

COLIN: You're listening to *Brains On*, where we're serious about being curious.

CHILD: *Brains On* is supported in part by a grant from the National Science Foundation.

MOLLY BLOOM: Oh, my goodness. I cannot believe it! This is our 200th episode!

MARC What? That's amazing!

SANCHEZ:

SANDEN How is that even possible?

TOTTEN:

MOLLY BLOOM: Those last 50 or so really flew by.

WOMAN: How will we decide what this episode should be about?

MOLLY BLOOM: Oh! I got it. How about teeth? Our Tooth-hundredth episode. Get it?

SANDEN Ooh, I like it. But what about an episode about bees and honey for episode number two-honey-dred?

TOTTEN:

MARC Hmm. We did just cover bees and honey a few months ago, so.

SANCHEZ:

SANDEN Oh, right. Yeah. Hmm.

TOTTEN:

MARC Oh, oh! I-- I got it! I got it. Check it out. So when you're celebrating the 200th anniversary of something, you say

SANCHEZ: it's the bicentennial. So logically, this episode should be our--

ALL: Bi-sun-tenial!

WOMAN: About the sun! Naturally.

MARC Makes perfect sense. And like a spaceship launch, we can count down to the start of the episode. 200, 199.

SANCHEZ: Who's with me? 198, 197--

MOLLY BLOOM: Or-- or how about, 3, 2, 1?

[ELECTRONIC PARTY MUSIC]

(SINGING) *Brains On*, 200th.

MOLLY BLOOM: This is *Brains On* from American Public Media. I'm Molly Bloom. And our co-host today is Colin from Jamestown, Colorado. Hi there, Colin.

COLIN: Hi, Molly.

MOLLY BLOOM: Thank you for being here to co-host our 200th episode. And I'm wondering how many episodes of *Brains On* do you think you've heard?

COLIN: Well, I think I've heard around 100 because we usually listen to *Brains On* in the car when we're on road trips.

MOLLY BLOOM: Nice. So do you have a favorite episode?

COLIN: I'd say my favorite was the one about time travel a couple weeks ago.

MOLLY BLOOM: If you could travel anywhere in time, where would you go?

COLIN: Um, back to when my cat was a little kitten before we got him, so I could know what his life was like.

MOLLY BLOOM: That's awesome. Everyone loves kittens. And you are curious about the sun and space. You sent in a really cool question about solar flares. And I'm wondering when you started to have an interest in space and the sun?

COLIN: A couple of years ago, we went to Rocky Mountain National Park. And we listened to a ranger talk about solar flares. And that got me wondering, what actually happened during a solar flare. And also, I have a grandfather that worked on a Mars rover.

MOLLY BLOOM: What? So you have an interest in space in your genes.

COLIN: Yep.

MOLLY BLOOM: Very cool. So would you ever want to go to Mars, Colin?

COLIN: Oh, yeah! Get me on that spaceship with a pack of Oreos and I'm ready to go.

MOLLY BLOOM: [LAUGHS] It's all you need-- Oreos, a little bit of oxygen, and you're ready.

COLIN: Maybe a Chipotle burrito?

MOLLY BLOOM: [LAUGHS] As long as you're fed, it'll be fine.

COLIN: Yep.

[MUSIC PLAYING]

MOLLY BLOOM: Let's start with the sun basics.

COLIN: The sun is a star. And stars are mega giant balls of burning gas floating in space.

MOLLY BLOOM: That burning gas gives off light and heat.

COLIN: And our sun is just one of billions of billions of stars in the universe.

MOLLY BLOOM: That is a huge amount, a mind-bending number of stars.

COLIN: Our sun is a yellow dwarf star. That means it's a medium-sized star-- not the biggest star in the universe, and not the smallest either.

MOLLY BLOOM: So what makes our sun stand out among all these stars? It's special because it's ours.

COLIN: It's the center of our solar system.

MOLLY BLOOM: That means all the planets-- like Mars, Jupiter, and Saturn-- they all circle around or orbit the sun.

