

## Brains On (APM) | Brains On! Mix: The science of cooking, pt. 4 1QN62YFGHXCXBQZ9TT6B01RTMO

NANTEEN BA: You're listening to *BrainsOn*, where we're serious about being curious.

**SUBJECT 1:** *Brains On* is supported in part by a grant from the National Science Foundation.

**MOLLY BLOOM:** I don't know about you, Nanteen, but this science of cooking business has me feeling super snacky.

**NANTEEN BA:** Yeah. Let's swing by the [? Libra ?] kitchen for a bite.

[CLATTERING]

[DISCO MUSIC]

**GUNGADOR:** [GROWLS] Kick. Twirl. Hips sway. Spin.

**MOLLY BLOOM:** Gungador?

**GUNGADOR:** Ah! Other people. Gungador turns down music. Hi-yah!

[MUSIC STOPS]

**NANTEEN BA:** Thanks. That was loud.

**GUNGADOR:** Loudest in land!

**MOLLY BLOOM:** So what exactly were you doing there, Gungador, the impromptu kitchen dance party?

**GUNGADOR:** Gungador combining love of food with love of dancing! Invented new method of mixing!

**NANTEEN BA:** Huh. How does it work?

**GUNGADOR:** Gungador place the salad and dressing in mighty mixing bowl, then covers bowl with foil of tin!

**MOLLY BLOOM:** You mean tin foil?

**GUNGADOR:** Yes! Foil of tin! Then Gungador takes covered bowl and dances heart out.

[DISCO MUSIC]

Shake, rattle, roll! Hoo-ah! Now super mega ultra jumping spin twirl. Whoa!

[THUDDING]

Oh!

**MOLLY BLOOM:** Wow.

**NANTEEN BA:** That was like a 1,440-degree turn.

**GUNGADOR:** Yes. Gungador feel dizzy and nauseous. Sitting down now. [GROANS] Suddenly, not hungry.

**MOLLY BLOOM:** I guess this new mixing method has its drawbacks.

**GUNGADOR:** Yes. Needs work. Here, have salad.

**MOLLY BLOOM:** Thanks. We were kind of hungry. And you did give it a real gourmet shake.

**NANTEEN BA:** Yeah, we'll eat it on the way to the studio. Thanks, Gungador. Bye!

**GUNGADOR:** Bye, guys! Next time, less spinning, more sashaying.

[PERCUSSIVE MUSIC]

(SINGING) Chill, chop, mix, heat. Reverse the order, then repeat. Heat, mix, chop, chill, the recipe for every meal.

[CRUNCHING]

[SODA FIZZING]

Chill, chop, mix, heat. Reverse the order, then repeat. Heat, mix, chop, chill, the recipe for every meal

[ICE CUBES CLINKING]

**MOLLY BLOOM:** You're listening to *Brains On* from American Public Media. I'm Molly Bloom. And my co-host for this delicious deep dive is Nanteen Ba from New York City. Welcome back, Nanteen.

**NANTEEN BA:** Hi.

**MOLLY BLOOM:** Nanteen comes to us from Harlem Grown, where she's learning a lot about growing and cooking food. So Nanteen, what is your absolute favorite ingredient to work with?

**NANTEEN BA:** Cheese.

**MOLLY BLOOM:** Oh. So why is cheese your favorite ingredient to work with?

**NANTEEN BA:** I think it's probably because I get to eat it while making what I'm making.

**MOLLY BLOOM:** You can take some snacks along the way.

**NANTEEN BA:** Mm-hmm.

**MOLLY BLOOM:** Well, Nanteen clearly knows her food, but she is not the only chef in the house. We've partnered with *America's Test Kitchen* to answer your many, many cooking questions.

**NANTEEN BA:** *America's Test Kitchen* is part lab, part kitchen, all delicious. They know their stuff.

**MOLLY BLOOM:** So far in this series, we've covered three important components of cooking-- heating, chilling, and chopping.

