mystery science

Lesson: “What's the best way to get rid of mosquitoes?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hi, it's Doug! Have you ever had this happen? You're playing outside when you start to feel an itch on your shoulder. You go to scratch it, not really thinking too much about it, but instead of going away, the itch gets worse. You take a closer look and notice this: a big bump. It's a mosquito bite. So many times when I was a kid, I got excited about playing outside in the summer and I'd forget about the mosquitoes. I'd come home with mosquito bites all over my arms and legs. And they'd itch so bad. Even when I sprayed mosquito repellent or if I wore clothes to cover my skin, it seemed like I always still got at least a bite or two. Here is a mosquito up close. Mosquitoes have this tiny mouth that's almost like a needle. They stick that through your skin. But it's so small, sometimes you don't even feel it when they're biting you. Afterward, though, you can definitely tell when you've been bitten. The bite starts to itch. Most people agree: mosquitoes are incredibly annoying. It's certainly no fun to get a mosquito bite, but a few years ago, I was really surprised when I saw a report in the news. It claimed that the most dangerous animal on Earth is...well you'd think, what—lions, sharks, maybe? Snakes? Nope. It's mosquitoes. "Really?" I thought. “Mosquitoes?” Annoying is one thing, but dangerous? How could such a small insect be dangerous? What do you think?

EXPLORATION VIDEO 2

About 200 years ago, there was a camp of soldiers from the French Army and many of them were getting sick. It was almost as if they had a bad case of the flu. The soldiers all had a fever, chills, headaches. Some of them were vomiting. Some soldiers got so sick that they died. This was very serious. No one could figure out where the disease was coming from. The army camp was located near a swamp, so some people thought the disease might be coming from the stinky swamp air. They named the disease malaria, from the words *mala* - *aria*, which meant *bad air*. But, at the time, no one understood what really caused malaria. The army asked a doctor, Dr. Alphonse Laveran, to see if he could figure out what was causing the soldiers to get sick. Dr. Laveran started his investigation by looking at the soldiers' blood under a microscope. Usually, this is what blood looks like under a microscope, but in soldiers with the disease, Dr. Laveran noticed that this is what their blood looked like. You notice those strange dark dots? When Dr. Laveran looked more closely, he realized that those dots were actually microscopic parasites, a type of germ, and he thought these might be what's causing the malaria disease. But to stop more soldiers from getting sick, Dr. Laveran had to figure out: where were these germs coming from? He went to the swamp and he checked everywhere. He checked the air, he checked the water, he checked the soil—but he couldn't find these germs in any of these places. Then he realized the swamp had more than just bad-smelling air: it had lots of mosquitoes. They were everywhere. Could it be that the mosquitoes were carrying these germs? Even though mosquitoes suck blood out of a person, when they do that, some of the mosquito's saliva, or spit, gets into a person's body. So if mosquitoes did carry any microscopic germs inside their bodies, that means those germs might get passed straight into someone's blood when a mosquito bites. Years later, Dr. Laveran's idea was proven correct. Mosquitoes

were responsible for spreading the germs that cause malaria. And it's not just malaria. Mosquitoes were discovered to carry germs that cause other diseases too, diseases with names you might have heard of like West Nile Virus, Zika virus, and yellow fever. So mosquitoes aren't dangerous because their bite makes you itch. They're dangerous because their bite can spread germs that cause different kinds of diseases. Every year, over 500 million people still get sick from diseases spread by mosquitoes. Luckily, scientists have discovered medicines that can help people get healthy again if they do get some of these diseases, but it's still very serious. If people don't get medical help, some of these diseases can lead to death. In trying to learn more about diseases spread by mosquitoes, scientists have noticed that many of these diseases are more common in some places in the world than in other places. For example, this map shows the places where malaria is most common. Notice how all of these places are places near the middle regions of the Earth, places near the equator. These are the warmest places on Earth, what we call the *tropics*. Although mosquitoes are found all over the world, except Antarctica, the tropics have the most mosquitoes, which might explain why diseases carried by mosquitoes are more common in the tropics. But why would that be? Why would there be more mosquitoes living the tropics compared to other places? What do you think?

EXPLORATION VIDEO 3

Tropical places, where the weather is warm and wet all year round, are the best kind of places for mosquitoes to live. Scientists have figured out that mosquitoes need warm weather because they die when it gets too cold, but warm weather isn't enough. There are warm places where you won't find a single mosquito: deserts. Deserts are dry. They get very little rain. So it's not just warm places that mosquitoes need. They need places that are warm and wet. Mosquitoes are especially common in swamps and rainforests, where there's lots of water all year round.

