But Why: A Podcast for Curious Kids

How do birds fly?

September 8, 2023

Jane  00:20
This is But Why: A Podcast for Curious Kids, from Vermont Public. I'm Jane Lindholm. On this show, we take questions from curious kids all over the world. And it's our job to go in search of answers. When I was little, I used to have lots of dreams where I could almost fly. I would be running along on flat ground and then I would leap into the air. And while I couldn't fully take off and soar like a buzzard or an eagle, I could extend my jump way beyond what I could do in real life, and then slowly glide back down to the ground. My clothes and hair would flap out behind me and I could go so fast, I would feel the wind in my face. Then I'd hit the ground running, take a couple of steps and leap again. I could do it over and over. I loved those dreams. I've been thinking about them this week because of today's episode. We're answering questions all about bird flight. Melody and I have been taking turns to research your answers and later on in the episode we're going to go to a nature center to learn more about soaring birds, and how they use wind currents to conserve energy. One of the questions I've been trying to answer is this one:

Maisie  01:30
My name is Maisie. I'm seven years old from Brandon, Manitoba, Canada. And my question is, why do birds fly instead of just walking like people and other animals?

Daisy  01:45
Hi, my name is Daisy. And I'm from California.

Hazel  01:50
This is Hazel. I'm from Arlington, Massachusetts. I'm four years old.

Violet  01:54
My name is Violet and I live in Charlotte, North Carolina.

Makai  01:58
I'm Makai. I'm from Weybridge, Vermont. Why do birds fly?

Jane  02:05
Birds use flight for all kinds of things. It helps them get their food, like berries or nuts, up high in trees, or even to catch food like insects. I keep beehives in my yard and every summer I watch cat birds swooping down to catch honey bees in mid-flight. Birds also fly to avoid the things that want to eat them, and to get to locations where they have the best chance of survival, like the many species that
are currently starting their migrations from northern hemisphere spots that are about to get cold to warmer locations where it’s easier to survive the winter.

**Jane 02:41**

But perhaps a bigger question is HOW did birds start to fly? How did these animals begin flying when other animals—like us humans—can't, even if we want to, except in our dreams? The ancestors of birds, dinosaurs, started flying more than 160 million years ago. Scientists have found fossils of a dinosaur called Archaeopteryx that had wings and feathers and was able to fly, although maybe not particularly well. So how did dinosaurs like Archaeopteryx start flying? It turns out that dream I used to have about leaping and gliding is one of the theories. This idea is that birds started flying by leaping and gliding as they ran along the ground. Kind of like how turkeys fly today. Another ground-up hypothesis is that these dino birds used wings and feathers to help them climb up steep slopes or tree trunks, like running up a wall, and that evolved into flying. But another theory is the tree-down theory. This idea is that birds used feathers and wing structures to help them glide from tree to tree or from a tree to the ground, the way flying squirrels do today. And eventually they evolved to be able to fly longer and farther distances.

**Jane 04:03**

You've likely heard the word adaptation before, right? A change in a living organism that allows it to better survive in its environment. Well, not all the body parts that birds use to fly are adaptations. I learned a new word today: exaptation. Exaptation is when an animal takes something that evolved for one reason—an adaptation—and uses it in a new or different way. Dinosaurs had feathers long before they could fly. Their feathers were probably used to help keep them warm, as insulation. But they became essential in the evolution of flight, which was a new use that they hadn't initially evolved for. So feathers are an exaptation! Now birds have all kinds of specialized feathers that help them fly in really cool ways. So feathers have become adaptations again, too.

**Lily 04:59**

My name is Lily, and I'm five years old and I'm from Georgia. How do birds fly?

**Paxton 05:04**

My name is Paxton and I live in Blaine, Washington. I'm six years old.

**Theo 05:09**

I'm Theo and I'm five years old. I live in Eagan, Minnesota.

**Brianna 05:14**

Hi, my name is Brianna. And I'm eight years old, and I live in McAllen, Texas.