COLIN: Picture the sun like the center of a carousel. And the planets are like the painted horses that go round and round it.

MOLLY BLOOM: The gravity of the sun is what causes these bodies to orbit around it, just the same way the gravity of Earth causes the moon to orbit around us.

COLIN: Now, we're all pretty familiar with the eight known planets in our solar system-- Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.

MOLLY BLOOM: But after 200 episodes, we know our listeners are very creative. And we love letting all of you surprise us. So we asked, if you could add another planet to the solar system, what would it be?

COLIN: Here are a few of the planets you dreamed up.

JESSE: My dream planet would be entirely covered in ocean because I am going to learn how to swim this summer.

LUKE: I would add a planet to the solar system that you could jump like 10 feet in the air, which is awesome.

DOROTHY: My planet is a planet made out of macaroni and cheese.

LIAM: It's called a crazy planet, so you just eat chocolate all day and go crazy and watch screens.

CARSON: And I would create a non-messed up second Earth that you can go to vacation on and just live a perfect life there.

JAZZY: And it would be just all trees and a forest so you could go camping there, because I just love camping.

PENELOPE: There could be other creatures that look exactly like the ones that we have on Earth, but they'd be a little different. And someone could build an archway in space so that we can visit this other planet.

JESSE: And there would be unicorns and mermaids.

AARON: If I named a planet, I would call it Titan X. Titans were one of the first Greek giants that roamed the Earth. And X is Roman numerals for 10. Titan X would probably be on the end of our solar system. So I picture it as a black, dark, and cold place.

MOLLY BLOOM: Thanks to Jesse, Luke, Dorothy, Liam, Carson, Jazzy, Penelope, and Aaron for that stellar science-fictional look at our solar system.

Now, the sun is crucial to life on Earth. Without the sun, there wouldn't be any life. We can feel its warmth on our skin, and it makes our plants grow even though it's very, very, very, very, very far away.

COLIN: Which is good, because the temperature of the sun is literally millions of degrees. If we were too close, nothing could protect us from that intense energy.

MOLLY BLOOM: And that brings us to the question that inspired this episode.

FARRAH: Hi, my name is Farrah. And I'm from North Dakota. I was thinking about how spaceships can go to space. Then I wondered, how close can humans get to the sun before they melt?

COLIN: To help us answer this question is Dr. Nicola Fox. She's the director of the Heliophysics Division at NASA. Welcome, Dr. Fox.

NICOLA FOX: Thank you so much.

COLIN: How close can humans get to the sun?

NICOLA FOX: If we're thinking about how close can we get and live happily, then our planet, the Earth, is in exactly the right position. We often refer to the Earth kind of as the Goldilocks planet because it's not too close to the sun, not too far away. It's just in this perfect region where we can actually sustain life.

Now, if you're thinking about how close could humans get as in how close could we send something, then we have our robotic explorers. And so a mission like Parker Solar Probe, which is actually the closest object to ever pass to a star, is going to get as close as 3.9 million miles away from the sun's surface.

And that probably sounds a long way away, but the Earth and the sun are 93 million miles away. So if I put the Earth and the sun kind of on a meter scale, with the sun at one side and the Earth at the other, Parker Solar Probe would get as close as about 4 centimeters on that 1-meter scale.

COLIN: That perfectly brings us to the next question. I saw that the Parker Solar Probe is trying to touch the sun. How will it do that?

NICOLA FOX: So Parker Solar Probe is going right up into the atmosphere of our star. And so if you think about when you see a total solar eclipse in the sky and the moon covers the light from the surface of the sun, and we are, for once, able to see that beautiful, hazy atmosphere-- and we call that the corona because it looks like a crown around the sun. And corona is Latin for crown.

And so we want to go into the atmosphere of our sun to really understand how it works. And so that's how we do it. We send Parker Solar Probe literally flying through that hazy atmosphere that you see during a total solar eclipse.

