But Why: A Podcast for Curious Kids

Why are cockroaches so yucky?

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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 just like you all over the world, and we find cool people who can help us with the answers. A few weeks ago, we left Vermont, where we usually make the show, to have an adventure in the biggest city in the US: New York City. And where did we go once we got there? Well, we made a beeline to one of our favorite museums, the American Museum of Natural History. When we got there, we headed downstairs to a new part of the museum that we'd never seen before, and it's only been open for about a year. The insectarium.

Jessica Ware 01:02
So the goal for the insectarium was that like this is a 21st century and we want to actually kind of capture everything about insects. So this, you know, 27 orders, and there's a million and a half described species. So how do you capture everything about insects?

Jane 01:15
That's Jessica Ware. She's an entomologist. That's a scientist who studies insects, and she works at the Museum of Natural History as an entomologist and a curator, someone who helps oversee museum collections. How cool is that? She gets to work behind the scenes at an amazing museum and be an insect scientist! She's also the host of the PBS Digital series, "Insectarium." There was so much to see in this part of the museum, so Jessica showed us around for a little while before we got down to your questions.

Jessica Ware 01:48
But you start with the phylogeny, if you come in from the side, to see how the different insects are related to each other, the tree of life of insects. And then along this wall are kind of vignettes or facts about insects: they are really good at camouflage, they're very good at flying, they have interesting mouth parts and their mouth parts very if they're chewing or sucking. We wanted to try and highlight the diversity that you can see both in our collections and kind of across all of the animals. So for that we have these meet the insect kind of these ovals. But they're kind of like highlighting the orders that have the largest numbers of species, I guess. And then there's some interactive kind of gamified things where you can zoom in and actually see scanning electron microscope images are computed tomography that scientists upstairs have done to see inside the animals.

Jane 02:33
And that's not even close to all of it. There's a ton more including information about how insects can have an impact on agriculture or can transmit diseases. There are live insects, too, like leafcutter ants and big polka-dotted cockroaches.

Jessica Ware 02:49

Not everybody experiences exhibits the same way depending on their abilities. So there also is like a sensory wall over in the back corner. So you can hear sounds and feel them as vibrations, depending on your hearing abilities. And you can feel the vibrations of how that would sound in the night or in the day and in different ecosystems.

Jane 03:08
I could have spent all day wandering around the insectarium. But we weren't just there for ourselves.

Jane 03:14
Well, Jessica, we have a lot of questions about insects from kids. Could we go to your office where it might be a little quieter and let everybody here be able to experience the insectarium and have you answer our questions?

Jessica Ware 03:23
Yeah, let's go upstairs.

Jane 03:25
So we got to ride up in an elevator that was so big, it could have fit a couple of elephants inside it with us. And then we walked through hallways with giant file cabinets full of museum artifacts that weren't on display. And we stepped into Jessica's beautiful office, a quiet oasis away from the hubbub of the museum to talk a little bit about bugs.

Jessica Ware 03:47
So insects have been around for a very long time. And we think that they evolved over time. And so I study their evolution. I always liked insects, I thought they were really pretty. And I was lucky enough that I was able to go outside as a kid and spend a lot of time lifting logs and flipping rocks. And there was a lot of insects underneath them.

Jane 04:09
We've gotten a lot of questions from you about insects. Some of you are really curious about the cooler aspects of insects, but others of you are not always sure how to feel about bugs...like Rosie.

Rosie 04:22
I'm five years old. I live in China. And my question is, why are roaches so yuck?

Jane 04:33
So let's talk a little bit about that feeling of yuckiness that Rosie is talking about and why some people feel that way about cockroaches in particular.

Jessica Ware 04:44
So I think that people tend to think of cockroaches, they tend to think of the 2% of them, the very small number, that are pests. These might be things that come out of the drain into your home, and they like to eat the food that we have at our houses. Sometimes they're coated with bacteria or germs. And that can make us sick. So we tend to not like to be around those kinds of cockroaches. But there's

thousands of other species of cockroaches that are not living in this way, that are very, very clean. And we shouldn't be afraid of them. And in fact, most other cockroaches don't look brown and sticky. They actually look colorful or polka dotted or metallic.