But that seems strange, doesn't it? Mosquitoes don't live in the water. They fly around in the air. Plus, it turns out mosquitoes hardly even need to drink water because they can get the water they need by drinking blood. So, why would mosquitoes need water to live? To figure this out, we need to look at the entire life cycle of the mosquito. Like many other insects, mosquitoes completely change the form of their bodies from when they're young to when they become adults. It's like with butterflies. Butterflies start out as larvae—that's the caterpillar stage. Then they turn into a pupa, or cocoon. Once the pupa goes through metamorphosis, a butterfly emerges. Well, mosquitoes go through the same phases. They start out as larvae that look like this. You can think of these as being like the caterpillar of mosquitoes. They're little worm-like creatures that people sometimes call wrigglers. At this stage, they live entirely in the water. They can't fly and they eat tiny living things in the water rather than sucking blood to get their food. In the next stage, a mosquito larva becomes a pupa. It's like a cocoon, except it's in the water. Mosquitoes don't leave the water until after the pupa goes through metamorphosis. That's when an adult mosquito emerges with wings and ready to suck blood. So, mosquitoes need water because they spend the first half of their lives in the water. Without water, mosquitoes wouldn't have anywhere to lay their eggs and grow up. This explains why there are more mosquitoes in tropical areas. It's because those places have more water for mosquitoes to lay their eggs and grow up. It also explains why even outside of tropical areas, places like where I grew up in the United States, there are always more mosquitoes in the spring and summer. In those seasons, the weather is warmer and there's more water available for mosquitoes to lay their eggs. In fact, people often get worried after an especially rainy spring season because they expect that there will be more mosquitoes that year. Learning about the mosquito life cycle can help people figure out ways to avoid getting bitten by mosquitoes. Given what you've learned about mosquitoes and their life cycle, does it give you any ideas for how people can avoid getting bitten?

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to help the little town of Pondville solve a pesky problem. There are too many mosquitoes! To solve the problem, you're gonna figure out what the people of the town can build or do to stop getting bitten. Now, there's always been some mosquitoes in Pondville. Like last year, if you sat in the park for an hour at sunset, you might have gotten one or two mosquito bites. But this year, if you sat in the park for an hour, you got dozens and dozens of bites! And there are mosquitoes all over the town. Fortunately, there's no malaria in Pondville. But people are tired of getting so many bites. What happened? Why this change? Well, it rained a lot in Pondville this year. There are puddles everywhere! And that little pond in the city park became a big pond. Lots of water plus warm weather means lots of mosquitoes. But no one wants to drain the pond that gave Pondville its name. So what can the people of Pondville do? It's your job to figure that out. I'll show you how to get started, step by step.

ACTIVITY STEP 1

Find a partner. You and your partner will share ideas, but each of you will come up with your own solution to the problem. If you're working alone, that's okay too. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Get these supplies. You'll get more later.

ACTIVITY STEP 3

Discuss with your partner. Then, fill in number one on your worksheet.

ACTIVITY STEP 4

Your first expert is a park ranger. She has observed what happens in the pond. Read what she's noticed aloud. Do her observations give you any ideas on how to solve the mosquito problem? Write down your ideas on your worksheet beside the park ranger box.

ACTIVITY STEP 5

Expert number two is a fisherman. He spends a lot of time by the pond. Read what he's noticed aloud. Do his observations give you any ideas on how to solve the mosquito problem? Write them down on your worksheet beside the fisherman box.

ACTIVITY STEP 6

The third expert is a weather reporter. She's noticed that wind affects the mosquitoes. Read more about what she's noticed and write down your ideas on the worksheet beside the weather reporter box.

ACTIVITY STEP 7

The fourth expert is a home repair expert. Read what she's noticed and write down your ideas on the worksheet beside the home repair expert box.

ACTIVITY STEP 8

The fifth expert is a hiker. He's noticed that mosquitoes are only out at certain times. Read more about what he's noticed and write down your ideas beside the hiker box.

ACTIVITY STEP 9

The sixth expert is a bird watcher. She pays attention to what the birds and the bats eat. Read more about what she's noticed and write down your ideas on the worksheet beside the bird watcher box.