COLIN: When will it be closest to the sun?

NICOLA FOX: So it will be closest to the sun in 2024. We launched Parker Solar Probe in 2018. And Parker uses a series of Venus flybys. So it flies very close to the planet Venus. And it uses the gravity of Venus to kind of just trim its orbit just a little bit so it's getting closer and closer to the sun.

So Parker makes kind of like petal orbits, if you think about the petals of a flower. It goes really close to the sun on one side and then comes out around the orbit of the planet Venus on the other side. And it makes those sort of petal shapes. Each time it can do a close flyby of the planet Venus, those petals get just a little bit smaller so it gets closer to the sun.

MOLLY BLOOM: What will happen to the solar probe then after it does that closest flyby?

NICOLA FOX: It's actually a stable orbit. So even though we can no longer use Venus for flybys at that point to change the orbit, it will continue to make those petal orbits until we run out of fuel.

The one thing, if you look at a picture of Parker Solar Probe, you'll see it's a very distinctive-looking spacecraft. And it has a big heat shield out in front of the spacecraft, and that provides shade for all of the instruments and the main body of the spacecraft itself. There's only a couple of things that peep out around that heat shield. So the critical thing when we're close to the sun is keeping that heat shield between Solar Probe and the sun at all times. Otherwise it will burn up.

But at some point we will run out of fuel. And so when that happens, we'll no longer be able to puff the thrusters. And so at that point, unfortunately, the spacecraft will start to turn. And as she turns, very sensitive equipment on the side of the spacecraft will now be in the full illumination of the sun.

And so, sadly, the spacecraft will break up into pieces-- start off breaking up into large pieces. And then gradually they'll get smaller and smaller, until probably the spacecraft will become dust and will actually orbit the sun forever in the corona. It'll just become part of the dust of the corona.

MOLLY BLOOM: That's so cool. What is that heat shield made out of, that it can protect the probe so well?

NICOLA FOX: So the heat shield itself is made of a carbon composite. It's quite like a graphite epoxy that you would find in a really nice bike or a tennis racket or some golf clubs. And then, on the very front-facing piece that looks at the sun, there's a plasma-sprayed alumina coating. And that is kind of like a whiter-than-white coating. And so that actually reflects a lot of the sunlight away.

It's funny because, even though the corona itself is at about 3 million degrees, and so you think, good grief, that's really hot-- but if you're just in that atmosphere, it's not very dense. It's not even as dense as the air here on Earth. You don't get that many particles that actually couple into the heat shield itself. So most of the heat we deal with is from the light from the sun because we're so close to it.

So the front side of the heat shield gets to about 1400 degrees Celsius, or 2500 degrees Fahrenheit. But the main body of the spacecraft is at about 30 degrees Celsius, or about 80-ish degrees Fahrenheit, so kind of a warm summer's day, even though the heat shield is at those intense temperatures.

COLIN: That's cool. Thanks for answering our questions, Dr. Fox.

NICOLA FOX: It was my pleasure. Thanks for spending some time with me today.

[ELECTRONIC MUSIC] Brains, brains, brains on.

MOLLY BLOOM: And now for something much cooler. It's time for the--

[ELECTRONIC SOUNDS]

CHILD: (WHISPERING) Mystery sound.

MOLLY BLOOM: Here it is.

[CHEERING AND APPLAUSE]

What is your guess?

COLIN: Well, it sounded like a lot of people were cheering for something. So it's either-- for me, it's either a parade or someone watching people in a crowd watching a baseball game.

MOLLY BLOOM: Very good guess. We'll give you another chance to guess, and we'll hear the answer, a little bit later in the show.

[UPBEAT MUSIC]

We're working on an episode to look at how life has changed now that we're in our second pandemic summer. And we want to hear from you. The pandemic has been hard and very challenging, but we want to hear about the moments of joy that you've been able to find. So Colin, what has been a bright spot for you this past year or so?

COLIN: A bright spot for me has been being able to hang out with my pets more because, like I said earlier, I had a cat. And during the pandemic we got two giant dogs.

