mystery science

Grades K-5
Mini-Lesson: “Could people ever walk on walls?”

VIDEO TRANSCRIPT

VIDEO 1

[Video Call]

- Hi, Doug!

- Hi, Sophie!

- I have a question for you. Can people ever walk on walls?

- That's a great question.

I'm sure you've seen bugs walk on walls. And if you're like me, you don't really think much about it. It's like it's no big deal, but stop for a second and think about just how amazing that is. When a bug is doing this, it's actually walking up and down walls and hanging upside down on the ceiling, just like a superhero, just like Spider-Man. And they're doing this without using ropes or superpowers or special effects. I mean, have you tried walking up a wall lately? If you have, you probably weren't very successful and yet many different kinds of bugs do this all the time. Like check out these, they're called Asian weaver ants. Not only can they climb up walls, they can do it while carrying more than 100 times their body weight. That would be like you climbing up the side of a building while 100 of your friends hang on for the ride. And it's not only bugs that can walk on walls and hang upside down on ceilings. Have a look at this tree frog. It can climb up trees or walls even in the pouring rain without sliding. In fact, they even stick better in the rain.

So if bugs and other animals, like tree frogs can do it, couldn't we? Before I say anything more, I'm curious, what do you think? Do you think people could ever walk on walls? And how would they do it?

VIDEO 2

Well, in order to answer this question it might help to learn more about how animals stick to walls. When I was thinking about that, I immediately thought they must use something sticky like glue. Like, do bugs that can walk up walls have glue on their feet? Well, sort of? Check out this fly. Look closely at its feet. You noticed something? A fly's foot is covered in tiny hairs. Scientists had found out that those hairs make a liquid that helps their feet stick to tiny bumps on a wall or ceiling. It's not the same ingredients as in glue, but the liquid does help them stick to the wall. Kind of like the way water will make a cup stick to a coaster or a piece of paper when you lift it up. And flies aren't the only living things that use this method. Other creatures like ants, grasshoppers, bees, and even tree frogs use liquid to stick to walls too. Hmm. So that makes you think, could humans do the same thing? Like could we put some kind of glue or liquid on our shoes to help us walk up walls? Well, there actually are types of glue that are strong enough to allow us to stick to a wall or hang upside down. But people soon discovered the hardest challenge isn't sticking to a wall, it's unsticking. You see the thing about insects like flies and ants is that the liquid on their feet is sticky enough to keep them on the wall, but not sticky enough to get them stuck. That's because they don't need that much sticking power because they're so small and don't weigh that much. All they have to do is start to move the position of their feet and they get unstuck again. They can walk while staying stuck on a wall or ceiling. But human beings are way heavier than flies or ants, too heavy. In order to stick to a wall you would need some really strong glue to hold your weight. But for the strength of glue you need, that

glue would be too strong to be able to lift your feet again. Okay. So sticking to walls like flies might not work, but are there any other wall-crawling animals we can get ideas from? And other slightly heavier animals that we could learn something from? There are. See this gecko? Geckos are the heaviest animals on earth that are able to walk on walls. And they're really good at it. So good that they can even hang upside down from the ceiling using only one of their toes. But here's what's most surprising. If you touch a gecko's toes, you'll soon discover that they aren't wet or sticky at all. Geckos somehow stick to walls differently than flies do. So how do they do it? Scientists have discovered once again, the sticking power comes from hair. Take a look up close. See all those hairs? Just like flies, gecko toe pads are covered with hundreds of tiny hairs called setae. And each of those hairs has even tinier hairs sprouting from their tips. Now these hairs don't have any liquid on them to help them stick like flies do, but they do have a sticking power. In fact, even more than flies. Scientists have discovered that the hairs on a gecko's toes can create an invisible pulling force called the Van der Walls Force. That might sound really strange. But there are other invisible forces you've probably noticed yourself. Like if you've ever rubbed your head on a balloon. Have you ever noticed when you do that your hair gets pulled invisibly toward it, almost like a magnet? The Van der Walls Force is kind of like that. You'll get to study more about this in high school science class. But each of the hairs on a gecko's toes has this invisible pulling force that pulls a gecko's toe pad towards the wall. Not hugely different from how your hair gets pulled toward a balloon or how a magnet gets pulled towards another magnet. So it's almost as if a gecko has little magnets on its feet. Notice that's a lot different than the sticky liquid that a lot of bugs use. Other creatures like spiders have this invisible sticking power on the hairs of their feet too. So could human beings copy geckos and spiders? And use this invisible sticking force to stick to walls? Well, maybe. Amazingly, students from Stanford University are trying to invent something that could work. They carefully studied

the way geckos climb walls and developed something called gecko gloves. Just like spiders and gecko's feet, it doesn't use magnets or electricity. And when you touch it, it doesn't feel sticky at all. But on each pad, there are lots and lots of tiny bendy spikes kind of like hairs. When you press down and flatten them out, the gloves stick. But when you lift them up, the stickiness stops, a lot like a gecko's toes. The only problem is so far they've only been able to make this work on glass. But as long as it's a glass surface, like a window, it is now possible for human beings to climb up walls. In addition to being amazing to see and fun to do, there might even be some useful things these gloves can do, like helping astronauts grab onto things when they're in space without floating away. That's all for this week's question. Thanks, Sophie, for asking it!