to peel off.

[Jane Lindholm] Imagine having to walk around your house, being really careful about where you put your feet because you might get stuck in the middle of your bedroom or something. But also being able to walk up the walls of your room when you want to. I would like that skill. Coming up, How do spiders choose where to make their sticky webs and how can you help the adults in your life, or maybe you yourself, be less afraid of spiders?

This is *But Why?* I'm Jane Lindholm, and today we're answering your questions about spiders with Arachnologist Catherine Scott. Remember, arachnids are animals with eight legs. They're not insects. Arachnids have their own special classification in the animal kingdom and they include ticks and scorpions and my favorite, the pseudo-scorpion. Arachnids are arthropods. That means they're animals that don't have bones like you and I do to keep our bodies in the right shape and help us move. Arthropods have an exoskeleton, a shell, that serves the same purpose. It gives their body their shape and keeps all their organs inside. Today we are concentrating specifically on spiders. We were just talking about the webs that many spiders build. But how do they know where to build them?

[Johanna] Hello, my name is Johanna and I am four and three quarters and I live in Minnesota and my question is, How do spiders choose a place to make their web?

[Catherine Scott] Basically, they want to choose somewhere that's safe and where there's lots of food to eat. So some spiders use their senses of smell and taste to figure out if there is a good source of food around when they're choosing a web site. You might find spiders in your house. Some spiders might have put up a web in a window or near a light inside or outside your house. And the reason for that is that they are detecting that it's a good place to find prey. So you might see, especially outside lights, might often have a lot of spider webs around them. Insects like moths are attracted to bright lights at night. So the spiders are able to detect that, "Oh, there's a light here. It's gonna be a really great place to capture a lot of moths and other flying insects". And so they choose that place to set up their web.

[Roy] Hello, my name is Roy and I'm seven years old and I'm from Barbersville, Virginia and my question is, What's the difference between a spider web and a cob web? And what is a spider web made of and what is a cob web made of?

[Catherine Scott] So that's an interesting question. The answer probably depends on who you ask. Someone who has messy old spider webs in their house or their basement might call them cobwebs. But Arachnologists call the messy looking webs of spiders like blackwidows and cellar spiders cobwebs. Whereas the beautiful spiral webs of garden spiders are called orb webs. And so there are actually a whole bunch of different kinds of spider webs that are made by different spiders in different families and species. So some spider webs are triangle shaped. Some are dome or bowl shaped. Some are funnel

shaped and some are more like flat sheets. So cobweb is actually a term that's used to describe a particular type of messy web that's not organized like orb webs are.

[Jane Lindholm] Catherine, do all spiders build webs?

[Catherine Scott] No, it depends on the lifestyle of the spider and the type of hunter that they are. So some spiders that are wandering hunters don't ever build a web. For instance, jumping spiders and wolf spiders, two of the spiders that have really good vision and are visual hunters, kind of like cats that pounce on their prey, they don't build webs. But a lot of spider species do build webs like orb weavers that build webs to capture flying insects or other spiders that build webs closer to the ground to capture crawling insects. So it depends on what kind of spider you're talking about. And actually, there are more than 45,000 different kinds of spiders in the world that scientists have names for. They're actually more that we haven't named yet. So there's a whole bunch of different kinds of spiders. And depending on the family that they're in, they may or may not build a web that they used to capture insects.

[Jane Lindholm] Wow, more than 45,000 different kinds of spiders?

[Catherine Scott] Worldwide every year, spiders eat somewhere between 400 and 800 million tons of insects, which is a lot.

[Jane Lindholm] That is a lot. While we're talking about eating, let's get to our eating questions.

[George] My name is George and I'm three years old, from Michigan and my question is, How do spiders eat?

[Elliot] Hello, my name is Elliot and I live in Seattle and I'm four years old. My question is, How do blackwidows eat their food?

[Eric] I'm Eric and I'm five years old. I live in Wisconsin and my question is, How do spiders eat flies?

