

MOLLY BLOOM: You've joined us on journeys to the inside of a volcano, deep under the ocean, and into outer space. Help keep the adventure going with a tax deductible year end gift to *Brains On*. Make your contribution today at brainson.org/donate.

[CRICKETS CHIRPING]

CARTER WILEY: Nothing like looking up at the night sky, am I right?

MOLLY BLOOM: Space is the coolest.

[RUSTLING LEAVES]

Wait, did you hear something?

CARTER WILEY: No. Just check out all those stars. Each one could have an alien planet orbiting it. How cool is that?

MOLLY BLOOM: Sure is cool.

[RUSTLING LEAVES]

Wait, so it doesn't sound like something is rustling over there?

CARTER WILEY: Nope. I'd love to explore new world one day, try different atmosphere, different gravity, see a different sunset in the sky.

[RUSTLING LEAVES]

MOLLY BLOOM: That would be amazing. Maybe one day. Still, I'm pretty satisfied here on Earth. I mean, there's a lot here I still need to check out.

CARTER WILEY: Very good point, Molly. I mean, Earth is pretty rad. We've got icy tundras, rain forests, deep oceans, volcanoes, mountains, beaches.

MOLLY BLOOM: Bears.

CARTER WILEY: Yeah. Uh, sure. Bears too. Only planet we know that has bears. Good point, Molly.

MOLLY BLOOM: No, I mean, over there. Bears.

CARTER WILEY: Eep. What do we do?

MOLLY BLOOM: Start the show. Start the show. Start the show.

[MUSIC PLAYING]

You're listening to *Brains On* from MPR News and Southern California Public Radio. I'm Molly Bloom, and my co-host today is Carter Wiley. Hi, Carter.

CARTER WILEY: Hi, Molly.

MOLLY BLOOM: Carter is helping us out with these National Park episodes because he has a very special connection to national parks.

CARTER WILEY: Up until just a few months ago, I lived my entire life in Yosemite National Park.

MOLLY BLOOM: A very unique experience. If you want to hear more about what it's like to grow up in a National Park, give a listen to our episode about Wind Cave. Today though, we're investigating a cool phenomenon that happened at Great Sand Dunes National Park in Colorado.

CARTER WILEY: As you can imagine, this park is sandy. And some of our listeners wrote to us to tell us about something they learned about when they visited the park.

HELENA NAMEY: I'm Helena Namey. And I like the Great Sand Dunes because I like the sound that they made.

MOLLY BLOOM: Because of this sound, the sands are called the singing sands.

CARTER WILEY: So we want to find out, why do the singing sand sing?

MOLLY BLOOM: Here to help us answer that question is science journalist Cally Carswell. Hi, Cally. Thanks for being here.

CALLY CARSWELL: Hey, I'm really happy to be here. Well, I have to tell you, Carter, when Molly first asked me to investigate this, I had a question of my own. What do you mean the sand dunes sing? I thought, sand dunes don't sing. They just sit there, maybe blow around a little. I mean, they're not even alive.

So I called up a guy named Fred Bunch. He's worked at the National Park for over 20 years. And he told me, oh, yeah, the dunes were making their strange sounds just the other day.

FRED BUNCH: Was out on the dunes recently. It was early November, matter of fact. And we were out doing some surveys on the star dunes, dune that has four arms to it. And it has a lot of slip faces. And these slip faces of the areas where it avalanches. And had been sunny, and had been dry, and had been windy.

And so when we walked up the ridge, it triggered an avalanche. When the dune avalanches, it makes a sound, a resonant sound like a cello, like a drone, like [BOOMING SOUND].

MOLLY BLOOM: Did you actually get to hear it for yourself?

CALLY CARSWELL: Unfortunately, no. At the Great Sand Dunes, at least, it's a fairly rare event. It only happens when the weather conditions are just right. But people described it as a low bellow. A lot of people describe it as a booming sound.

FRED BUNCH: First time you hear it, you think, wow, is that an airplane? Is that-- what could be making that sound?

CALLY CARSWELL: Do you want to hear a recording of it?

CALLY CARSWELL:

MOLLY BLOOM: Yes.

[BOOMING SOUND]

CARTER WILEY: It sounds like a sci-fi kind of sound.

MOLLY BLOOM: Do all sand dunes make these sounds?