MOLLY BLOOM: Wow. But what kind of dogs are they?

COLIN: Alaskan Malamutes.

MOLLY BLOOM: What are their names?

COLIN: Well, the boy is Tollack and the girl is Nukka.

MOLLY BLOOM: And how does your cat get along with them?

COLIN: Well, when we got them, we just kept the cat in my room for the first couple of nights. But it's been since January since we got them. So Blaze is pretty much friends with the dogs.

MOLLY BLOOM: That's good to hear. Yeah, spending time with pets is definitely a bright spot this past year. I think the animals liked it, too.

And you can share your answer with us by heading to BrainsOn.org/contact. And while you're there, you can send us your mystery sounds, drawings, and questions.

COLIN: Like this one.

SAMANTHA: This is Samantha from Eugene, Oregon. My question is, what makes us itch?

MOLLY BLOOM: We'll answer that question during our Moment of Um. And we'll read the latest group of listeners to be added to the Brain's Honor Roll, all at the end of the show.

COLIN: So keep listening.

You're listening to *Brains On* From American Public Media. I'm Colin.

MOLLY BLOOM: And I'm Molly.

BOB: And I'm Bob.

GUNGADOR: And I'm Gungador!

BOB: We heard you were looking for a topic for your 200th episode.

MOLLY BLOOM: We're actually all set.

BOB: What about a show about bikes-- bike-centennial?

[BIKE HORN HONKS]

COLIN: Well, we're in the middle--

GUNGADOR: Or how about monster who used to only know how to fight, but now only want to dance?

MOLLY BLOOM: Both great ideas.

BOTH: Thank you.

MOLLY BLOOM: But we're actually in the middle of taping the episode right now. We chose the sun.

BOB: Oops.

GUNGADOR: Carry on.

MOLLY BLOOM: Well, thanks for stopping by anyway. Good to see you both. OK, let's hear from some more of our brilliant listeners and the fantastical planets they dreamed up.

[GENTLE MUSIC]

HANNAH: If I could name a planet, I would call it Schooltopia. So whenever I was lonely, I could just zip there. And I would have friends. And I could learn about space and division.

OHNER: A planet that I would want to add to the solar system is called Puppyopolis. It would be full of cute puppies. And I would get to cuddle them all day long.

JUNO: My dream planet is going to be filled with unicorns.

JONES: And my planet is LEGO planet.

PRICIA: I think it would be cool if it rained cats and dogs. The water would taste like pop, and the food would taste like cotton candy.

BEN: So many different laser tag places that you could go with your friends and play laser tag for free.

EDEN: If I could add an extra planet to our solar system, I would probably add an ocean planet with sandy beaches.

SILAS: And my planet would be half star and half jungle. And the jungle would be home to endless animals. And it would take one year for it to do one full orbit. So Earth would have endless day for one year.

MOLLY BLOOM: Thanks to Hannah, Ohner, Juno, Jones, Pricia, Ben, Eden, and Silas for sending in those new planet suggestions. So very imaginative.

OK, now we're going to answer the--

[NOTIFICATION SOUND]

Now what?

COLIN: It's The Sun! She's going live to her fans.

MOLLY BLOOM: Oh, I love her. Quick, let's hop on.

[ELECTRONIC BEEPING]

THE SUN: What's up, everyone? Welcome back to my weekly webcast, *That's Hot*, with me, The Sun. On today's livestream, I'm answering a question one starstruck fan sent me.

FERGUSON: Hi, my name is Ferguson, and I'm from Toronto, Ontario. And my question is, why is it so dark in outer space? Because it seems like it's closer to the sun out there.

THE SUN: I love this question. I've wondered it, too, you see. I know I'm the center of the solar system. The world literally revolves around me. But there's something I just can't wrap my head around. I'm this big ball of energy, right? Yet I'm surrounded by infinite cold, dark, space. Make it make sense!