[Catherine Scott] Spiders have a really cool and kind of gross way of eating their food. They actually start digesting it outside of their body. First, they either paralyze their prey with venom or wrap it up in silk to subdue it or they do both. Then the spider regurgitates or spits up digestive fluid either onto or into the food item. So what happens next depends on whether or not the spider has strong jaws. Some spiders chew their food before they eat it, just like we do to help break it down before they swallow it and finish the rest of the digestion process in their guts. But other spiders, like blackwidows, pump digestive fluid through a tiny hole in the exoskeleton of the insect they've captured and wait for the insides of the insect to start being digested. And then once the insides are soft enough, the spider sucks them up, just like drinking a milkshake through a straw.

[Jane Lindholm] So with the blackwidow, it's actually kind of waiting for that inside of the insect just to turn into a slushy?

[Catherine Scott] Yes, so once the blackwidow is finished eating its prey, you'll be left with the exoskeleton of that insect and it will look almost identical to the way it looked when it was alive. But it will just be a shell and all of the insides will have been sucked out by the spiders.

[Jane Lindholm] That's both gross and cool.

[Catherine Scott] Yeah, other spiders like wolf spiders for instance, that have bigger jaws, they'll munch on the insect while they're eating it and chew it and so you won't necessarily be able to tell what they've eaten afterwards because there'll be lots of bits of the exoskeleton left behind because the spiders can't digest those. But with blackwidows and some other spiders that have puny little jaws and can't really chew their food, you're left with just an empty shell of an insect.

[Jane Lindholm] Do all spiders eat insects?

[Catherine Scott] Yes, all spiders eat insects but insects aren't the only thing that spiders eat. So the majority of spiders eat mainly insects, but they also eat other arthropods, including other spiders. And some spiders can actually eat vertebrates, so animals with backbones like us. So some spiders called fishing spiders prey on small fish and tadpoles. They actually live on the edges of lakes and ponds and can dive under the water to capture fish. And then some other spiders, like blackwidows, for instance, can prey on small lizards and small snakes or even small rodents. And spiders like the really big tarantulas that live in South America can also eat larger vertebrates like birds and frogs.

[Jane Lindholm] Whoa, I didn't realize that some spiders could eat fish and birds and frogs and rodents.

[Catherine Scott] Yeah, spiders are predators. They're carnivores that eat other animals. But some of them do also eat plant based food. So some spiders feed on nectar produced by flowers. Orb web spiders, like the ones you see in your garden, pollen sometimes gets stuck on their sticky silk and these spiders take down their webs every night or every couple of nights and they actually eat up the silk and recycle it. And if there's pollen on the silk, they also eat that pollen. And that's nutritious as well.

[Jane Lindholm] You know, all of this is very interesting. But what if you're afraid of spiders? A lot of people are. And it's true that some spiders are venomous. Venom is a chemical or really a combination of chemicals than an animal like some spiders and some snakes can use to attack their prey or to defend themselves. Poison is actually kind of different from venom and spiders aren't generally poisonous. By that, I mean that the spider itself isn't harmful. If you licked a spider, which by the way I do not recommend, it wouldn't hurt you to lick it. And in some cultures, spiders are a delicacy. Some cultures eat, for example, tarantulas. But if a venomous spider bite you with that combination of chemicals, it could make you very sick or in some cases actually kill you. So you do need to be cautious around spiders and have an adult help you figure out which kinds of spiders are dangerous and which ones are not. But Catherine Scott says you really shouldn't be afraid of spiders.

[Catherine Scott] Spider bites are extremely rare. Spiders eat insects. They don't eat people. So some arthropods, like mosquitoes and ticks and bedbugs, feed on blood. Spiders don't do that. They don't eat us. So they have no reason to bite us. There are some spiders that are capable of causing harm to humans if they bite us. And those include spiders like the blackwidow. There's really no reason to be afraid of spiders. Spiders don't want to bite you. And if you leave them alone, they're going to leave you alone and they don't pose a threat.