Jane 05:24
And I actually, like, even the cockroaches that you see on the sidewalk, they're very cool looking. They have that hard shell. And they can like sort of spin around and go backwards and do all these cool things with their bodies. What are some other cool things that cockroaches do?

Jessica Ware 05:39
Cockroaches are very good at moving around, scuttering.

Jane 05:41
Is that what the technical name is, scuttering?

Jessica Ware 05:43
Yup. They're very clean; they actually clean themselves constantly. You may see them taking their antenna and putting it near their mouth. And that's actually them cleaning their antenna. They can do neat behaviors. Because the mom cockroaches actually can produce milk. In some of the species of cockroaches, they produce milk that they feed their young with, even though they're not mammals. And the composition of the milk actually has the same kind of nutrition, it's like nutritionally similar to what mammal milk has, which is very cool. Some cockroaches actually mimic other things so they can mimic ants or roly polies, like the little tiny pillbugs. So I think cockroaches, I mean, they have very small brains, but they seem very smart.

Oliver 06:26
My name is Oliver. I live in North Carolina. Why do we have cockroaches?

Malena 06:32
Hi, But Why my name is Malena, I'm nine years old, and I live in Spain. And my question is, why do cockroaches exist?What is their purpose?

Jane 06:44
I guess we could all say the same thing about all of us too. But what do cockroaches do?

Jessica Ware 06:49
The reason why cockroaches exist is because an ancestor to them existed and they've evolved. But the reason why I think cockroaches are important is because they actually are decomposers. So they break down leaf litter. They do soil aeration, they put air into the soil. And if not for them, then actually every tree that ever fell would just stay a tree. The reason why it rots and becomes a log that eventually decomposes into the ground is because of things like social cockroaches, or termites.

Jane 07:18
Termites are a type of cockroach.

Jessica Ware 07:20
Yeah, so around 2007, scientists finally changed the name. Because termites are actually just a fancy social version of a cockroach.

Jane 07:29
What do you mean by social?

Jessica Ware 07:31
Basically, we we, when we talk about social insects, we talk about cooperation. So this is a lot of individual termites cooperating together for the greater good. Termites have a social system where there's a king, a queen, a worker, and a soldier. And they work together as a team. There's actually hundreds, sometimes thousands of workers. They do all the jobs. The king and queen kind of are like royalty; they make the babies that go on to the next generation of termites. But they get taken care of by the workers. So the workers groom them and the workers feed them. But sometimes other animals try and invade the nest. And so that's when the soldiers kind of spring to action. And they prevent other animals like ants, and other predators from coming inside of the termite nest.

Aiden 08:17
My name is Aiden, and I'm four and a half. And I live in Mckinleyville, California. And my question is: how can termites bite through a whole entire house of wood?

Jessica Ware 08:38
Well, they don't do it in one bite. The joke is very slowly. That's how they do it. They do it very slowly. No. Well, termites, some termites can actually bite through hardwood, and some termites can't. So termites use their mouthparts, which we call mandibles, to break down things. Some of them are very weak, and they can barely just clip blades of grass. And others have very strong jaws. And they can cut through wood, rotting wood, and some of them can actually cut through hard wood that's not rotting. I have a graduate student, former graduate student, she actually looked at what their teeth are made of what their jaws are made of. And some of them can incorporate metal into their jaws. And it makes the jaws very strong. It makes the mandibles very strong. And that's how they're able to eat hard things like wood.

Jane 09:24
Where do they get the metal from?

Jessica Ware 09:26
From the soil, from the environment. So they're able to incorporate it into their bodies from the environment and that makes them really good at chewing hard things.

Jane 09:35
That's amazing. I'm a little distracted having this conversation with you because you have a beautiful pin that you're wearing of a praying mantis.

Jessica Ware 09:45
Oh yes.

Jane 09:46
It's really lovely. And we have a question from Dylan, who wants to know how to praying mantises pray.

Dylan 09:52
Hi, my name is Dylan. I'm four years old. I live in Maryland and my question is how do praying mantises pray?