ACTIVITY STEP 10

The last two experts are a dad and his daughter. Read what they've noticed aloud. Did their observations give you any ideas on how to solve the mosquito problem? Write down ideas on your worksheet beside the dad and kid box.

ACTIVITY STEP 11

Now you have lots of ideas about how to solve the problem of mosquitoes. Review all your ideas with your partner. Maybe you'll come up with new ideas together. If you do, write them down too. In case it's helpful, I'll set a timer for two minutes.

ACTIVITY STEP 12

Now you have lots of ideas about how to solve the problem of mosquitoes. So, get your last supply. Each person needs one “Bug Off” worksheet. You can choose from the playground, the picnic area, or the backyard, but only choose one.

ACTIVITY STEP 13

Have a look at the places that have big mosquito problems. Look at your “Bug Off” worksheet and discuss. Afterward, answer question number three on your “Problem Solver's Sheet.”

ACTIVITY STEP 14

Choose a solution or a few solutions for your site. Draw what you would build or do to solve the mosquito problem. Your solutions can be different from your partner’s. If you like, you can add people to your picture too.

ACTIVITY STEP 15

At the bottom of your “Bug Off” sheet, write how your solution will help solve the mosquito problem. If you're in a class, your teacher will post your drawing so that everyone can have a look.

ACTIVITY STEP 16

Discuss, then fill in question number four on your “Problem Solver's Sheet.” Don't forget to watch the final video.

WRAP-UP VIDEO

In the activity, you came up with ideas to reduce the number of mosquitoes in Pondville, where the townspeople have had a really rainy spring season and they're worried about having more mosquitoes this summer. You could have come up with many different solutions, but here are

just a few solutions that we came up with. At the picnic area, we realized that we couldn't just get rid of the pond because people loved it and they liked to go fishing there. Instead of draining away the water, we decided to add more mosquito-eating fish to the pond and lots of dragonflies nearby so that they would eat the mosquito eggs and larvae. We also decided to put up a bat box and birdhouses so that bats and birds might live there and eat the adult mosquitoes. At the playground, we realized that we probably couldn't just cover the entire area with nets because the nets would have to be huge and they'd get in the way of kids playing. But, we thought, maybe kids would want to wear nets. Now mosquitoes wouldn't be able to bite them. We noticed that buckets in the sandbox would collect water and mosquitoes could lay eggs there. So we decided to make a sign telling kids to turn over the buckets after playing with them. We also wrote on the other sign that the playground closes 30 minutes before sunset, so that kids could get home before lots of mosquitoes came out. At the backyard, we noticed that it would be easy to hang a mosquito net over the umbrella to prevent mosquitoes from biting people who were sitting on the lawn chairs. We also noticed that there was an electrical outlet where we could plug something in. So we decided to add fans that could blow the air at 10 miles per hour. That way, mosquitoes couldn't fly in the backyard. We noticed that a watering can was left out, full of water. That should be put away right after people water their garden so that mosquitoes couldn't lay eggs there. We did want to keep the swimming pool, though, since swimming is so much fun. We just needed to make sure that people who lived here dumped out the water after swimming, so mosquitoes couldn't lay eggs in it. You probably noticed how each site was a little different and the same solutions wouldn't work in every single place. Engineers would say that the sites had different *constraints*, things that limit which solutions you can use. For example, the pond had a constraint of not having electricity nearby, so we couldn't use a fan that needed to be plugged in. Constraints aren't bad things—they're just things you have to think about when

you're coming up with solutions. Because of the constraints, some solutions made more sense in some places than others. Today, scientists are trying to figure out even better ways to prevent human beings from getting diseases from mosquitoes. One solution they've come up with are vaccines, the shots that you get at the doctor. So far, scientists have developed vaccines for a few of the diseases that mosquitoes carry, like malaria, but they're still trying to figure out vaccines for other diseases, like Zika. Looking to the future, some scientists are even wondering: could we protect people from diseases by changing mosquitoes? Like, maybe we could use selection to breed mosquitoes that can't carry diseases, or maybe it's possible to get rid of mosquitoes entirely by causing them to go extinct. Scientists are trying to figure out if getting rid of mosquitoes would have any bad effects, like for birds and bats that eat mosquitoes as their food. But if scientists ever do figure out any solution, it's interesting to think about. What would life be like to never have to worry again about getting itchy mosquito bites? Have fun and stay curious!