Ask A Biologist Vol 102 (Guest: Christy Spackman)

A Tasty Side of Science

Dr. Biology takes a bite into the world of food science with scientist **Christy Spackman**. The two venture into the realms of taste, smell, and texture. There is talk of burgers, some of them impossible. The two also talk about how we have been working towards what Christy calls “making nothing”, which by itself is really something.

Transcript

Dr. Biology:

This is Ask A Biologist a program about the living world. And I'm Dr. Biology. Now take a deep breath through your nose. What do you smell? If it's early in the morning and you live close to a bakery, like I do, you might smell fresh baking bread.

Dr. Biology:

It turns out it doesn't take a lot for our noses to smell something in the air. And even though there are animals that have an even better sense of smell, we do a pretty good job as humans. And when you combine smell and taste, food becomes that much more enjoyable to eat. So, what is it about the sense of smell that makes it arguably one of the most important senses we have?

Dr. Biology:

Today we get some time with Christy Spackman a professor who has a dual appointment in the School for the Future Innovation in Society and the Herberger Institute for Design in the Arts. She has a doctorate in food studies from New York University. And her research explores the world of smell and taste, with a focus on our experiences of eating and drinking. So for the next 30 minutes, let's learn a little bit more about our sense of smell and taste. Thank you so much for joining me on Ask A Biologist. I really appreciate you taking the time out.

Christy:

I'm excited to be here. I think we'll have an adventure.

Dr. Biology:

If you had to describe yourself and just two or three words, what would they be?

Christy:

A runner, a baker and a very curious person.

Dr. Biology:

I love it, and I'm going to pick on, for this next question, the baker. What are the skills for a baker?

Christy:

A good baker has two sets of skills one an interest in measuring things and paying close attention to measurement, so precision. And the other is the desire

to explore what happens when you don't follow the precise procedure. So curiosity.

Dr. Biology:

So, a scientist?

Christy:

Oh, absolutely. Maybe a microbiologist too?

Dr. Biology:

Yes. Yeah. Get some yeast in there. Right? We're also talking about some things that are near and dear to you, and that's taste and smell. Let's talk a little bit about what are smells.

Christy:

This is a great question. And to be honest, I think this is a question a lot of people have been asking for a long time. So currently, we understand smells as being what happens when a volatile molecule and by volatile, I mean something that can evaporate or float above something interacts with the receptor in a nose. And so, this combination of molecule floating around in the air and the receptor in your nose, that then sends a signal once that molecule meets that receptor to your brain, that's what we would call a smell. So, before it gets to your nose, it's an odorant. And once it gets to your nose and interacts with it, it's an odor.

Dr. Biology:

Ah, okay. And when we talk about odors, and then ultimately smells, are they completely independent of all our other senses?

Christy:

Wouldn't that be cool, [laughter] they are not. So people who work on taste and smell, the two always go hand in hand. We think of them as flavor when we talk about taste and smell. And when we're talking about them separately, I'll say oh, that's taste and not smell. But when you're smelling something, you can also taste it when you're tasting something you can hopefully also smell it. Sometimes, like when you're sick or you have a cold, that relationship gets interrupted.

Dr. Biology:

So how do you taste and smell work together?

Christy:

I think the first thing we should say is if you want to be a scientist, there's a lot of opportunity for you to study this because we still are figuring out how they work together. Tastes we can generally think of as being characterized by the things you've learned about in school, sweetness, saltiness, bitterness, sourness. And more recently, people have started talking about umami, which is often described as the taste of protein or a fullness in your mouth. And then there's one other taste that hasn't been codified, but that's the taste of carbon dioxide. So that fizzy feeling on your tongue is also considered a taste.

Christy:

And then smell is all of the other stuff that comes along with those things. So if you eat an orange, you got sweetness, you've got sourness, but then you also have all of the orangey flavors, the, the citrus things. So there's maybe some

greenness in there, a little bit of something we might think of as floral, and all of that when you take bite down on that piece of an orange kind of explodes in the area in your mouth. So, you have stuff, the receptors on your tongue that are going to help you identify the sweetness and the sourness. But then you have all of this space in your mouth going up into your throat and up into your nose and all of that area too is where the experience we call flavor happens.