**NANTEEN BA:** Today, we mix it up.

**MOLLY BLOOM:** Mixing, you know-- stirring, whisking, folding, incorporating, blending, combining, fusing, kneading, emulsifying.

**NANTEEN BA:** With so many ways to say it, you know it must be important.

**MOLLY BLOOM:** So let's start this mixing episode with a question about two things that just don't want to.

**MAITRI GHOSH:** Hi. My name is Maitri Ghosh. And I am from Portland, Oregon. My question is, why don't oil and vinegar mix?

**MOLLY BLOOM:** Have you noticed that too, Nanteen? What happens when you pour oil and vinegar together?

**NANTEEN BA:** I noticed the oil sits on top of the vinegar, and they just don't mix.

**MOLLY BLOOM:** Right. They totally separate. Maybe the vinegar will form a blob in the oil if it's in a shallow bowl. Or if it's in a bottle like you said, that layer of oil just sits on top of the vinegar. Same thing happens with oil and water. And that's because there's a lot of water in the vinegar. Water and oil do not get along. We asked Kristin Sargianis, managing editor of *America's Test Kitchen Kids*, to explain why this happens.

**KRISTIN SARGIANIS:** So oil and water are kind of like cats and dogs, or they're kind of like brothers and sisters in the backseat of a car on a really long road trip.

[CAR DOOR SHUTS]

[KEY TURNING IN IGNITION]

[ENGINE STARTING]

**WATER:** Stop looking at me, Oil.

**OIL:** I'm not looking at you, Water. I'm looking out the window.

**WATER:** Dad, make Oil stop.

**KRISTIN SARGIANIS:** They typically don't like to get close together, and that is because water is a polar molecule. So it has a positive charge and a negative charge, kind of like a magnet. And so the opposite charges, the positive and the negative, they attract. So water stays really tightly together.

**WATER:** I'm my own best friend. I don't even know why you came along on this trip, Oil.

**OIL:** Uh, because we're siblings.

**KRISTIN SARGIANIS:** Oil, on the other hand, is nonpolar. So it doesn't have any positive or negative charges. So there's no way for the water to stick to the oil. So they stay on opposite sides of the room, or the car.

**OIL:** Whatever. You do you, Water.

**WATER:** Oh! That's such a you thing to say. Dad, I can't take it. Stop the car, and kick Oil out.

**OIL:** No, you get out. I'm fine right here. Come on. Just stop it already. [GROANS]

**MOLLY BLOOM:** So oil and water don't play nice. But wait, there are plenty of foods where oil or other fats are mixed with water.

**NANTEEN BA:** Yeah, like milk, salad dressing, mayonnaise, cheese, ice cream, even hot dogs.

**MOLLY BLOOM:** These are all what we call lunch-- I mean, sorry. These are what we call emulsions. And that means oil and water are mixed up so well that they look like just one substance instead of two separate layers.

**NANTEEN BA:** There are a couple of ways you can accomplish this feat.

**KRISTIN** So the first is you can mix them really, really, really well, like get a super, super good arm workout well. And what happens is you break the water up into really teeny, teeny, tiny droplets, and they're suspended within the oil. So that's a way you can make an emulsion, number one. And the second way is that you can get help from a different kind of molecule that's called an emulsifier.

**MOLLY BLOOM:** Emulsifiers, these are the unspoken heroes of so, so many recipes.

**KRISTIN** And so what emulsifiers do is they bridge the gap between water and oil. So they have one end that is compatible with water, and the other end is compatible with oil. And so they can hang on to both of those molecules. And then you have one cohesive substance.

**MOLLY BLOOM:** One emulsifier that works super well is egg yolk.

**NANTEEN BA:** Or you can use mayonnaise, which has egg yolks in it.

**MOLLY BLOOM:** Or honey. These substances can bridge the differences between water and oil. OK, so let's extend this backseat of the car idea. Remember, here's water. Negative and positive sticks to itself.