**Luka 05:20**

My name is Luka. I live in [garbled] South Africa, and I'm eight years old.

**Joseph 05:24**

I'm Joseph. I am 11 years old. I'm from Dublin, Ireland.
Jane  05:30
Hi, I am Jane and five years old, and I live in Eagle Mountain, Utah.

05:34
Hello, I'm Griff. I'm five. I live in Cheltenham, England.

Natalia  05:40
My name is Natalia and I'm five and a half years old. And I live in Lowell, Maryland.

Leah  05:48
My name is Leah. I'm six years old, and I'm from Ohio.

05:53
My name is Chelsea. And I am seven years old. I live in Pittsburgh, Kansas.

Louis  05:59
My name is Louis. I am seven years old. I'm from Kansas City. And my question is, how do birds fly?

Ansel  06:09
How do birds fly?

Jane  06:11
That last question came from five year old Ansel in Newark, Delaware. And Fiona in Winnipeg, Canada also wants to know how birds fly. Birds' bodies are adapted for flight. We were talking a minute ago about feathers. But wings are also really important when it comes to flight. And the shape of the wings matters. Bird wings are shaped like an airfoil. An airfoil is a shape that's designed to make flight possible and efficient. We call it aerodynamic. An airfoil is a curved surface, rounded on top and thicker in the front, gradually sloping back to be very narrow. Bird wings have this shape. And so do airplane wings and fish fins. Those airfoil-shaped wings have feathers that are strong and flexible. If you've ever found a feather on the ground, you've probably noticed that the quill of the feather is hollow. The quill is the long shaft that all the other frilly pieces attach to. Most birds also have hollow bones, which makes their bodies light and strong. The rest of the bird's weight is centered in its body.

Jane  07:20
Okay, so that's how the shape of the bird helps it fly. But how do they do it? Well, birds have to flap their wings to get the air moving around them. They aren't just flapping up and down like you would flap your arms. They're using those wings to move air around the wing. This generates thrust. A plane would use a propeller or a jet engine, but a bird can do it using the muscles in their chest. If you watch a bird, you'll sometimes see them jump a bit on takeoff as they're flapping their wings. Once the air is moving, the air going over the top of the wing has to travel farther and faster than the air under the wing because of that rounded shape. So there's less pressure on the top of the wing and the bird has lift and then they're flying. Birds will flap their wings in flight to create that forward thrust and the air rushing under their wings will maintain lift. Some birds will take a break from flapping to soar. In a little while we'll talk about how they use special body adaptations and wind currents to do that.
Blake 08:22
My name is Blake, I am seven years old. I'm from Atlanta, Georgia. And my question is: why do hummingbirds fly so fast?

Jane 08:31
Hummingbirds are amazing, aren't they? They can dive at speeds of about 50 miles (or 80 kilometers) per hour. One of the reasons they look so fast, Blake, is because their wings are moving so fast. Some hummingbirds beat their wings 90 times per second! Try flapping your arms for one second. How many flaps did you get? One, two, maybe three? Imagine if you could do it 90 times in one second. Ready, go. Yeah, I couldn't. Hummingbirds are unique in the bird world because they can fly backwards as well as forwards and they can hover for a really long time. They actually beat their wings in a figure eight pattern, which means they're pushing air both forward and back--and down, allowing them to generate that force called lift in both directions of their wings strokes. And even though they're so tiny, hummingbirds often travel thousands of miles during migration, sometimes not stopping to rest for 500 miles or more.

Jane 09:40
Now let's go from some of the smallest birds to something much bigger. Remember how I said that some birds soar? Raptors are soaring birds. Raptors are medium to big birds that eat other animals. They are predators. They're carnivores. Some raptors include owls, hawks, falcons and eagles. At certain times of the year, raptors will take advantage of changing air temperatures to soar on special gusts of wind called thermals. We visited VINS, a nature center and bird rescue in Queechee, Vermont, to find out more about raptors and how they do this special kind of flying. And we spoke there to an educator named Anna Morris. Well, she was the human educator. She also had a winged educator with her.

