But Why: A Podcast for Curious Kids

How Do Butterflies Fly?

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[Jane] This is *But Why: A Podcast For Curious Kids* from Vermont Public Radio. I'm Jane Lindholm. On this podcast we take your questions and find interesting people to help answer them. If you have a question about anything we'll tell you how to record it in your own voice and send it to us at the end of the episode.

Today we're going to learn about things that fly. Some things that fly are very, very heavy, like the airplanes and spaceships we'll hear about later in the episode when we visit the Smithsonian Air and Space Museum in Washington D.C.

But first, flying things that are very, very light, so light that most of them wouldn't even register if you put them on your bathroom scale at home. We're talking about butterflies. I went to ECHO, Leahy Center for Lake Champlain in Burlington. ECHO is a museum and aquarium that's usually dedicated to the animals and landscape of the Lake Champlain basin, but this spring it's all about butterflies. Inside the building, they've set up a big tent of white plastic. It's kind of like a greenhouse if you've ever seen those.

If you're standing outside the tent you can see the shadows of plants and the movement of the butterflies inside. When you step inside the tent it's hot and humid. My glasses fogged up. I met one curious kid right inside.

What's your name?

[Leola] Leola.

[Jane] That's a beautiful name. How old are you?

[Leola] 5.

[Jane] So what do you think about these butterflies?

[Leola] I love them.

[Jane] Have you had a butterfly land on you yet?

[Leola] I had one land on me before.

[Jane] What did it feel like?

[Leola] It felt like a blankie.

[Jane] Did you get to feel its little feet?

[Leola] Yes.

[Jane] Do you have a favorite color butterfly?

[Leola] I like the orange because I love them so much.

[Jane] A lot of other kids feel the same way and some of you have sent us questions. So I looked for someone inside the tent who could answer them.

[Cailee] My name is Cailee Smith. I'm the public programs manager at ECHO Leahy Center. Right outside, it's quite cold it's still snowing and sleeting, but we are inside our butterfly pavilion. It's a really exciting lush place because we have butterflies from tropical areas all over the world. So right now it's about 76 degrees in here and very humid. So quite warm, I actually just took off my sweater because it’s a little hot in here and people with cameras often get frustrated because all the condensation their cameras fog up.

[Jane] So why does it need to be humid in here?

[Cailee] Because we have a lot of tropical butterflies here in our pavilion exhibit. So there are not species you would see here in Vermont. They are species that are native, or found, in other areas of the world and in particular tropical areas so we have a lot of species from southern North America as well as Central America and South America and then also some from Southeast Asia and Australia.

[Jane] And it's OK for them all to be in the same place here because you'd probably never have butterflies from South America getting to know butterflies from Asia out in the wild.

[Cailee] That's a very good point. That's true and with some animals, you might see some interesting interactions, but with butterflies they are all, they're all pollinators. They're all feeding on flower nectar or some species are what we call in science fruitovores, or fruit eaters, feeding on fermenting fruits. So there's not any real competition here. We give everyone plenty of sugar water and overripe bananas to eat. So you'll see some sitting together and sharing a plant, but there's no issues here because no one is a predator. No one is prey and no one is competing for the same resources or competing for the same food so they…

[Jane] And no one is allowed to leave.

[Cailee] Yes that's right. No one is allowed to leave. So I’ve said the word native a few times. Native animals are ones that are found in an area usually.

[Jane] And none of these butterflies are native to where we are here in Vermont.

[Cailee] So it's very important that they stay here inside our pavilion so that we don't accidentally introduce anyone to the outside. They could end up becoming residents of the area which is not what we want. That's not good for the butterflies it's not good for the local habitats and ecosystems or food webs in our area.

[Jane] Let's tackle a couple of the questions that we've gotten from our listeners about butterflies. All right, so our first question is from Jack who's four and lives in Beverly Massachusetts and asks.

[Jack] How do butterflies fly?