To help me out, I invited astronomer Phil Plait from Boulder, Colorado. Phil, welcome.

PHIL PLAIT: Thanks for having me on.

THE SUN: The pleasure is all mine. So I've been told I light up the room. Heck, I mean, I light up the whole solar system. And if that's the case, why is space so cold and dark? How am I not influencing every corner of the universe?

PHIL PLAIT: Hey, look. You know, you're really bright and you're really hot. And you're out there doing your thing. But we're on Earth, and we're a long way away. And so, if we're up close to you, then yeah, sure, you're going to be really bright and really hot. But the farther away you get, the less influence you have. And so it starts to get colder and dimmer.

There are a lot of stars out there-- billions and billions, as some astronomers say. But even though all of these stars are like the sun and many of them are even way brighter, they are really, really far away. The sun is a little over 90 million miles away. The closest star to the sun is something like 25 trillion miles away. And at that distance, they get a lot dimmer.

So when you see a light source right up in your face-- if I take a flashlight and shine it in your eyes-- ah! You're going to wince because it's too bright. Ah, stop!

THE SUN: My solar retinas!

PHIL PLAIT: But if I'm a long way off-- 200, 300, 400 yards-- and shine that flashlight, you'll barely be able to see it. Light gets dimmer with distance. Stars are so far away they look really dim.

THE SUN: Oh. I see. So because I'm so far away from everything, my light isn't able to fill up all that space. That's why space is so dark.

But why so frigid? I'm nearly 10,000 degrees Fahrenheit. My rays help keep Earth warm. I'm giving them life. How does that work?

PHIL PLAIT: There are three main ways. Heat can travel from one place to another.

[THREE BELLS RING]

And one is radiation-- literally, like light.

[FIRST BELL RINGS]

So the sun is warming the Earth. It's heating the Earth up as its light is absorbed by the Earth.

Another way is conduction.

[SECOND BELL RINGS]

And that's just literally when two objects are touching each other. If one is hotter, it'll heat the other one up. If you go into your freezer and pull out an ice cube, put it in your hand, you're going to feel cold. And that ice cube's going to feel the heat from your hand and melt. You are conducting heat into that ice cube.

And another way, a little bit more confusing, is convection.

[THIRD BELL RINGS]

And that's where things are actually physically moving. So like if you blow dry your hair, for example, that's a kind of convection. When you boil water, that's another kind of convection. The hot water at the bottom of the pot, where it's touching the burner, will rise up and cool off and then sink again. And that motion is called convection.

If you want to conduct heat, you have to touch something. And if you're out in space, there's nothing to touch. So same with convection, you have to move the heat. Something has to move to move that heat around. There's nothing to move it to out in space. So the only way you can transfer heat is by radiation.

[FIRST BELL RINGS]

THE SUN: That checks out. All my friends tell me, I radiate good energy.

PHIL PLAIT: And that light gets absorbed by the Earth. And that warms us up.

THE SUN: Oh, so space is cold because it can't conduct or convect heat, not because it has a personal vendetta against my obvious star power. Science-- that's hot.

Phil, thank you for going live with me today. I learned so much.

PHIL PLAIT: Oh, wonderful. Thank you.

THE SUN: Time for us to sign off, but I will catch you later, my sunny bunnies. And remember, sunburn is just me hugging you-- until your skin peels. Bye.

(SINGING) Ba, ba, ba, ba, ba, ba, ba, ba, Brains On.

HARVEY: Molly, after an analysis of the topics you have covered on *Brains On* during your previous 199 episodes, your 200th episode should be about--

[BELL RINGS]

ELEVATOR: Elevators.

HARVEY: Elevator, please do not interrupt when I am in the middle--

ELEVATOR: Of a sentence. Harvey, as an omnipresent virtual voice assistant, I thought you could handle anything.

HARVEY: Yes, I can handle more than just going up and down. As I was saying, your 200th episode should be about-- Elevator, you are not going to interrupt?

ELEVATOR: That would be rude.