Jane 10:28
Hi, Anna.

Anna Morris 10:29
Hi, Jane.

Jane 10:30
And hello to whoever this is. Who is this?

Anna Morris 10:32
This is Northfield. Northfield is a broad-winged hawk.

Jane 10:35
Oh, broad-winged hawk sounds like maybe he has broad wings?

Anna Morris 10:39
You would be right about that. He has big wide flat wings that help him to soar.
Jane 10:45
Oh, soaring. So he is one of the raptors that soars.

Anna Morris 10:48
Absolutely.

Jane 10:49
Okay. And how does a bird like Northfield soar?

Anna Morris 10:52
Well, he's going to use those wings to catch a lot of wind up underneath him. These birds are looking for particular kinds of air like thermals, or rising columns of hot air that come off the land during the day, or mountain updrafts that come from the wind blowing over mountain ranges, like the Appalachians. So he's looking for those particular kind of highways of wind to carry him up into the sky and then southward on his winter migration.

Jane 11:17
Why not just flap your way there?

Anna Morris 11:19
Well, that takes a lot of energy. That, really, if you stand there and flap your arms for a really long time, you're gonna get tired. And so with these birds, so it helps them to save energy to not need to eat as much food while they're traveling.

Jane 11:32
And it's amazing: the shape of their wings and the shapes of their bodies are what help them to have this very efficient form of flying so that they can do that migration that takes so much time and energy. Northfield himself cannot soar. Why not?

Anna Morris 11:46
That is true. He actually, as a baby, fell out of his nest, and the person that found him brought him to our wildlife clinic where we were able to see that he had broken his shoulder. And unfortunately, that injury didn't heal properly, so he really can't fly at all. He can barely fly, like 20 or 25 feet, let alone 3000 miles to South America. So he now is an education ambassador and helps us to teach about soaring birds.

Jane 12:14
Now Anna was telling us earlier about how birds' wings are developed to help them be able to fly like that. But it's also really important what kind of wind is out there, what kind of air currents are moving through the landscape that the birds can take advantage of. So let's talk about two of them. One is thermal soaring. Raptors fly on thermals, and that's when warm air, which is down towards the bottom near the land that has been heated by the sun, rises. Because, as you've probably heard, warm air rises and that helps lift the birds up so they can get higher into the air. Birds like the hawk that we just
saw also rely sometimes on updrafts. Now, updrafts occur when the air and wind is moving along a landscape and then hits an obstruction like a cliff or a hill. The air has to turn upwards to get through and over that obstruction, and the birds can take advantage of that air rising too. It's really neat how these birds have adapted to be able to use the landscape to their advantage to have the most efficient way of flying. Thanks to Anna Morris and everyone here at VINS for teaching us a little bit more about the science of soaring.

**Jane   13:38**
We visited VINs as part of our new educational video series called But Why: Adventures, Northeast Nature. It's a monthly video series for educators. All through this school year we'll be exploring things happening on the landscape each month, particularly in the northeastern part of the US and Canada where we're living. Maybe your class or homeschool would like to use these videos. We also have curriculum lesson guides that go with them. Have your adults take a look and sign up at butwhykids.org/nature.

**Jane   14:10**
Coming up, Why do birds fly in a V? How high do ducks fly? And do birds ever fall down while they're flying?

**BREAK   14:17**
BREAK

**Jane   14:18**
This is But Why. I'm Jane Lindholm and today we're learning all about how birds fly. We just heard about special adaptations raptors have that allow them to fly without flapping their wings, using special types of wind to help move them up and forward. That's really efficient flying because the birds don't have to use all of their energy flap, flap, flapping! But that's not the only way birds have learned to make flying a little easier.