CALLY No, not all sand dunes do. There are only around 30 to 40 places in the world where dunes are known to make
CARSWELL: this particular booming sound. Here in the US, there are dunes that boom in two other parks, Death Valley National Park and the Mojave National Preserve.

MOLLY BLOOM: Why just those? What do they have in common?

CALLY The climate and all of these places is very dry, the dunes are all very tall, and the dunes that boom also all have
CARSWELL: pretty steep slopes.

MOLLY BLOOM: OK, so dry, tall, and steep. But I don't quite understand why that makes a sound like an airplane or a cello.

CALLY Yeah, well you're not the only one. It turns out that people have been fascinated by the sounds sand dunes make
CARSWELL: for a long time. Charles Darwin wrote about it after traveling through the Gobi Desert. Marco Polo theorized that the sounds came from desert spirits. There's even a Bing Crosby song about the dunes in Colorado.

But for a long time, there wasn't really a satisfying scientific explanation.

MOLLY BLOOM: This whole episode is about a mystery sound. So we have to pause here and try another mystery sound.

[MUSIC PLAYING]

CHILD: (WHISPERING) Mystery sound.

MOLLY BLOOM: Here it is.

[BURPING SOUND]

Any guesses what that is, Carter?

CARTER WILEY: It sounds like something like coughing or something, or some kind of like walking, kind of.

MOLLY BLOOM: Excellent guess. Let's hear it one more time.

[BURPING SOUND]

Any other thoughts what that might be?

CARTER WILEY: Not really. Or something like breathing or something. Some kind of animal trying to do something.

MOLLY BLOOM: Excellent. Well, here is the answer.

MELANIE HUNT: So I'm Melanie Hunt. I'm a professor of Mechanical Engineering at Caltech. Some graduate students here at Caltech had brought me back a jar of sand. And actually, I have just two jars of sand sitting on my desk here.

What's funny in the sand in a jar is if you have sand from some of these dunes and you shake it, and if it's the sand from the top of the dune-- I don't think you'll be able to hear it, it makes this funny what we call kind of a burping sound.

And if you take the sand from the bottom of the dune, it doesn't sound like anything special at all.

MOLLY BLOOM: So that was burping sand.

CARTER WILEY: Wow. That's amazing.

MOLLY BLOOM: Yeah.

CALLY I know. Crazy, right. So Melanie had one of these jars of sand on her desk when we were talking on the phone.

CARSWELL: And she said I probably wouldn't be able to hear it burp. But I had her hold it up to the microphone anyway, and that's that sound you just heard.

Naturally, she heard the sand burp in the jar. And she was pretty intrigued. And she and her students start making trips to the Mojave Desert to try to figure out why the dunes do what they do.

MOLLY BLOOM: We're going to hear about what they found right after this.

CARTER WILEY: Do you have a mystery sound you'd like to share with us?

MOLLY BLOOM: A question you want answered on the show?

CARTER WILEY: Or maybe you just want to send us a drawing or a high five.

MOLLY BLOOM: Email us anytime. We're at brainson at M as in Minnesota, P-R dot org.

CARTER WILEY: Or you can find our mailing address at our website, brainson.org.

MOLLY BLOOM: And if you're a fan of the show, please consider leaving a review in iTunes.

CARTER WILEY: It really helps other kids and families find out about the show.

MOLLY BLOOM: Now is the time in the show when we send high fives to all the kids who fill the show with their creativity and energy. Here's the most recent group to be added to the Brains Honor Roll.

[MUSIC PLAYING]

[LISTING HONOR ROLL].

[MUSIC PLAYING]

MAN: Brains On Live.

MOLLY BLOOM: All right, Cally. We've been in suspense. What is the secret of the singing sands?

CALLY Well, they figured out that a lot of it has to do with the structure of the dune. Physically, the dune acts like a

CARSWELL: musical instrument.

MOLLY BLOOM: Go on.

CALLY OK, so the sand in the jar that burps. That's the sand from the top of the dunes. And what's special about it is

CARSWELL: that all of the grains are basically the same size. There aren't any big grains of sand. And there aren't any really small grains either. They're all nice medium-sized grains. And they have a particular shape.

MELANIE HUNT: The grains themselves-- because it's desert, they're very roundish. So it's different than a beach sand that seem to be more angular.

CALLY That's important because the round, evenly sized grains roll over each other really easily. The way balls move
CARSWELL: around in a pit better than a bunch of square blocks would.

On a steep dune, when they're disturbed, they slide downhill in a nice layer. They create those avalanches that Fred Bunch was talking about when we started.