Dr. Biology:

So let's think about taste testers.

Christy:

Okay,

Dr. Biology:

That's a skill.

Christy:

Yeah, absolutely. It's something you can do at home and teach yourself.

Dr. Biology:

Ah, actually, that would be great. Give me an example, something, a fun little experiment to do at home.

Christy:

So, a really fun thing to do would be to get a few spices out of the spice cabinet in your house and working with someone. First, you could start by sniffing them and seeing if you can start to recognize the smell of a certain spice and give it a name. And then after a while, you can ask someone to set up a test for you where they won't actually give you the name and you smell them, and you see if you can identify what's present. Then once you've done that, you can then start having fun where let's say you get a new dish that one of your parents has made or you yourself decide to make a dish for your parents. Then you can ask them what's in here? What do you taste and have them use the words to describe? So that's one form of a taste test. There are lots of forms, however, of taste tests.

Dr. Biology:

Sounds like a great experiment. Is there another one you could suggest as well.

Christy:

Another type of test we've done is we'll get different chocolates, and then we'll have the students taste the chocolate and they'll create what is called a flavor wheel. These are really fun to do over a series of activities. It's not something you can do all at once. Because you get tired after a while as you taste things and smell things. But the students will go through and they'll taste it and try and come up with as many descriptors as they can. So that's the descriptive part. And then they'll work on building a shared with vocabulary and so they'll go get examples of something. So, if you say this chocolate smells to me or tastes to me like chalk, you would go find a piece of chalk, and then you would share it around. Everyone would know that when you said the word chalk, we were all thinking of the sensations associated with that particular piece of chalk. Or if we said grassy, it's going to be with the grass from our yard. And so you can create a shared vocabulary around things and then you can essentially make a wheel so draw a circle, break it up into triangles, like pie slices, and each pie slice is

going to be a descriptor related in some way to the sensation you had when you tasted or smelled the food that you picked.

Dr. Biology:

I like the one with chocolate for many reasons. One is a chocoholic without a doubt. Do companies that make foods hire people to do this?

Christy:

Yes. They're called sensory scientists. I have a lot of friends who are sensory scientists. One of them, for example, works for Frito Lay, she helps make the flavors that go on your favorite potato chip, or your favorite Dorito.

Christy:

The people who actually are going in however, and doing the tests themselves, are different from the people designing the test. So, most of the jobs are f or people who design the test, who analyze the information. And it might just be your coworker, the person who's hanging out next to you who comes in to taste the food. Or maybe you're going to hire people from the community to come in and taste the food too.

Dr. Biology:

So, let's talk a little bit about your research. Because this is a space in the world of observing and thinking about smells and tastes. It's a space that you're exploring every day. So, let's talk a little bit about what you're doing.

Christy:

I wish I could say every day I was going out and tasting things for my research. That's not actually what I do, I am looking for that absence of taste and smell in my research. So, if we think about tastes and smells is caused by molecules that are circulating in the environment, that means we can also think about all of the techniques or the ways we could maybe make those molecules disappear. And one of the really important cool things about tastes and smells is that at certain concentrations, so maybe if they're just very few of them, we can't smell them. But is there more than we can and then is there even more, maybe we can't again, and so there are these thresholds at which we're able to see them or not. And it's similar, if you think about at dusk or dawn, the way in which has the light changes, you can go from being able to not see something to being able to see something at dawn or in contrast at dusk, being able to see something to not being able to see something.

Dr. Biology:

Hmm.

Christy:

And so, there are a lot of researchers who are very interested in how can we manage those thresholds where we go from being able to perceive something to not?

Dr. Biology:

So do you think of humans as really great instruments for measuring tastes and smell?