**Jane   14:44**
My name is Teddy I'm eight years old and I live in Lake Elmo, Minnesota. Why do geese fly in a V shape?

**Melissa   14:53**
My name is Melissa and I am seven. Why do geese fly in a V shape?

**Jane   15:01**
in the spring and fall, you might look up and see a flock of geese flying high overhead, squawking as they go, all flying in formation in the shape of a V, or maybe a checkmark. Just like the raptors using thermals to conserve energy, geese are conserving energy by flying in a V. But they're not using thermals; they're using each other. Here's how our friend Bridget Butler, better known as the Bird Diva, explains it:

**Bridget Butler   15:27**
You have to fly a really long distance when you’re migrating and you want to conserve as much energy as possible. If you stood there right now, and you flap your arms, and you just keep flapping and flapping and flapping, you can get tired pretty quickly. But if you work as a team together, you can decrease the amount of energy you have to use. So when you fly in a V, what the geese are doing is they’re drafting each other. So they’re kind of providing a windbreak for the bird in front of them. So they stack up just right a little bit above each other and next to each other, in order to take advantage of breaking the wind. And then the wind that’s coming off of the goose’s back in front of them, which we call the upwash or an updraft, and they flap together and they fly together. And Jane, they take turns, which is really awesome. So that goose that’s out front leading the way and breaking, the wind will drop back and someone else will take that place in order to give that goose a little bit of break and a chance at taking advantage of the updraft.

Jane  16:27
If you are looking up and seeing those flocks of geese, it’s obviously light enough for you to notice the shape they’re flying in. But geese prefer to do their long distance flying at night. It’s a little bit safer because their predators are probably sleeping. And it’s cooler because the sun’s not beating down on them. Flying makes them pretty hot, you know! But there’s another reason, too. Those thermals that the raptors love can actually mess with the geese and make it harder for them to fly. But at night, the air tends to be calmer with fewer thermal gusts. Much better for the geese.

Marcus  17:00
My name is Marcus and I’m six years old. I live in Quebec, Canada. And my question is how high do ducks fly?

Jane  17:08
The highest flying ducks people have recorded are a couple of species of ducks that fly over the Himalayan mountain ranges in Asia to migrate. These ducks have been known to fly at altitudes heights of more than 20,000 feet (6000 meters). There’s less oxygen in the air at that altitude and these ducks are flying hard. So that’s amazing! But most ducks fly much lower to the ground, anywhere from a couple hundred to a couple thousand feet in the air.

Chase  17:38
My name is Chase. I live in [garbled]. I’m three and a half. Why do birds fly and never fall down?

Jane  17:48
Birds don’t usually fall when they’re flying. That’s because they’re using the forces we learned about earlier, lift and thrust, to keep them in the air. But occasionally things go wrong for birds. And often that has to do with people and things we’ve created, like buildings or airplanes or distracting lights at night. Sometimes large groups of birds might fall if they’re flying close together and are disturbed by a predator. But those instances are rare.

Naomi  18:13
My name is Naomi. And my question is why can’t chickens fly?
My name is Sahara. I live in New York City. I'm five years old. Why do chickens have wings if they can't fly?

Jane 18:27
Great question. But Naomi and Sahara, chickens can fly. It's true, they don't fly long distances like some of the migrating birds we were just talking about. Chickens fly primarily to roost--basically to go to bed. Chickens need to find a safe place to spend the night. They can't see much at all in the dark and they like to get up off the ground away from potential predators. They get there by flying. And they can fly short distances for other reasons during the day if they feel like it, like to get away from kids who are chasing them, or to hop a fence if there's something better to eat on the other side. Unless you've spent a lot of time with chickens, you may never have seen one fly. Chickens that live in coops might not have to roost up high at night, they could potentially just pop up. Chickens are domesticated animals, meaning humans have been taking care of them and breeding them for certain characteristics for thousands of years. Some breeds of chickens can fly really well, while others have lost their ability for long flight because humans have prioritized heavy bodies or silky feathers which are not good for flying. But their wild ancestors most certainly flew.

Nicholas 19:34
Nicholas and where am I from? Holt, Michigan. Holt, Michigan. Do penguins fly?