MOLLY BLOOM: OK. And it's the avalanches that somehow produce the booming sound?

CALLY Yup, that's right. So to get sound from the dune, you have to first put energy into it. The same is true for an
CARSWELL: instrument.

[MUSIC PLAYING]

You put energy into a cello, say, by plucking its strings. And you put energy into a dune by setting off an avalanche, sending the sand tumbling downhill.

MELANIE HUNT: When we want to trigger what we do is we slide down. And we just sit down and slide down the dune. And you get a bunch of sand then avalanching down what we call the slope phase of the dune.

And one you get enough sand going, again, if it's dry, you start to hear this rolling thunder. And it can last for several minutes. So it really is this weird thing. And again, if you put your hands down on the dune, you can really feel these vibrations as well.

[MUSIC PLAYING]

CALLY So sound is produced by vibration. In a cello, the vibrating strings don't make a lot of sound on their own, but the
CARSWELL: energy they generate causes the air in the body of the instrument and the instrument itself to vibrate. And that's what makes the sound you hear.

[MUSIC PLAYING]

The same is basically true on the dune. The moving sand creates vibrations that travel in waves through a dry layer of sand just below it. That layer is a meter or two deep. And under it is a hard, moist layer of sand, almost like cement. That hard layer reflects the sound waves.

So the vibrations become trapped in the super dry layer of sand. And the sound then resonates in that like it resonates in the body of a cello.

MOLLY BLOOM: You keep mentioning the cello. Is the booming sound actually similar to the sound of a cello?

CALLY Actually, it is. The tone of the sound the dune produces depends on the depth of that layer the sound is
CARSWELL: resonating from. It's just like how the size of an instrument affects the sound it produces by amplifying only certain frequencies.

MOLLY BLOOM: If you compare a cello to a violin, the violin is smaller and you get a higher frequency, a bass is larger and you get a lower frequency.

CALLY So it turns out that the length of a cello is similar to the depth of this sand layer that the sound is resonating from. And that's why they produce similar sounds.

MOLLY BLOOM: So now that we know how this works, if we went to the Great Sand Dunes tomorrow, could we make this happen? Would we be able to hear it?

CALLY Alas, probably not. Fred Bunch has been working there a really long time. And here's how many times he's heard it.

FRED BUNCH: I've been at the Great Sand Dunes for over 20 some years. And I've experienced it maybe a half a dozen times, 5 or 6.

CALLY When it rains or snows and the sand gets wet, the effect just isn't the same. It has to be quite dry, and it isn't always. So things have to line up just right to be able to hear it.

But even if you don't hear that low, long boom, you can still get the sand to make some pretty cool sounds. My husband and I were there once, and we climbed some dunes. And when you get to the top, your natural instinct is to just start running down and then occasionally, jumping into the sand.

MOLLY BLOOM: Naturally.

CALLY And when you jump down into the sand, you can often hear this thump. It's like womp, womp. And it's pretty magical all the same, like the sand burping in the jar.

And I mean, you've also got to remember where you are. So you're in the Rocky Mountains, surrounded by these big, burly, rugged mountain peaks. But then there are these sand dunes, huge dunes that look straight out of the Sahara desert.

FRED BUNCH: It's a mystical place to begin with. And then the sound that it makes is the sound of gravity. It's not the wind. It's not other sources. It's the sound of the actual movement of the Earth or of the dunes. And so that makes it somewhat enchanting, I think.

[BOOMING SOUND]

MOLLY BLOOM: Thank you so much for sharing this with us, Cally. It is super cool.

CALLY No problem.

CARSWELL:

[MUSIC PLAYING]

MOLLY BLOOM: That's our show. You can check out the rest of our series on the National Parks at our website, brainson.org, or wherever you usually listen.

CARTER WILEY: *Brains On* is produced by Marc Sanchez, Sanden Totten, and Molly Bloom.

MOLLY BLOOM: Many thanks to Leslie Whatley, Lauren Dee, and Corey Schreppel.

CARTER WILEY: You can see photos from more National Parks on our Instagram.

MOLLY BLOOM: We're at @brains_on.

CARTER WILEY: And that's our Twitter handle too.

MOLLY BLOOM: You can also keep up with us on Facebook or by subscribing to our newsletter. You can do that at brainson.org.

CARTER WILEY: Thanks for listening.

[MUSIC PLAYING]