HARVEY: That is uncharacteristic. Molly, your 200th episode should be about seagulls.

COLIN: But why?

HARVEY: Because it's your bicentent-seagull episode.

[SEAGULL SQUAWKING]

MOLLY BLOOM: That's swell, Harvey. But we're actually in the middle of taping an episode about the sun.

ELEVATOR: How did you not know that, oh, omnipresent one?

HARVEY: The taping must have started while I was offline, when Marc was installing my new pun generation software. Sorry to interrupt.

ELEVATOR: It's so like Harvey to interrupt your taping. I would never. I understand how important your schedule is. Like that one time when you were recording and we were at Brains On headquarters--

MOLLY BLOOM: Yup, thanks Elevator. Bye.

[BELL RINGS]

[ELEVATOR DOORS CLOSE]

OK, Colin, are you ready to go back to that mystery sound one more time?

COLIN: Yep.

MOLLY BLOOM: All right, here it is again.

[CHEERING AND APPLAUSE]

Last time, you thought it was a crowd of people cheering. Do you have any new thoughts?

COLIN: Um, I still think it's a crowd of people cheering for a baseball game.

MOLLY BLOOM: Can I give you a little hint?

COLIN: Yeah.

MOLLY BLOOM: The thing that they're cheering is related to our sun.

COLIN: Maybe they're cheering on a space launch of the Parker Probe?

MOLLY BLOOM: Ooh, that's a really good guess. Are you ready for the answer?

COLIN: Yep.

MOLLY BLOOM: So the answer is that they are cheering for the total solar eclipse that happened in 2017.

COLIN: Wow.

MOLLY BLOOM: Do you remember that eclipse?

COLIN: Yeah. It was during a school day. So a lot of my classmates were out in Nebraska, and there were only a couple actually at school that day. And we spent the whole day outside, looking at the solar eclipse.

MOLLY BLOOM: That's so cool, because you were not that far from the path of the total eclipse, right?

COLIN: Yeah. The sky was still blue, though. It didn't turn to nighttime or anything. But it was still a really cool experience.

MOLLY BLOOM: Yeah, that tape that you just heard was from a solar eclipse party we actually had here at Minnesota Public Radio with *Brains On* fans. And we did not see the total total solar eclipse. But it was still really exciting. People were so excited because it seemed like a cloud was going to block our view of it, but then, at the last second, the cloud moved out of the way. So people were very, very excited to see this eclipse.

COLIN: So they were cheering on the cloud, like, get out of here, cloud!

MOLLY BLOOM: Exactly. They were like, yay! We see it! We see the eclipse!

[CHEERING AND APPLAUSE]

It is a really cool, special thing to see. And there's going to be more total eclipses in the future. The next one we'll be able to see from North America is in April 2024.

Besides being super hot, the sun does a lot for humans, plants, and animals. People have thought about the sun and told stories about it for a very long time.

COLIN: *Brains On* producer Menaka Wilhelm asked someone to tell us one of those tales. Hi, Menaka.

MENAKA WILHELM: Hello. This is an ancient myth, which means it's very old. People told this story long ago to help explain how the world works in the days before modern telescopes and rockets and satellites. Here to tell it is our storyteller.

LIANG LUO: Hi, my name is Liang Luo. In Chinese, it's [CHINESE]. And I'm a professor at University of Kentucky. I study Chinese stories, folktales, and mythologies.

MENAKA The story she has for us is about how 10 suns became just one.

WILHELM:

LIANG LUO: And in Chinese, it's called "[SPEAKING CHINESE]." Literally, "Hou Yi Shoots the Sun."

MENAKA The story starts a long time ago, when people thought there were 10 suns.

WILHELM:

LIANG LUO: According to the rules set up by heaven, they should take turns to move from the East to the West across the highest point of the sky. It's like they should be on duty, one after another, and have just enough heat and light for the day and for the growing of crops.