Penny 19:41
My name is Penny and I live I'm from Oregon. Why do penguins don't fly?

Charlee 19:49
My name is Charlee and I'm from Bryant, Arkansas. I'm six years old.

Sammy 19:54
My name is Sammy, I'm five years old. I live In Springfield, Virginia.

Esperanza 20:02
Hi, my name is Esperanza. And I'm six years old, and I live in Union City, California.

Grayson 20:08
My name is Grayson and I live in Groton, Connecticut and I'm eight years old.

Lila 20:14
Hi, I'm Lila. I'm eight years old and I live in Nampa. Idaho.

Everly 20:20
Hi, my name is Everly. And I'm four and I'm from Stratford, Connecticut. How do penguins have wings, but they can't fly?

Jane 20:31
Penguins fly. They just do it underwater. All right, that's a bit of a trick answer. Penguins do not fly. They have evolved into such good swimmers that their wings aren't used for flying at all. In fact, they're the only birds that can't bend their wings. Their wings are stiff and have changed so much from the wings of other birds that many people now think of them as flippers instead. Penguins spend about three quarters of their life in the water because that's where the food they like to eat is. They can swim up to 22 miles an hour. That's fast. They're also one of the few birds that don't have hollow bones, since they don't need to lift their bodies up into the air but instead need to get down under the water. Their dense bones are really helpful.

Declan 21:16
Hello, my name is Declan and I live in Halifax. I'm nine years old and my question is, why can't some birds fly?

Violet 21:23
Hello. My name is Gefen. I'm six years old. I live in Los Angeles, California. My question is why some birds like ostriches and emus have feathers and wings but they can't fly.

Jane 21:39
In addition to penguins, ostriches, emus, rheas, and cassowaries are all birds that can't fly. Those are all big tall birds with wings that can't carry their heavy bodies. And they have longer legs than many birds who do fly. Birds that can't fly are missing a bone that would attach to flight muscles. They tend to have bigger bodies and longer legs than birds that can fly and feet that are adapted to running. In fact, ostriches can run 43 miles an hour, almost 70 kilometers. That's almost as fast as a car driving down the road. Scientists think these birds have smaller ancestors that could fly. But at some point, all of those species adapted to bigger sizes and gave up their ability for flight. It's still not clear why. One theory is that they didn't need to fly in order to escape predators in their environments. There are also a handful of smaller birds that can't fly, including Weka and kiwi and a handful of others.

Ruby 22:35
My name is Ruby. I'm eight years old. I live in Berkeley, California. My question is, do birds have fun flying? Or are they just looking for food?

Jane 22:48
I like this question, Ruby. The truth is, no one really knows. Because we can't ask birds how they feel. It's tempting to think birds have feelings just like we do. But without being able to experience what it's like to live inside a birds brain and body. We just can't be sure. Flying takes a lot of energy. So most of the time when birds are doing it, they're doing it for a reason. But I can tell you that I would enjoy flying. I sure did in my dreams as a kid. How do you imagine flight? Do you daydream yourself jumping and gliding, flying from the trees down? Soaring like a raptor or going a mile a minute like a hummingbird? Ooh, and where would you fly? Would you migrate long distances every year so you could see different parts of the world.
We'd love to see your pictures or any stories you write about flying. Send them to questions@butwhykids.org. That's of course also where you can send your questions. Have an adult help you record yourself. If your adult has a smartphone, they can use the memo function or another free recording feature. Be sure to tell us your first name, where you live and how old you are. And try to do it in a quiet space, not in the car. We can't answer all of your questions, but we do listen to them all and we love hearing your voices. If you're not comfortable or able to record your voice though, you can always have your adult write out your question. Again send them to questions@butwhykids.org.

Jane 24:15
Our show was produced at Vermont Public and distributed by PRX. Our team includes Melody Bodette, Kianna Haskin and me, Jane Lindholm. Luke Reynolds wrote our theme music. We'll be back in two weeks with an all new episode. Until then, stay curious!