[Cailee] That's a great question Jack and something that I actually had to go do a little bit of extra research about to find the answer. If you look really closely at a butterfly's wings you'll notice that they're very different from a bird wing. So birds have feathers on their wings and are rounded. Butterflies have scales on their wings and they actually have a sharp edge. So when they fly they actually cut the air, kind of like a knife, maybe a butter knife moving through something, like a cup of tea. And then the wings will move and swirl the air like if you move that knife through your hot cup of tea. And that creates a little bit of a vacuum because of a change in pressure and it sucks the butterfly up so it moves higher up in the air. And then they do it again, they cut with the wings, they swirl and that keeps pushing them forward as they fly. And the effect is the wings of most butterflies look like they're moving in a figure eight shape. Some right over there that are moving around a little bit, but it happens so fast that it's hard to really appreciate that figure eight pattern.

[Jane] All the butterflies in here, Cailee, have really different colors. There are some that are yellow, some that are brown, some that have circles on them, some that are these white iridescent, blue colors. What do the colors of the butterflies do for them?

[Cailee] Butterfly colors are one of my favorite things to talk about because there are so many incredible colors and there's so many good reasons and a lot of them are actually for survival. So everyone here is really a big fan of the Indian leafwing. It is a species that looks like a dying brown leaf, at least on the outside.

So when his wings are closed and it’s just hanging out and resting it looks just like a dead leaf. So here it's pretty easy to see on our feeding sponges. But if you can imagine if you were in a tropical rainforest you might not see that butterfly until it opens its wings. It's actually bright purple and orange.

[Jane] Do you see one? I want to see it.

[Cailee] There's one right up there on the ceiling, so if you look, next to that plant and then look up.

[Jane] It does look just like a leaf.

[Cailee] It does. So that's one reason that butterflies have the colors they do. It's for camouflage, to blend in with the world around them, to hide from their predators. But not everyone hides like the Indian leafwing. I also think that the giant owl butterflies are really cool. I don't see one right now, but they're really noticeable because they've got these giant eye spots on their wings. So when their wings are closed, if you were to suddenly shine a light on them if you didn't see them, it would look like a giant eye. So a predator might say, ‘what is that thing?’ and then decide not to try to eat it when it's actually just a butterfly.

[Jane] So basically they've all found ways and evolved over time to have different ways of either defending themselves or hiding and camouflaging themselves all different ways to try to stay alive.

[Cailee] Yes, so all these butterflies the reason these beautiful colors have evolved is different ways to stay alive. And a lot of them are scaring away predators or hiding from predators. But some of them will actually even warn predators they are, so the really bright ones, like that guy over there, the piano key who's got red and yellow and black and white on him, the reason that they are such bright beautiful colors is because they actually taste terrible, or in some cases are even toxic, like a poison dart frog. So it's a warning to predators. They’re saying, ‘hey don't eat me. You're gonna regret it.’ So we have multiple of those terrible-tasting butterflies here. If you're in North America monarch butterflies have that coloration. And there's species here like the rice paper butterfly from Southeast Asia and Malaysia that have a similar pattern because they taste terrible. And then the piano key I mentioned, they are a species that is very common in Central and South America. So butterflies all over the world have beautiful colors to warn people that they actually taste gross.

[Jane] Now this butterfly right over here though, has see-through wings so it has almost no color. What's that?

[Cailee] Yes, that's the glass-wing butterfly and they are also from Central and South America. They're huge hit here. People love looking at them. I actually find it very amusing because people's cameras don't focus on them very well. The butterfly’s all blurry and you can see the leaves behind it perfectly clear. Most butterflies have pigments or special scales that reflect light to give them color. But the glass-wing butterfly just has these itty-bitty sub-microscopic bumps on them and no pigment so they actually end up being see-through or translucent as we say in science.

[Jane] Now I won't do it because it's not good for the butterfly but if you are ever to touch a butterfly's wings, or a moth, you find that when you let it go there's this very fine a shiny dust on your fingers or, or at least it's shiny if the butterfly is shiny. What is that?

[Cailee] That's a great question and people say that all the time, you shouldn't touch the butterflies because you'll get dust on your fingers. So butterfly wings, if you were to look at them under a microscope, they're covered in teeny, teeny tiny scales. They almost look like a lizard-scale. Though, they're not. They're made out of something very different but they look like that a little bit up close under a microscope. And they are so fine and so tiny and they're very delicate. They rub off very easily.