**WATER:** It's so hot back here. [GROANS] Oh, but look out the window. It's so pretty. I love it.

**NANTEEN BA:** And oil, which as we mentioned, is neutral.

**OIL:** Well, we are still in a car. Hey, want to play a game to pass the time, Water?

**WATER:** No. Don't talk to me. Just leave already.

**OIL:** No, I don't think so. But if you're so upset, you can leave.

**WATER:** No, you leave.

**OIL:** No, you.

**MOLLY BLOOM:** Now watch what happens when we throw an emulsifier in that middle seat.

**NANTEEN BA:** Like honey. Everybody loves honey.

**HONEY:** Hey, guys. Sure is quiet in here. Hey, Water.

**WATER:** What?

**HONEY:** You know what's super fun to do on a road trip? Having deep thoughts that no one else understands, staring intensely at a thing, brooding.

**WATER:** Oh my goodness, that sounds amazing.

**HONEY:** We can brood together.

**WATER:** You get me.

**HONEY:** And Oil, I'm an excellent multitasker. I will totally play that game with you.

**OIL:** Really? Awesome. How about a thumb war?

**HONEY:** Oh, you do not want to get in a thumb war with Honey. I do not have thumbs, but I am really sticky. There are no winners there. How about I Spy instead? I will go first. I spy something--

**MOLLY BLOOM:** Now, Oil and Water may not be talking to each other, but at least they're not both trying to kick the other out of the car. It's a peaceful kind of truce brokered by our good pal Honey.

**HONEY:** And remember, even ingredients should always wear a seat belt.

[VOCALIZING]

**SUBJECT 2:** *Brains On.*

**MOLLY BLOOM:** Fun fact-- emulsions aren't just food. They happen whenever two substances that normally wouldn't get along are forced to hang out. Moisturizing lotion is an emulsion, and so is car wax, and so is asphalt. And here's something else fun. It's the mystery sound.

[ETHEREAL SOUNDS]

**SUBJECT 3:** (WHISPERING) Mystery sound.

**MOLLY BLOOM:** Here it is.

[CLAPPING SOUND]

[LIQUID DRIPPING]

Any guesses, Nanteen?

**NANTEEN BA:** The beginning, it sounded like when you're trying to turn on a stove. But then the liquid dropping sound threw me off.

**MOLLY BLOOM:** Hmm. You want to hear it one more time?

**NANTEEN BA:** Mm-hmm.

**MOLLY BLOOM:** Here it is.

[CLAPPING SOUND]

[LIQUID DRIPPING]

Any new thoughts?

**NANTEEN BA:** No, I'm so confused.

**MOLLY BLOOM:** This is a tough one. I like your thought though about how that sounds like a stove, like a gas stove trying to be lit. Well, we're going to be back with the answer in just a bit. But first, Nanteen, help me out. For people who don't know, what is a whisk, and what does it look like?

**NANTEEN BA:** A whisk, it's a mixing tool. It's mostly used for things like egg yolks or when you're making things like brownies or cake, stuff like that. I would describe a whisk as a large string just twisted and turned into almost a circular shape, but more like an oval.

**MOLLY BLOOM:** Exactly. Yeah, so it's kind of like loops of metal or sometimes silicone that are sort of overlapping on a metal rod. So in the times you have whisked eggs or something, what motion do you use with your hand?

**NANTEEN BA:** It's kind of like you move it side to side so you can really get the corners and crevices. But it's also circular, so it's all over the place. Sometimes, I end up spilling things out of the bowl. So I don't really use-- sometimes, I end up using a fork when I'm whisking my egg yolk because it just gets everywhere.

**MOLLY BLOOM:** I use a fork too for my whisking. Well, there are a lot of ways to whisk, but which is the best way to whisk? Our friends at *America's Test Kitchen* have been doing some serious testing, naturally-- it's in their name-- to find out the best method for whisking.

Now, we didn't really understand how intense whisking could get. To give you a taste, this is what it sounds like when a brother and sister are in a competitive whisking race.