Jessica Ware 10:04
Oh, that is a good question. Praying mantises have what they call raptorial forelegs. That's a fancy way of saying that when they hold their front arms--they have three pairs of legs, because they're insects, they have six legs in total. When they hold their front legs, they kind of bend in a way that looks like their hands are coming together to make like a prayer. But actually, those legs are doing a function. They have these little spines on them. And when food comes by, they actually are able to quickly grab the food and then angle their leg towards their mouth and then eat whatever it is, a fly or a butterfly, necause mantises are predators, so they eat other insects. So the way that you see them holding their hands, the reason why they're they're kind of holding their their insect hands in that direction isn't because they're praying it's because they're waiting for food.

Jane 10:54
So instead of praying, P-R-A-Y, maybe these insects should be called praying P-R-E-Y mantises, like they're sitting there with their arms up preying on other unsuspecting bugs, get it? Here's another cool thing about mantises:

Jessica Ware 11:11
Mantises have ears. It's relatively new that we've known that mantises have ears, but they're able to pick up sound and vibration, which is kind of neat. Mantises have really great vision, we think, so they're able to detect movement and also see color. So a lot of the mantis colors that you see are actually signaling, males signaling to females that they're they're members of the same species, which is really neat. They're able to see a lot of different colors.

Jane 11:35
Wow, we have some questions about dragonflies. And I hear you really like dragonflies.

Jessica Ware 11:40
I love them.

Edmund 11:41
My name is Edmund. I'm six and a half years old and I live in Collinsville. And my question is: how do dragonflies snatch spiders without getting stuck in spider's webs?

Jessica Ware 11:55

That is a very good question. So I'm not sure if you mean...there is a group of damselflies that are called Pseudostigmatidae or megaloprepus is the genus. They're also called giant helicopter damselflies. They live in Central and South America, and they specialize on eating orb weaver spiders. So they're very good at hovering in front of a spider web, and then kind of using their legs and their mouthparts to pick the spider off. Spiders are pretty crafty, though. So sometimes when megaloprepus, when these giant helicopter damselflies, start flying through the forest, spider just drop down onto the ground off of their web so that they can't be found to be eaten. So that's a very unique circumstance where they're kind of are specializing on spiders. And the way that they're able to pick them off is very delicately, very carefully, and they hover kind of in front of the web. But there's other times that you see dragonflies and damselflies that try and get things off of webs. And often what you see is the dragonfly or damselfly has actually got themselves in the web, I often find them kind of tangled up in webs.

Aiden 13:01
Hello, my name is Aiden. I'm nine years old. I live in Pleasanton, California. And my question is, if a dragonfly moves backward in a moving train that is moving forward, will the dragonfly move?

Jessica Ware 13:17
If a dragonfly is moving backwards in a train that's moving forward....well, the dragonfly is moving, right? But the question is, does the dragonfly know that it's moving? And the answer is yes. They're really good at navigation. They're really good at controlling their speed. And they're really good at sensing where the horizon is. So although I've never spoken to a dragonfly, and they obviously can't talk to tell me, my guess is the dragonfly would be able to perceive that it was moving, accelerating in the direction that's different from where it's intending to go. And it would adjust its speed and it would adjust its flight to try and make sure that it actually is progressing in the direction that it wants to travel.

Jane 13:56
Got it.

Jessica Ware 13:57
Some dragonflies can fly very fast, like 30 miles an hour. So it depends on the speed of the train.

Jane 14:02
That's what I was thinking. I mean, if the dragonfly is flying in one direction, and the train is going in the other, eventually the dragonfly is going to hit the end of the train if it's going faster than the train, and then the dragonfly will be going in the same direction as the train.

Jessica Ware 14:14
Yeah, that's a good question. But is it a bullet train? Is it an Amtrak train? Like what's the speed of the train? There's the question.

Ollie 14:19
I'm Ollie from Tacoma, Washington. My age is six. How long does a dragonfly live?

Jessica Ware 14:27

Oh, that's a very good question, Ollie, because it varies a lot. So there's over 6400 species of dragonflies and damselflies. Some of them live for a couple of weeks as a baby in the water. The female lays her eggs in freshwater, they develop in freshwater and then emerge as an adult. Some of them do that in a couple of week periods. But some of them do that in like five, 10 or 20 year periods. So the longest-lived dragonflies are, like I said a couple of decades old that they spend as juveniles in the water. It's always the case that the adults live for just one summer. So no matter how long you've spent as a kid in the water, you usually just have one summer as an adult.