So when you hold a butterfly by the wings or touch one by the wings you're actually rubbing off those scales. And that's important that they have them because they're important for making sure that they are able to move through the air well, keeps them aerodynamic. And then also if you rub off too many layers of scales they can actually lose some of their coloration. So you don't want to damage the wings and butterflies only get one pair of wings for their entire life, so they are very delicate. So we'd always tell people when they come in that if a butterfly lands on you, wonderful, that is great and enjoy it watch with your science eyes. But please don't touch them because those wings are very delicate, are very fragile and we don't want them to get injured. We want them to live as long a life as possible here.

[Jane] We have another question about butterflies and why they're named butterflies because I mean you do think butter. Well, I know what butter is, but why is that a butterfly. So let's hear this question.

[Juanito] Hi, I'm Juanito. I'm 11 years old from Santiago, Chile. My question is why are butterflies called butterflies?

[Cailee] That's another great question and we've spent so much time here at ECHO learning about the science that it was fun for me to go back and look at some of the history behind the name. And the truth is people aren't completely sure where the name butterfly came from. But I found a few really good hypotheses, or educated guesses, about where that name came from.

And butterfly is believed to be an English word. So there's a few different potential origins. So there is the old English word for butterfly which comes from a butter-colored fly. So in Great Britain there is a very common butterfly that is yellow. It's called the brimstone. So it's kind of a buttery color, so people might think, well maybe it came from the brimstone butterfly, that it had butter-colored wings, or was a butter-colored fly before they knew the difference between flies and butterflies. So that's one hypothesis.

One of the other educated guesses is that it comes from a German word “butterfliege.” And then another word that also means milk thief. So apparently some butterflies in Europe, ours here love sugar water and fermenting bananas, there's some butterflies that like to hang out at puddles, but apparently some butterflies in Europe used to be attracted to buttermilk, when they were making buttermilk. So another guess is that the name butterfly came from those butterflies that were trying to feed from the buttermilk and that led to the name butterfly.

So we're not completely sure but there are two really interesting ideas and fun to think about for sure.

[Jane] “Mariposa” is of course how you say butterfly in Spanish and if you're living in Chile you probably say “Mariposa.” And you have a butterfly on your hair, so I'm going to take a picture of you right now.

[Cailee] What color is it?

[Jane] Brown, dark brown and then lighter brown sort of caramel colored on the outside.

[Cailee] Oh so this one, the one on my head. Oh I hear him flying off. That one is called a rusty tipped page.

[Cailee] We we're talking earlier about butterfly wings being delicate. That's actually a butterfly that we glued a new wing on. You can actually glue new wings on butterflies.

[Jane] Really?

[Cailee] Yes. So I myself have had some of that powder on my fingers when we've been doing some butterfly surgery, if you will. If butterflies pass away here at ECHO we try to often, after we follow our USDA regulations and freeze them. We've been able to save some of the wings and glue them on butterflies when their wings get tattered so that if a butterfly is doing really well and just has a broken wing, it can keep flying. And it's so fun to see so that I believe was the brown-tip page that we actually glued a new wing on.

[Jane] So you're like a butterfly surgeon.

[Cailee] I guess you could say that.

[Jane] Now I want to ask you about this butterfly that's right up here in this spider plant because, first of all it is beautiful. It's like blue and green and yellow. But what I want to ask you about specifically, Cailee, is you can see right under the butterflies head this part of it that is curled up in a loop. And I think that's the butterfly's tongue, right?

[Cailee] Yes that's correct. So the butterfly we're looking at is a green bird wing. It is from Australia and you're right they are super cool with their coloration. They're a little

bit fuzzy. So butterflies are insects and insects have some of the coolest different mouth parts in the animal world. Some have mandibles, some have what we call chelicerae, like the spiders and butterflies have a proboscis, a straw like tongue. It unfurls. They'll stick it down into a flower or into a banana or another fruit or in some cases there are a few butterflies that eat feces.Some of the butterflies in Africa actually are attracted to feces and carrion or dead animals.