**JOHN KIM:** [LAUGHS]

**SELAH KIM:** John's getting it. John's doing it.

**LISA** Well, that looks good. Both are good.

**MCMANUS:**

**SELAH KIM:** Can we swap bowls after?

**MOLLY BLOOM:** Yeah, it's noisy, but it's for science. Lisa McManus, the gear guru of *ATK*, invited us and brother and sister duo John and Selah Kim, who you just heard whisking, into the kitchen.

**NANTEEN BA:** They're going to show us the scientifically proven top whisking technique.

**LISA** You can either go in a circle like this, we found.

**MCMANUS:**

**JOHN KIM:** That's usually what I do.

**LISA** Some people go side to side like you were doing. And some people whip it in sort of a vertical loop, up and down

**MCMANUS:** and around like a Ferris wheel, like goes up and down.

**MOLLY BLOOM:** That's usually what I do.

**LISA** Yeah. Well, we've decided to figure out which way works best.

**MCMANUS:**

**MOLLY BLOOM:** So in order to test whisking technique, Lisa and her team set out to see how quickly they could turn heavy cream into nice, fluffy whipped cream with different whisking styles.

**LISA** Going in a circle barely works at all. And when we tested this, the side-to-side method worked much faster. It  
**MCMANUS:** whipped the cream in four minutes. And the circular motion, just like stirring a pot, it took 10 minutes, more than twice as long. And just for the record, beating in a vertical loop took eight minutes, and then we gave up. And that's still twice as long as the side-to-side method.

So we looked at what happened. Well, first of all, as you can tell, it's a little bit easier to just go side to side. You can do it really fast and really aggressively, like really get going. So you can carry out more and harder motions per minute than with the other methods.

And that creates more of what we call shear force on the liquid. And that's shear like scissors, like cutting through. And because stirring and beating in a vertical loop only moves the liquid in one direction, they don't make as much shear force. And the force matters because it basically creates air channels that trap air inside and gives it more volume, so it starts to fluff up. So you get whipped cream faster. So now you know an easier, and faster, and more effective way to whisk, side to side.

**NANTEEN BA:** We have a video on our website of this ideal whisking technique, if you want to see what it looks like for yourself.

**MOLLY BLOOM:** So you can make sure your whipped cream is ready to eat as soon as humanly possible.

**NANTEEN BA:** Do you have a question you'd like to hear answered on the show?

**MOLLY BLOOM:** A mystery sound to share?

**NANTEEN BA:** Maybe a drawing of the *Brains On* [? Libra ?] kitchen?

**MOLLY BLOOM:** Yeah. Let's see Gungador and his cutting-edge new mixing technique. You can send all of these things to us by visiting [brainson.org/contact](http://brainson.org/contact).

**NANTEEN BA:** That's what Zoe and Allie did.

**ZOE:** We recently heard that bananas are radioactive.

**ALLIE:** Is this true?

**MOLLY BLOOM:** We'll be back with the answer to that during our Moment of Um at the end of the show.

**NANTEEN BA:** And we'll read the latest group of listeners to be added to the Brains Honor Roll. Keep listening.

**MOLLY BLOOM:** So we just learned the best way to whisk, but there are machines that can do this kind of work for us.

**NANTEEN BA:** There's the electric mixer.

**MOLLY BLOOM:** Both the stand and handheld varieties.

**NANTEEN BA:** And there's the blender.

**MOLLY BLOOM:** And it turns out blenders were invented for a very specific and delicious purpose.

**TUCKER SHAW:** Well, a blender is one of the great inventions of the 20th century partly because it was invented in the pursuit of milkshakes.

**NANTEEN BA:** That's Tucker Shaw, an editor from *America's Test Kitchen*.

**MOLLY BLOOM:** Let's go back to the 1920s.

**TUCKER SHAW:** And this was at a time when electricity and refrigeration were still sort of starting to come around. It existed, but not everybody had access to it. But milkshakes were like the hot thing at that time because it really was the first time that you could transport frozen dairy products and so forth and have them at a lunch counter or a soda fountain, or something like that. So rather than making milkshakes the old way, which involved putting ingredients into a jar and literally shaking it until it turned frothy, and cold, and delicious--

**STEVEN** Can somebody else take this? My arm's tired.

**POPLAWSKI:**

**TUCKER SHAW:** --a man named Steven Poplawski from Wisconsin wanted to find a better way to make more milkshakes faster.