Christy:

It depends what we mean by measuring. So, if measuring is producing a number that's reliable, over and over and over again, we're really bad at. If

measuring means detecting something, we're really good at it. We might not be as good as puppy dogs, but we're still really good at it. Because this is something that our bodies do. In fact, there are cases where instruments that scientists use to measure things tell you nothing's present. And human noses are like, Oh, yeah, there's something here. Pay attention, be careful.

Dr. Biology:

Right. And it's not all human noses...

Christy:

Correct.

Dr. Biology:

... you know, kind of like a, you know, some of us can run faster than others. Some of us can smell different odors better than others,

Christy:

And that can change from day to day even. Again, if you have a cold it can be really hard. Or maybe if you have a headache, you're much more attuned to being able to smell something than otherwise. So, a smell that you wouldn't normally pay attention to your head hurts, like, oh, make that go away. That's horrible. And then the next day, you can go right back to not even noticing that it's present

Dr. Biology:

That's a curious one because there's that connection for people, especially in the workplace between colognes and perfumes, and the triggering mechanism for headaches. You're one of them.

Christy:

I am one of them.

Dr. Biology:

She's pointing back at her. Okay, you're looking for the absence of taste or smell.

Christy:

Yeah, especially how do we make those tastes and smells disappear? And what might the consequences be? I can think of some really good consequences. If I lived next to say, a dairy plant. There's one here in Tempe where we live and the smells from the plant or kind of gross. I would love it if they could make those disappear. So that's a good thing. Maybe a bad thing is if I can't smell them, then I'm not going to pay attention to how well the people who own the plant are taking care of the environment. Are they treating the water appropriately? Or are they quietly dumping extra stuff into the water that shouldn't be there? And so, we have this interesting question of what do we learn using taste and smell and what does it mean if someone can control that.

Dr. Biology:

In the news lately? There's a lot about burgers.

Christy:

Impossible burgers. Normal burgers? All burgers.

Dr. Biology:

Yes, right. So, they're the Impossible burgers, which are meatless, and they're also the ones that are being made out of lab grown meat. But there's some challenges with those right?

Christy:

Absolutely.

Dr. Biology:

Let's start with lab grown meat.

Christy:

So, one of the most interesting challenges is another aspect of flavor that we haven't talked about yet, which is texture. So even though flavors primarily taste and smell, we also have these expectations of texture to come along. And with lab grown meat, they have not yet figured out and by “they”, I mean the scientists researching this and the technologist, how to make the cells grow in three dimensions. How to make them not just grow flat, they like to go flat and sheets just fine. But how to also make them go up and down and side to side. And that ability of cells, when they're growing in an animal to go in multiple directions is what gives meat the texture we're used to. And so, my friends who have really researched this say that one of the biggest things with lab grown meat, is it mushy, doesn't taste right because it doesn't feel right. And you can think about a potato chip, leave it out on the counter on a rainy day, after a few hours, it might still kind of taste the same, but it doesn't feel the same. Even though there's nothing wrong with it. It's perfectly safe to eat, you're not going to eat it because that pleasure from the crunchy sound and experience makes it so you don't care if the taste is there, because the pleasure part is gone from that crunch.

Dr. Biology:

So shifting to the Impossible burger, there's a little bit different story there. You have the texture, up until that point, making things out of plant. something was missing.

Christy:

So can I tell the Impossible burger story? And then maybe we'll critique it a little bit?

Dr. Biology:

Sure. Let's do it.

Christy:

So as you said, one of the biggest challenges for people producing alternatives to meat is they're trying to get meat eaters to eat is this idea of texture and flavor. And so the story the Impossible burger likes to tell is the story of going out and looking for a specific taste molecule to help give this plant based burger, the taste of meat, and what they decided was the most important characteristic is what they call the heme protein. This is a protein that's similar to iron. So, it's gonna taste a little bit like the taste you get from flesh because there's iron in the blood that feeds the flesh. And so that is their big claim, they say they have been able to isolate this heme protein and we put it into our burger. And because of that they're saying you like to eat meat, or maybe you don't, but this is going to taste a lot like meat - so close that you might not even notice. And

here's the critique. I haven't had an Impossible burger so I can say about them. I've had the Beyond Burger burger. It tastes really similar while you're eating it, but five hours later 10 hours later, and in my case, 15 hours later, I could still taste what I have eaten. And that's the interesting challenge between naturally occurring flavor and flavors that have been created and added in. Is sometimes those flavors that have been created and added in, lasts a lot longer. And I wasn't very excited to be tasting my burger the next morning.