[Jane] And feces is poop.

[Cailee] Yes feces is poop. I tried to use my science word but, yes. So they might sometimes eat poop, but so that proboscis it unfurls or unrolls and they'll stick it down and they'll slurp things up with it. But the cool thing is it looks like just one straw, it's actually two straws that zipped together. So the butterflies can actually unzip the two parts to clean themselves, which you don't see often but sometimes if you look at just the right time you can see the two different parts of it when they're unzipped while they're cleaning because butterflies don't have teeth to brush but sometimes a proboscis this might need a little cleaning after spending too much time in an overripe mango.

[Jane] We should be honest about what happens to the butterflies and the moths in here, what, they don't survive after they're in this butterfly pavilion, right?

[Cailee] That's correct. So the butterflies are incredibly beautiful animals and they play a really important role in our world as pollinators and delivering pollen to different plants. But beautiful animals like these have a short life span. A lot of these butterflies only live a few weeks. A lot of them between three and six weeks at a time. And that's their natural life cycle. So unfortunately they do die here. But it's part of the butterfly life cycle which is important to understand and appreciate that that's just a part of life and we're happy to say that here at ECHO we've been seeing them die by species.

So you'll see a whole bunch of one species die at the same time which means that they're reaching the end of their lifespan and they're not being eaten by predators which means that we're doing a good job caring for them.

One more fun fact to share with you is butterflies have been landing on a lot of people that have come into our pavilion and some of that is because they like the saltiness in our sweat. That's really good for their nervous systems. But a lot of little kids get scared of the butterflies. So what I tell them is sometimes we see them attracted to bright colors. And if a butterfly lands on you it's probably because they think you're a flower.

And butterflies actually are very different from us so we see with our eyes, we smell with our nose, we touch with our fingers. Butterflies have antennae. They're able to detect things with their antennae. I say it's like a finger and a nose all in one. And then

because that proboscis, that tongue is so important for feeding they're not tasting with it. They actually taste at their feet. So if a butterfly lands on you, they're actually tasting and figuring out that you're definitely not a flower and that a person is not a good food.

[Jane] So when we leave here we have to go through some plastic sheeting and then another door so we can make sure the butterflies don't get out because as we've talked about we don't want these butterflies to get out. We don't want them to survive here because they might influence the ecosystem that's already in Vermont but also it's pretty cold outside and that wouldn't be good for these butterflies.

[Cailee] I always tell kids butterflies are great at hide and go seek, especially the glasswings, with their see-through wings and a lot of them have been landing on people. So we always check everyone on the way out for butterflies to make sure that everyone stays in here. It's great for the butterflies, there's also rules that we have to follow and regulations for us. But we ask everyone as they go to do a butterfly spin. Tell us your favorite thing they learned and to enjoy the rest of their day and hopefully they'll all go home with a new appreciation of these incredible insects

[Jane] All right, I'm going to do my butterfly spin will you check and see if I have any on me? I'm spinning…

[Cailee] That was a beautiful spin, but a little fast.

[Jane] All right I'll spin slower.

[Cailee] OK.

[Jane] Well none on me. You spin now. If we're going out together I want to check you. That was a beautiful spin.

[Cailee] Thank you.

[Jane] That was Cailee Smith at the ECHO Lake Aquarium and Science Center in Burlington, Vermont.

Now even if you're nowhere near Burlington there may be a butterfly exhibit somewhere near you or if it's spring where you live I hope you can get outside and find some butterflies nearby soon. They're so fun to watch. We have pictures of some of the butterflies we talked about at butwhykids.org.

Maybe all of this talk of butterflies has made you wish you could fly.

Well, our species has figured out how to fly, but we do it with machines like airplanes helicopters and rocket ships. You've got some questions about our flying machines.

[Anna] My name is Anna my age is 6. And I live in in Cartier, Manitoba in Canada. My question is how do airplane fly?

[Zoey] Hi my name is Zoey I'm eight years old. I live in Falls Church, Virginia. My question is how, if gravity pulls everything down, do planes and rockets get up in the air?