Max and Andrew 15:09
I'm Max. I'm Andrew and we want to know why are dragonflies different colors?

Oliver 15:19
My name is Oliver and five years old, and I live in Germany. Why all dragonflies different sizes?

Jane 15:34
Dragonflies today have wingspans of two to five inches, but they used to be much bigger. There's an ancient extinct dragonfly that had a 30-inch wingspan. That's more than two feet! And different species have different colors: red, yellow, brown, blue. When you include damselflies, which look a lot like dragonflies, you can even find purple ones. There are over 7000 species of dragonflies. And these insects first appeared 325 million years ago. So in that time, many different species have evolved and that's led to a lot of diversity in size and color. Coming up, more answers to your insect questions with entomologist Jessica Ware.

Jane 16:21
This is But Why: A Podcast for Curious Kids. I'm Jane Lindholm. We're at the American Museum of Natural History in New York City today with insect scientist and curator Jessica Ware. We're talking about insects, but do you know what makes an animal an insect, or how to tell an insect from a different kind of animal?

Jessica Ware 16:43
All have six legs. They all have a head, a thorax and an abdomen. The thorax is divided into three parts. And the second and third part have wings. So the winged insects are the Pterygota, which means wings. And they all have wings on the second and third segment of their thorax. So if you see something that has six legs, it's probably a hexapod, which means six legs. If you see something that has six legs, but it also has wings on the second and third segment of its thorax, then it's a winged insect or Pterygota.

Jane 17:19
But when we think about some insects, like ants, we don't think about wings necessarily. So not all of the insects have wings.

Jessica Ware 17:27
Ants are a good example. Because ants actually do have wings, it's just that the workers don't have wings. So the reproductives in the social insects, like termites, and like ants, they tend to have the

reproductives with wings and the workers and soldiers without wings. And that's because termites go inside of their mounds, and if they had wings, it would get all torn up. Same for ants. Bees of course, bees all have wings, even if they're not reproductives, because they're not going inside something underground where they would have their wings torn up. And they need to be able to fly to forage. Things that don't have wings that have lost wings or things like fleas like that your cat or your dog might have. Those are things where there's no wings. If anyone's ever had lice, it's a thing, sometimes people get lice, that's an insect. They don't have wings because they don't need wings, right? They're kind of crawling and clinging to animal hair or bird feathers, but they're still insects.

Jane 18:17
Remember, spiders are not insects.

Jessica Ware 18:20
So arachnids are different from insects because they have eight legs instead of six. And instead of having three segments, a head, thorax and abdomen, they just have two.

Jane 18:29
So you could have a lot of things crawling on your body, and it may or may not be an insect, is what I'm getting at.

Khalil 18:34
Hi, my name is Khalil, and I live in Beirut, Lebanon. Why do beetles have shells?

Jane 18:45
Why do beetles have shells?

Jessica Ware 18:47
Ooh, also to protect their wings. Winged insects always have two sets of wings, and in beetles, the top set of wings, we call them the forewings, they're hardened into this tough shell which we call an elytra. Why do they have that? It's so that that way they can protect the wings that are underneath it, which are the hind wings. They need to be able to fly. But if their hind wings, which are very floppy and delicate, if they weren't protected, every time a beetle went underground or underneath bark, they would be torn to shreds. So the elytra, the hard shell, is actually just to protect the hind wings.

Benjamin 19:20
Hi, my name is Benjamin. I live in Arizona, and I'm six years old. And my question is, do bugs have brains?

Jessica Ware 19:31
Yes, they do, Benjamin, but not in the way that that humans or mammals have brains. They have kind of clusters of nerve cells. We call them ganglia. And they're in different parts of their body. There is a bunch that are kind of centralized in the head, and they have a part of their head that's called the mushroom body which we think is related to memory.

Jane 19:50
So bugs may have memory.

Jessica Ware 19:53
Insects might be able to remember things from time to time. I don't know. It varies a lot amongst the insects.

Etienne 19:59
My name is Etienne. And I'm four years old and I live in [unclear]. How do bugs pee? So silly!

Jane 20:09
Etienne wonders how bugs pee.