**MOLLY BLOOM:** A heroic cause if I ever heard one.

**STEVEN** Yes, I agree. That is why I, Steven Poplawski, dedicated my life to the noble cause of the milkshake. These jar-

**POPLAWSKI:** shaking shenanigans must end. It is time for the milk to be shaken by technology.

**TUCKER SHAW:** And he created a very small machine that could spin very, very quickly. And he figured that if he could attach blades to that spinning little machine and sort of encase all of that with a pitcher or a cup, or something like that, then he could conceivably put ingredients in there and have that thing spin around like crazy, and blend everything together.

**STEVEN** And I quoteth, for the first mixer of my design having an agitating element mounted in a base and adapted to be

**POPLAWSKI:** drivingly connected with the agitator in a cup when the cup was placed in a recess in the top of the base--  
[CLEARS THROAT] that's patent language for I just invented a blender, people! Wah! Wah! Wah! US patent number 1480914, y'all! Milkshakes for life!

**MOLLY BLOOM:** Still at this point, blenders were only found in soda shops or restaurants. They were too expensive for people to have in their homes.

**FRED WARING:** That's where I come in, Fred Waring. You've probably heard of me. I'm kind of a big deal.

**NANTEEN BA:** Fred was a famous big band leader.

**FRED WARING:** You know, Fred Waring and the Pennsylvanians.

[BAND MUSIC PLAYING]

You probably know our hit songs, like "I Wonder How I Look When I'm Asleep" and "I've Never Seen a Straight Banana." Straight classics, right?

**MOLLY BLOOM:** And yes, those are actual song titles of songs they played. Alas, Fred and his music have largely been forgotten, but it's his non-music work that proved to have staying power. Fred was also a former engineering student and a tinkerer who would eventually bring blenders into the home. He took a rough prototype for a cheaper blender that just wasn't working. He tinkered with it. He made adjustments until finally he unveiled--



**FRED WARING:** The Waring blender.

**MOLLY BLOOM:** In 1937.

**NANTEEN BA:** Man, this guy sure knows how to brand. Now, even though they were affordable, the public was still a little iffy about this whole home blender thing.

**MOLLY BLOOM:** One article called it--

**SUBJECT 4:** An electric motor with an odd-shaped jar.

**MOLLY BLOOM:** But Waring, being Waring, he was good at publicizing it.

**FRED WARING:** Helps to be Fred Waring, world-famous touring musician.

**MOLLY BLOOM:** So Fred Waring took the Waring blender on tour.

**FRED WARING:** We have one trunk for the blender and one trunk for the food. Oh, yeah, and instruments too. First, we'll swing, then we'll blend.

**MOLLY BLOOM:** Fred Waring and the Pennsylvanians promoted the blender far and wide, and it soon started to catch on. In fact, Fred developed a stainless steel version for scientists that was used by Dr. Jonas Salk in the development of the polio vaccine.

**FRED WARING:** That's how I invented the Waring polio vaccine.

**NANTEEN BA:** Good try, Fred, but no.

(SINGING) Oh, yes, we have not never, never, never, never, we've never seen a straight banana. Though they're things I hate, millions I have ate. But doggone me, I've yet to see bananas that are straight.

**MOLLY BLOOM:** Now before we shake things up any further, it's time to go back to that mystery sound. Here it is again.

[CLAPPING SOUND]

[LIQUID DRIPPING]

Any new guesses, Nanteen?