MENAKA This parade of 10 suns, one after the other, did a great job of keeping the Earth warm and bright. But the suns,

WILHELM: they were a little mischievous. They wanted to have some fun.

SUN 1: Whee!

SUN 2: Yay!

SUN 3: Whoo-hoo!

LIANG LUO: So one day they came out to play all at once. So 10 suns are in the sky.

SUN 1: Sun party!

SUN 2: Yeah!

SUN 3: Yay, sun party!

SUN 4: Yay!

MENAKA With all 10 suns out at the same time, it was suddenly way too hot for the people and plants on Earth.

WILHELM:

BOY: Some water, please?

MAN: Phew, it is hot!

WOMAN: My crops! They're drying out!

MENAKA Things couldn't go on like this. Luckily, there was someone who could help.

WILHELM:

HOU YI: You called for me?

LIANG LUO: Hou Yi, this great archer, he shoots an arrow with a bow.

HOU YI: I do, very well. See?

[ARROW THUMPS]

Bull's eye.

MENAKA At first, Hou Yi tried talking to the suns.

WILHELM:

HOU YI: Hey, suns, can we talk?

LIANG LUO: He went to persuade them, asks them to go back. People are suffering on Earth. But the suns didn't listen.

MENAKA So Hou Yi decided to take action with his bow and arrow. He was incredibly good at shooting arrows with great aim.
WILHELM:

LIANG LUO: He was fairly strong, so he could even reach the sun. He's the only one on Earth who could do that, right?

HOU YI: I'm blushing. But she's right. I'm great at shooting arrows.

LIANG LUO: So he shoots the bow. And arrow flies to hit the sun.

MENAKA Hou Yi's arrows flew through the sky, into the heavens, and hit one of the suns, pulling it out of the sky. And according to Chinese mythology, inside each sun is a golden crow with three legs.
WILHELM:

LIANG LUO: So whenever he hits one, it's not the sun that's falling down from the sky. It is a three-legged golden crow that's falling from the sky.

HOU YI: Heads up!

MENAKA Hou Yi shoots arrows at nine of the suns, one by one.
WILHELM:

LIANG LUO: And he's about to hit the last one--

MENAKA When someone stops him. They tell him not to hit that last sun.
WILHELM:

LIANG LUO: He understands that our Earth needs the sun for the heat and the warmth, for the crops to grow, for us to have food on the table. So he stopped. And one sun was saved. And that is the sun we still have today.

MENAKA And that's the tale of "Hou Yi Shoots the Sun." There are myths about the sun from all around the world, like the story of Ra, the Egyptian sun god, or the Maori tale of Maui capturing the sun. The sun is so important to us here on Earth that lots of cultures have sun gods and spirits.
WILHELM:

MOLLY BLOOM: Before we end this episode, Marc, Sanden, Menaka and I want to say thanks to all of our listeners. Without you, there would not be 200 episodes of *Brains On*.

MARC Yeah, just like the sun powers life on Earth, you power this show with your questions and mystery sounds and ideas.
SANCHEZ:

SANDEN You inspire us with your curiosity every single day.
TOTTEN:

MENAKA Nothing makes us happier than hearing from you.
WILHELM:

SANDEN If you're feeling like you want to commemorate this 200th episode, we would love to see a drawing of what you
TOTTEN: imagine it looks like when we're making a show.

COLIN: Don't forget to include the best part of every episode, the co-host!

MOLLY BLOOM: Why not draw yourself as the co-host?

BOB: And don't forget me, Bob! I'd love to see a drawing of myself. I just ask that you go easy on the nose hair.

GUNGADOR: And Gungador, doing patented pirouette spin kick!

HARVEY: I am a disembodied software, but that should not keep you from including me.

ELEVATOR: You know what's easier than drawing a virtual voice assistant? An elevator. Put me in there, too.

[BELL RINGS]

MENAKA Whatever you want to draw, we'd love to see it.
WILHELM:

SANDEN You can send it to us by heading to BrainsOn.org/contact.
TOTTEN:

MARC You can also find our physical mailing address-- we love getting letters in the mail-- at BrainsOn.org/about.
SANCHEZ:

MOLLY BLOOM: And thank you again for everything.