Jessica Ware 20:12
Ah, Etienne, it depends on the kind of insect. There's lots of different types of insects. There are things like cicadas and they basically just drink sap from trees drink the sugary water from instead of trees. So everything that they excrete is basically liquid, we call it honeydew. It's a very sweet liquid. And they have an opening in their abdomen, all of the stuff comes out the same opening. So their poop is really just liquid sap and any liquid excretion is also liquid honeydew. Oh, termites. Termites have poop that is hexagonal, because their bum is--and I know you asked me about pee--but their bum is like shaped with six sides. So their poop comes out as these perfect little six sided pellets, which is very cool.

Jane 20:57
Wow, that's cool.

Jessica Ware 20:57
And then their pee is just liquid.

Henry 21:00
My name is Henry. I'm seven years old. I live in Jekyll Island, Georgia. And my question is, why are bugs attracted to light?

Amelia 21:09
Hello, But Why! My name is Amelia. I'm from New York City, and I'm nine years old. And my question is, why are bugs attracted to light?

Jessica Ware 21:18
So some insects that fly at night, especially, they tend to navigate using the moon. So when they see a bright light, sometimes they get confused, especially if it's a new moon and there isn't a bright moon in the sky. They're kind of like navigating with this moon that suddenly is very close. And that makes them kind of go closer and closer and kind of circle the light, ultimately, sometimes, to their demise. Because if they do that they're wasting time, they're wasting energy, they're not feeding. Sometimes they actually can get caught in the the fixture where the light is. So you should always actually, as a kindness to

insects, turrn off for your lights. Because light pollution is one of the reasons why we think night insects are declining.

Jane 21:57
Because so many people have lights on their porches or because of bigger light problems.

Jessica Ware 22:03
A lot of the light pollution is the things that you and I do, having our backyard lights on, having lights in front of our house, having a light that's just shining on a tree as a property fixture. So turning off lights, making a dark sky. Most of these insects that fly at night evolved before humans invented light bulbs. They really evolved to be able to communicate with each other and to be able to navigate in darkness. So if there's really bright lights, fireflies can't see the signals that they're flashing to each other, moths get kind of caught with their navigation cycle being thrown off.

Jane 22:34
So turn off your lights if you can.

Jessica Ware 22:37
Turn off your lights.

Rowan 22:38
Hi, my name is Rowan and I live in Springfield, Missouri. I'm four years old. Do bugs have teeth?

Jessica Ware 22:45
Insects do have mouth parts and some of the mouth parts look like teeth. There are these things called mandibles, which is what they use. We kind of think of them like a tooth, and they use it for grinding. Some mandibles are really sharp and pointy and they actually can use them for fighting with each other. And then some of them are almost just like your molar would look like.

Aneja 23:03
Hi, my name is Aneja. I'm four years old. I'm from Montreal, Canada. I want to know why do insects don't have bones.

Jessica Ware 23:14
Insects don't have bones because they're a member of a group called invertebrates. So instead of having their structure to support their bodies inside as bones, they have an external hardened shell, which we call the cuticle.

Lila 23:28
Hey, my name is Lila. I'm seven years old and I live in Waterbury, Vermont. My question is: are bugs ticklish?

Jessica Ware 23:37

I don't know if bugs are ticklish in the way that we think of ticklishness. But if you were to go up and rub a bug, they probably will walk away from you. They probably don't enjoy the sensation.

Zinnia 23:48
My name is Zinnia. I live in Waltham, Massachusetts, and I'm five years old. And I'm wondering: why are bugs so small?And why aren't there any bugs that are as big as us?

Jessica Ware 24:00
Ooh, that's a good question. Part of the reason why they're not as big as humans is because they don't have an internal skeleton. They have an external exoskeleton, and just the physics of it make it kind of impossible for them to be that size without their body kind of collapsing in on themselves. We think that there used to be a lot of larger insects in the past. We have fossils of those. But over time, insects we think have kind of gotten smaller, so they have kind of optimized the best size so that they can best compete for the space that they have in the ecosystem.

Jane 24:29
What is the biggest insect How big is it?