[Marty] My name is Marty, and I'm five. I live in San Jose. My question is why do planes have engines and how do the make them?

[Jane] We sent those questions to the Smithsonian Air and Space Museum in Washington D.C. and Mike Huslander sent back some answers. He's the manager of onsite learning at the museum.

[Mike] Airplanes and rockets get into the air by using thrust that's created by the engines that they have. Airplanes use piston engines or jet engines to generate this thrust which creates a forward movement that provides lift and counteracts drag. Rockets use, obviously rocket engines, to create this thrust that pushes them up into the air and counteracts the force of weight, or gravity.

[Jane] Ok, one more time because this is complicated. There are four forces in action when it comes to flight: weight and lift, and drag and thrust. There's weight, or gravity that pulls the plane down towards the earth. And then there's drag. Drag is friction created by wind and air pressure and it slows the plane down. You have felt drag if you've ever stuck your arm out a car window and felt the wind pushing your arm back, that's drag.

Planes counteract those two forces by using thrust and lift. Thrust is what pushes the plane forward. And it's usually created by an engine that powers the machine. It really pushes that plane forward using those powerful engines and the wings on a plane are there to create lift to help keep the plane up in the air.

So weight and drag are competing against lift and thrust. Pilots balance those opposing forces to fly. They can fly level if all of those forces are even. If they want the plane to go up, they increase the thrust. If they want to go down they let weight take over a little bit. Does that make sense?

Now here's Marty's question again.

[Marty] Why you do planes have engines and how do you make them?

[Mike] Hey, Marty. Airplanes have engines to generate thrust to provide a forward motion that creates lift and counteracts drag. The engines can be anything like a piston engine like you might have in your car, or a jet engine. And some airplanes actually

even have rocket engines. These engines basically operate in the same way. Piston engines generate thrust by using a propeller. Rocket engines and jet engines generate thrust directly for the airplane.

Oh, some airplanes don't have engines. We called these gliders and gliders use the gravitational pull of the earth to generate that thrust so they're thrust always depends on having enough altitude to move faster as they descend from a higher altitude to a lower altitude.

How are engines made? That's a pretty complicated question. Because airplane engines, like car engines are very complicated machines.

Aircraft engines are made up of thousands of different parts. So I think what I would say is the most important thing is not how they are made but some of the priorities to making an airplane engine. So an airplane engine has to be made out of very strong but lightweight materials. The aircraft engine has to be made of very strong materials because it's undergoing a tremendous amount of force and a tremendous amount of heat. So those parts have to be very strong to handle the force and to handle those extreme temperatures that, that an air aircraft engine might create.

The parts have to also be light-weight because the more weight an aircraft has the more power it has to generate. So you want to make everything in an airplane including their engine into as light a weight material as possible. So a lot of engine might be made out of like lightweight aluminum materials which are strong but yet lightweight.

[Jane] The Smithsonian Air and Space Museum website has an illustration of how thrust helps a plane fly. Have an adult help you find their Web site at howthingsfly.si.edu. We have a link at butwhykids.org and on our Facebook page.

Thank you so much to Mike Huslander and Nick Partridge at the Smithsonian Air and Space Museum.

Have you ever had a dream about flying? I have lots of times actually and in my dreams I can jump and soar like a flying squirrel, like I have springs in my feet so I run and jump and I fly into the air. I can fly like a bird but I can soar for a long way before I sort of glide down to the ground and jump again. In my dream, it feels amazing.

I've never gone hang gliding or skydiving but I imagine that feels pretty much as close to actual flying as humans can get. I don't know, I might be too scared to do that.

Tell me about what you would do if you could fly. Have an adult record you on a smartphone and send your thoughts about flying to questions@butwhykids.org. That's also where you can send your questions. Be sure to tell us your first name, your town and how old you are. We love questions on any subject.

But Why is produced by Melody Bodette and me, Jane Lindholm, for Vermont Public Radio. Our theme music is by Luke Reynolds. Additional music in this episode from Podington Bear.

We'll be back with an all new episode in two weeks. Until then, stay curious