[Jane Lindholm] So basically, you should be cautious of spiders the same way you are of any wild animal, but you don't need to be afraid of them and they're not coming for you. They're not trying to bite people.

[Catherine Scott] Absolutely, yeah, spiders are not interested in biting you. And, you know, if you grab them with your bare hands or are crushing them, they're going to bite defensively because they're scared. They have no other option. Biting is kind of a last resort. But spider venom is for subduing prey. It's for eating insects and other arthropods. It's not for hurting people.

[Jane Lindholm] Last question here from Izzy.

[Izzy] I come from Durham, North Carolina and I'm six and a half years old and my question is, Why are daddy long legs called daddy long legs when they have a female to produce their babies? Bye.

[Catherine Scott] This is a great question that I don't have a really good answer for. The name doesn't make a lot of sense. People use daddy long legs to describe three different kinds of animals. The first one is another arachnid called Opiliones. The common name is harvestmen, which also doesn't make much sense because they are not all male. So I prefer to call them harvesters. And then even some flies are called crane flies are called daddy long legs by some people. But I assume that because this is about spiders, that the question is about why some spiders are called daddy long legs. So the spiders that people call daddy long legs are also known as cellar spiders, which is the name I like to use for them. So Izzy is right. They're both male and female cellar spiders. But for some reason, we don't call the females momma long legs. So this name really doesn't make much sense. Nobody seems to know where the daddy part of the name comes from. So I really don't have a good answer for the question. But the long legs part does make sense because these spiders have extremely long skinny legs.

[Jane Lindholm] What's the benefit to them of having such long skinny legs?

[Catherine Scott] Having long skinny legs can be advantageous for cellar spiders because it allows them to stay really far away from their prey when they're trying to capture it. So cellar spiders can actually eat spiders that are much bigger than them. Cellar spiders are a web building spider. They spend most of their life on their own messy cobweb, but they also can leave their web and wander around. And sometimes they'll even enter the webs of other spiders and capture that spider. And so their method of prey capture involves wrapping the prey item with a whole bunch of silk. But because they have such long legs and they use their legs to pull silk out of their spinnerets and sort of throw it at the insect, they can stay really far away from the insect because their legs are so long. And that helps them avoid getting injured by an insect or other spider that's trying to fight back.

[Jane Lindholm] Catherine says spiders are really cool. And if you don't like them, maybe you just need to spend a little more time with them.

[Catherine Scott] Spiders are beautiful. I think if you spend some time watching spiders, you'll find that a lot of them are really beautiful. My favorite thing about spiders is that they have really cool behavior. So if you watch them, you can learn a lot about them. Their prey capture behavior is really interesting. If you find a spider web in or around your house and you can find a small ant or a fly or something and put it on the spider web, you might be able to see how the spider captures its food and that can be really, really cool. I also think

it's cool that spiders have really some sophisticated communication systems. So they are able to talk to each other using vibrations, sounds, chemicals, smells. And so they have they have a lot to say and they're having conversations that we can't hear, but they have rich lives and that's really cool I think.

[Jane Lindholm] That was Arachnologist Catherine Scott. She's getting her PhD at the University of Toronto in Canada studying blackwidow spiders. Thanks, Catherine. If you wind up doing some spider studying of your own, let us know how it goes. We'd love to know what you learned to appreciate about the spiders in your home and yard. And if there's anything you want to know more about, send us a question. We love hearing from you about all topics, big and small. It's easy to send us a question. Have an adult record you asking it. Be sure to tell us your first name, your town and how old you are, and then send the whole file to questions@butwhykids.org.

[00:28:39] *But Why* is produced by Melody Bodette and me Jane Lindholm at Vermont Public Radio. Our theme music is by Luke Reynolds. We'll be back in two weeks. Until then, stay curious.