Jessica Ware 24:32
Well, there's some pretty big Hercules beetles that are, in terms of weight, they're very, very heavy. But then there's very big dragonflies like petalura, which is a giant dragonfly. It has pretty big mass and it's about the the width of your hand from your palm to your fingertips if you have a grownup's hand.

24:51
What do you love about studying insects? What's so cool about being an entomologist?

Jessica Ware 24:57
Well, there's a lot of things to discover. And I like the idea of discovery. I like the idea of mystery. So studying insects means that every day is new. You get to go to the jungle, you get to go to the Arctic, and kind of find new species, determine what's happening with biodiversity, and hopefully help save the planet.

Jane 25:15
Did you know when you were a kid that...could you have pictured where you are right now, working in the American Museum of Natural History, being able to study bugs and teach kids about bugs and, you know, doing this on TV and with students and all of these other different ways?

Jessica Ware 25:31
Definitely not! I was going to either be a cab driver or maybe work at a bank. So I definitely didn't think I was going to do this for my job. Because I didn't know this was a job. I think if someone had told me as a kid, this was a job then maybe I would have jumped at it. But I didn't learn that there was such a thing as entomology till I was in university.

Jane 25:48

Oh, wow. So you liked bugs, but you didn't know you could study them until you were at a place where you could actually study them?

Jessica Ware 25:54
Yeah, I had no idea that people actually could get paid to do such a fun thing.

Jane 25:58
So how did you take your first class and entomology. Was it on a whim?

Jessica Ware 26:02
I was going to take marine biology at university and I was taking invertebrate zoology, which is a required course. You know, things like sea anemonies or jellyfish. They don't have backbones, either. So we learned about those in the beginning of the class. And then one day, this woman, Karen Needham, walked in and she said, "I'm teaching the next part of the class, I'm an entomologist. There's more insects on this planet than any other life form." And I was like, that's it. I want to study insects forever.

Jane 26:28
You know, there are a lot of kids who really like insects, and who live with adults who don't. What happens between childhood and adulthood that makes some adults fearful of insects? And how can kids convince their adults like, "Hang on a minute, let's not be prejudiced against all insects. Look at all of the amazing things they do!"

Jessica Ware 26:48
I do think we all kind of grew up maybe observing insects and maybe thinking that they were cool. But a lot of grown ups kind of teach us to not like insects. We know this--a lot of work that's been done that says that when you're afraid of insects, it's a learned behavior. If your grownup is afraid of insects, that probably means someone who was a grownup in their life when they were a kid taught them to be afraid of insects. So it's really important to talk to the grownups about how many different insects are out there. There's a lot of them there. Most of them are not pests. The majority are not pests. And without them all species wouldn't do very well.

Jane 27:22
And that brought us to a final question. Why do we need insects anyway?

Cass 27:26
my name is Cass. I live in New Mexico. I'm five years old. And my question is, why do bugs exist on Earth?

Jane 27:39
Regal, who's seven also sent us the same question: why do insects exist? And the answer is, quite simply, we need them.

Jessica Ware 27:49

Birds need them. Chipmunks need them. Humans need them, fish need them. So our world kind of depends on insects, and we have to do what we can to protect them.

Jane 27:57
Some insects are pollinators, making sure our flowers and food can grow. Some insects are decomposers, who break down wood and plant materials so it doesn't all just pile up, but instead becomes the soil for our fruits and vegetables. Some insects are predators, others are prey. Insects are really important. And aren't we lucky to have people like Jessica Ware who can help us appreciate them. Jessica is associate curator and the current division chair in the division of invertebrate zoology at the American Museum of Natural History. She's also the host of the PBS series, "Insectarium."

Jane 28:36
That's it for this episode. Now, if you have a question about anything, have an adult recorded, it's easy to do on a smartphone using a free app like voice memos or voice recorder. Then have your adult email your question to questions@butwhykids.org. We always like to remind you that we can't answer every question we get. Because we know it's sometimes disappointing not to hear back from us right away. But we do listen to every single one of your questions and we love hearing what's on your mind. But Why is produced by Melody Bodette, Kianna Haskin and me, Jane Lindholm, at Vermont Public. Our theme music is by Luke Reynolds. We're distributed by PRX. We'll be back in two weeks with an all new episode. Until then, stay curious.