**NANTEEN BA:** Uh-- hmm. It's kind of hard. [SIGHS] I want to say an odd faucet.

**MOLLY BLOOM:** I like that guess. You ready for the answer?

**NANTEEN BA:** Yes.

**MOLLY BLOOM:** Here it is.

**MOLLY BIRNBAUM:** So I'm Molly Birnbaum. And I'm the editor in chief of *America's Test Kitchen Kids*. That was the sound of ketchup coming out of a glass bottle. So I was banging that glass bottle with the palm of my hand in order to get the ketchup out of it. It's not an easy task to get ketchup out of a glass bottle.

**MOLLY BLOOM:** Have you ever gotten ketchup out of a glass bottle before?

**NANTEEN BA:** Nah.

**MOLLY BLOOM:** Yeah, it's tricky. It just sticks in there. And that is because ketchup is a non-Newtonian fluid. A non-Newtonian fluid is something that is neither a liquid nor a solid, just like slime. If you want to learn more about these very cool substances, you can listen to our episode called "The Science of Slime." So Nanteen, do you like ketchup?

**NANTEEN BA:** Yes.

**MOLLY BLOOM:** What do you put ketchup on?

**NANTEEN BA:** My french fries. And I don't know if they have it in other states or if it's just a New York City, Harlem, Bronx type of thing, but there's this thing called a chop cheese, where it's like you chop off the beef, blah, blah, blah, and they melt the cheese on it. When I get it, I'll just ask for that, cheese and ketchup. It sounds odd, but it's actually good.

**MOLLY BLOOM:** That sounds good. Now, there are some people who put ketchup on everything, and it's their favorite food. And Molly Birnbaum is one of these people who loves ketchup.

**MOLLY BIRNBAUM:** Personally, I think it is one of the world's most perfect foods. It's incredibly delicious because it has all five of the human taste sensations as part of it, the salty, sweet, bitter, sour, and umami. And these are all the tastes that you get on your tongue from the taste buds in your mouth, which is different than flavor because flavor has a lot to do with smell. But ketchup is perfect because it has all five taste sensations.

[SHOUTING]

**NANTEEN BA:** So we've talked about emulsifying and blending, but we haven't even touched on baking yet.

**MOLLY BLOOM:** For a deep dive on the science of baking, check out our episode conveniently titled "The Science of Baking." It's a classic. I mean, it's not as big as "I've Never Seen a Straight Banana," but few things are.

**NANTEEN BA:** But wait, we can't finish this episode without talking about why mixing is so important for baked goods.

**MOLLY BLOOM:** No. No, we cannot. So here to drop some baking knowledge plus an amazing recipe for brownies is Elle Simone from *America's Test Kitchen*.

**ELLE SIMONE:** Mixing is a very important skill that you need in all cooking, but especially in baking, and very important in our brownie recipe today.

**MOLLY BLOOM:** Elle told us mixing is not only important for combining ingredients like chocolate and butter, but also for getting the right brownie texture. The magic there comes from how you mix the wheat proteins known as gluten.

**ELLE SIMONE:** Well, if we mix too hard, that will overactivate the gluten. Wheat flour has two proteins, glutenin and gliadin. And these are the proteins that work together to form a network. So it's these two things, like unfurling and colliding back together, to create this network called gluten.

And so it's great to have gluten. Everything that has flour pretty much has gluten. And it's good to have it here. But what you don't need is an overmixed gluten because we want our brownies to be soft and moist, and we don't need it to be airy and fluffy as like maybe a cake or bread. So this is just a gentle creation of a gluten network.

**MOLLY BLOOM:** It's like you're knocking all those proteins together. And the more you knock them together, the more connections you make. So it's tougher. But if you don't make as many connections, it's silkier.

**ELLE SIMONE:** Yes.

**MOLLY BLOOM:** Got it.

**ELLE SIMONE:** Yes. All right, so the batter's ready.

**MOLLY BLOOM:** So with brownies and a lot of other recipes, it's not just what you mix. It's how much you mix it that matters.

**ELLE SIMONE:** So I'm going to put our brownie mix into the pan. All right. So it's going in. And we'll have some delicious brownies in 30 minutes.