Dr. Biology:

It'd be kind of like when you have a meal with a lot of garlic in it.

Christy:

A little bit. Yeah.

Dr. Biology:

Right. It just stays with you. And while it was really good during the meal, you didn't want to go to bed with it.

Christy:

Mm hmm.

Dr. Biology:

Yeah, I get that. I have not tried either. And it's intriguing to me. It's intriguing to me, even if I wasn't a vegetarian, it's clear that we won't be able to sustain meat as a main dietary consumed food, if we still have growth like we were having on the planet. So, it's going to be important for us to figure some of these things out. And so, I'm all for it.

Dr. Biology:

So back to your research. And I'm fascinated with the idea of the lack of taste or the lack of smell. Where do you want to use this? And what is it that you see using it on a daily basis doesn't even have to be daily basis. Where does this play in our lives?

Christy:

I'm going to give you two examples. The example I study is the case of tap water. So, there's all sorts of work that is done before our water gets to us to change it. We can call it to cook it cooking the tap water, they're not necessarily adding heat, but they're filtering it. They're adding in chemicals that help pull out maybe minerals that are present. But they go on ahead and they do all of these treatments to help make it so the water that comes out of our taps is safe, but also over the twentieth century they've developed treatments to help make it so the water coming out of our taps is unremarkable. So, in a way, you can think of it as an industrialization of the flavor of municipal water.

Christy:

So in the early 20th century in, let's say, 1900s, if you were to go to St. Louis, at that time, their water would have been brown, when it came out of the taps, it would have definitely reflected the geography of the area around it. Whereas if you were to go up to New England, maybe it would have been tea colored. And all of us right now think, oh, if I opened up my tap, and got out a glass of water that was brown or tea colored, I'd be really worried. And so, there we have a visual indicator that has been removed, but we've also had flavor indicators that have been removed.

Christy:

So for example, maybe the people upstream from us are dumping in chemicals on purpose, or maybe it's not on purpose, it could be just runoff from a farm where they've used fertilizer to help the plants grow. And at the same time that fertilizer has ended up in the water. So, we don't want people drinking that. It could be dangerous. So, we remove it, but we're also at the same time, removing what could be a sensory indication of taste or smell that that's present. Now, we can't taste or smell everything that's present in the environment. There are really dangerous things that don't even taste or smell. And more worrisome. Some of them might taste good, like lead in high concentrations, which is bad for our brains actually tastes sweet. So, Yikes.

Dr. Biology:

Hmm. You know, you brought up water. Can you talk a little bit about making nothing?

Christy:

[Laughter] So, I'm writing a book that's tentatively titled Making Nothing. The book itself is looking at this work of managing the taste and smell of municipal water in the United States over the last 100 or so years, and what I'm really curious about is what sort of work goes into that practice of making nothing, especially because the reality is, it's actually really hard to do. So, while the tastes and smells are changed, and in general, I would say our water workers have been really successful in creating a product that we don't pay attention to, unless it tastes bad.

Christy:

So, when it tastes fine, like that's, that's fine, it's water. But if it tastes bad, we pay attention, we change our habits, or maybe we pick up the phone and call our municipal water provider. So I'm just really curious what's going on here and why is this desire to erase tastes and smells so strong, when at the same time it also is potentially changing how we as individuals interact with and care for the world around us.

Dr. Biology:

It's interesting because I just installed a whole house water system. The city water that was making nothing, I'm making double nothing.