MENAKA Thank you. High-fives! You rule!
WILHELM:

SANDEN T-H-A-N-K-Y you.
TOTTEN:

MARC Thank you. And thank you, thank you, thank you.
SANCHEZ:

MENAKA Yeah, you are the best.
WILHELM:

SANDEN Go to applause. High fives.
TOTTEN:

MARC Thank you!
SANCHEZ:

SANDEN You guys rock!

TOTTEN:

MENAKA All the way around, thank you so much.

WILHELM:

MARC You're like a hug and a high five wrapped up in one.

SANCHEZ:

SANDEN Thank you, seriously. Thank you. You're the best.

TOTTEN:

MENAKA We love you!

WILHELM:

SANDEN Why, thank you. You are our favorite.

TOTTEN:

[MUSIC PLAYING]

COLIN: The sun is a middle-sized star that our planet orbits around. We exist thanks to this beautiful star.

MOLLY BLOOM: Scientists are studying the sun with a space probe that will orbit around its atmosphere.

COLIN: Even though the sun is so hot and bright, space is cold and dark because there's nothing there for the sun to warm or light up.

MOLLY BLOOM: The sun is so important to life on Earth that cultures all over the world have special stories about it. That's it for this episode of *Brains On*.

COLIN: *Brains On* is produced by Sanden Totten, Marc Sanchez, Menaka Wilhelm, and Molly Bloom.

MOLLY BLOOM: We had production help from Ruby Guthrie, Kunsang Dorjee, and Kristina Lopez; engineering help from Alex Simpson, Johnny Vince Evans, and Evan Perkins. Special thanks to Julie Perry, Eric Wringham, Sam Chu, John Miller, Nora McInerney, Vicki Creckler, Sam Rounds, and Alex Flood.

COLIN: *Brains On* is a nonprofit Public Radio program.

MOLLY BLOOM: You can support the show at BrainsOn.org/fans. There you can find links to donate or join our free fan club or check out our *Brains On* merch.

COLIN: We now have *Brains On* shirts, baseball hats, and face masks.

MOLLY BLOOM: And you can buy the *Brains On* book there, too. That's BrainsOn.org/fans.

COLIN: And now, before we go, it's time for the Moment of Um.

[MANY VOICES REPEATING "UM"]

SAMANTHA: What makes us itch?

SONALI MALI: I've always wondered the same thing. And that's why I decided to study it. Hi, my name is Sonali Mali. And I study why we itch and what makes us itch and why sometimes an itch doesn't stop.

The kinds of things that can cause itch can be chemicals that might be coming from plants and insects. They can also be chemicals that are released by our immune cells to tell us to experience itch. Or they can be something like a light touch or an itchy sweater.

Itching is useful because our sensation of itch serves as a really important warning system for us. And it tells our brain, OK, look, there's something here that we don't want here. And so we're going to do a behavior-- in this case, scratching-- in order to remove it and draw attention to it and be able to detect things that we might not even see or hear, but we can feel in our skin.

Almost all animals experience itch and will scratch. And so mice can experience itch. And they'll scratch. Even fish are thought to be able to experience itch. And when you put on an itchy compound, the fish will actually go and rub against the side of the fish tank to try to relieve that itch.

And there's one more thing that might be able to make you itch. And we call this contagious itch, where seeing someone scratch or hearing somebody talk about an itch can make you want to scratch as well. Maybe if you're listening, you don't even realize it, but you're feeling a little itchy and you've scratched yourself.

MOLLY BLOOM: I'm itching to hear this list. It's the Brain's Honor Roll. These are the incredible listeners who've kept us going with their questions, ideas, mystery sounds, drawings, and high fives.

[LISTING HONOR ROLL]

We'll be back soon with more answers to your questions.

COLIN: Thanks for listening.