**MOLLY BLOOM:** You can find this very tasty brownie recipe at our website [brainson.org](http://brainson.org). And if you want more recipes like this one, the *America's Test Kitchen Kids* newsletter brings recipes and hands-on activities straight to your inbox. Go to [americastestkitchen.com/kids](http://americastestkitchen.com/kids) to sign up, and learn more about their upcoming cookbook for young chefs.

**NANTEEN BA:** Plus this fall, *ATK* is launching *America's Test Kitchen Kids*. It'll be chock full of fun stuff designed to excite the next generation of curious cooks and engaged eaters.

Water and oil don't mix because water molecules have a charge, and oil molecules don't.

**MOLLY BLOOM:** But with the help of a molecule called an emulsifier, the two can play nice.

**NANTEEN BA:** And whisking back and forth is way better than whisking 'round and 'round.

**MOLLY BLOOM:** An engineering degree can be used for the betterment of snacks and humankind.

**NANTEEN BA:** And mixing is important in developing the gluten in baked goods like brownies.

**MOLLY BLOOM:** That's it for this episode of *Brains On*.

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

**MOLLY BLOOM:** And we could not have made this series on the science of cooking without our friends at *America's Test Kitchen*-- Molly Birnbaum, Kaitlin Keleher, Sasha Marx, Lisa McManus, and Elle Simone.

**NANTEEN BA:** This week, we also had production help from Lauren Dee, Emily Allen, and Jacqueline Kim.

**MOLLY BLOOM:** And we had engineering help from Veronica Rodriguez and Sarah Bruegger. And many thanks to Tony Hillary, Julie Williams, Katia Duba, Joe Juvland, Seth and Maxwell Juvland, Tracy Mumford, Eileen Noonan, John Miller, Kyle Shealy, Jeff Jones, Curtis Gilbert, and Cindy Kim.

**NANTEEN BA:** Now, before we go, it's time for our Moment of Um.

[PEOPLE UM-ING]

**ZOE FARRAND:** Hi. I'm Zoe Farrand. And I'm 11.

**ALLIE SANDS:** And I'm Allie Sands. And I'm nine.

**ZOE FARRAND:** And we live in Nordland, Washington.

**ALLIE SANDS:** And we recently heard that bananas are radioactive.

**ZOE FARRAND:** Is this true?

**ROBERT CHIN:** So that is true. So bananas are indeed radioactive. I'm Robert Chin. I'm a radiation oncologist at UCLA.

So we treat cancer patients with high energy radiation beams to zap tumors out of people. Radiation is the energy given off by a lot of the atoms in our universe, especially the atoms that are unstable and need to get to a more stable state. Bananas are radioactive because bananas have a lot of potassium in them.

And potassium has a rare version that is a little bit unstable. And to get from an unstable state to a stable state, it gives off a little bit of energy. And that energy is what we measure in radiation. And if someone had a Geiger counter, which is a meter to measure radiation, and was patient enough and close enough to a bunch of bananas, you can actually measure a little bit of that radiation.

So there are lots of things that are radioactive. For example, people are radioactive. And even being close to somebody and sleeping next to somebody, there's a little bit of radioactivity just from that. And there's a little bit more radioactivity the higher you go in the atmosphere. So for people taking airplane rides, you get a little bit extra radiation just by being that much closer to the sun.

Bananas are still very safe to eat. The amount of extra radiation from one banana is about 1% of what you would get every day just living your life.

**MOLLY BLOOM:** I'm radiating love and appreciation as I get ready to read this list of names. It's the latest group to be added to the Brains Honor Roll. These are the listeners who shared their ideas, questions, mystery sounds, and drawings with us.

[LISTING HONOR ROLL]

You can check out the rest of our series on the science of cooking at our website, [brainson.org](http://brainson.org), or wherever you listen to podcasts. And if you have questions, ideas, mystery sounds, and high fives to share, head over to [brainson.org/contact](http://brainson.org/contact).

**NANTEEN BA:** And next week--

**MOLLY BLOOM:** The aliens are coming.

**NANTEEN BA:** What's for dinner?