Christy:

[Laughter]

Dr. Biology:

I have another question. And it's about a short story that you wrote and the title is First meal. I was intrigued with this one because I could see you as the scientist that's interested in tastes and smells, and the scientists and the artists coming together. And then the futurist thinking of the day when we sit down to the first meal with some alien visitors. Can you talk a little bit about that?

Christy:

Happily. So, this is a question I've been struggling with for a while. To be honest, ever since I read Twilight as a young adult, where I was curious why in the world would anyone go on a date with someone who couldn't eat the same way they could eat? What a crazy concept? Especially someone who wants to eat you. And so when I think about what it would be like to go out and encounter an alien species, the first thing that always comes to mind for me is, how do you

sit down as a group of beings together and eat together, because such an integral part of how we form relationships as human beings is the idea that we can sit around a table and share food. And if you've got a pet, you often think about, maybe your puppy dog or your kitty cat also wandering around underneath the table looking at you saying, Hey, can I have some of that?

Christy:

So even if they're not invited to sit at the table with you, they still can eat much of the food you eat. Just don't give your dog's chocolate. It's bad for them. And as I was working on this, I started to realize That it would be really challenging because maybe not only would we have very different sorts of experiences, we wouldn't be able to share that same sort of history of smelling and tasting something in the same way.

Christy:

What would these two species need to be able to sit down, eat together, especially if one of them ate in a very different way from the other one, and then form bonds and share memories. And so for me, one of the most important parts of this was, if at the heart when we eat together, what we're doing is creating shared sensory memories. How could two species create shared sensory memories with different inputs? So that's what I was trying to explore with that story.

Dr. Biology:

And this is on the Interplanetary Community in a Box website. So, you know, you need to read the story. We don't want to tell too much because it's fun to read.

Dr. Biology:

Christie before my scientists get to leave, I always ask three questions. So you're ready.

Christy:

Okay.

Dr. Biology:

Right? first one's fairly straightforward. Although with you, you have a little bit of a different background, as we talked about, you ended up being the scientist that's been drawn to the arts. While I was the artist that was drawn to the science. When did you first know that you wanted to be a scientist? And then I'm going to add the next level to that is, when did you know that you were interested in the arts and combining them?

Christy:

My father is a gardener. And when I went to college, all I knew was I wanted a job where I could work outside and get my hands dirty. And so, I started taking classes in botany. And the part I liked best in my biology classes was the part about human cells that did not take me outside at all. But it was just so cool the way it worked together. And so, I think that's when I first knew I really wanted to do science. And when I started to realize that it wasn't quite the right fit, I had been drawing ever since I was a little kid, was when I started working in a research laboratory at the University of Chicago. I was very good at what I did. And I think that's because I like to cook and bake because it's the same thing. You're in a kitchen. That's a lab. So you measure stuff, you use all of your

senses to pay attention. You use your eyes to see if you've made the right amount you use your nose to tell when something's done or not.

Christy:

And so, I started going to culinary school at night, because while I was good at my job, I didn't like my job. And while I was in culinary school, I learned about this really cool field called Food Science where you can do food and science. I was so excited. And so at the right moment, I went and started a food chemistry program and that for anyone who wants to combine the two, I would say look at food chemistry because you get to do all the fun things you get to cook and then you get to think about why your food turned brown or what's happening when it burned or how you can mix and mess up with things. It's great fun. So right now I'm working on a project called flavor stories. That is working to invite people into that process of playing around with flavors as an artistic medium to communicate or tell stories about the future. We're still in the early stages. This is a big endeavor, because to ask you to tell me Hey, what do you think the future will taste like five years from now? 10 years from now? 25 years from now? Oh, that's a big can of worms, but it will be really fun to explore.

Dr. Biology:

I don't think anybody's ever asked me that either. They asked about the future, but they don't ask me what the future will taste like. I suppose. What would the future smell like?

Christy:

Yeah, well, what's the flavor of the future?

Dr. Biology:

Yeah, right. So now you told me that I'm going to take it all away. This is where you get to kind of spread out and use your imagination. I'm going to take away teaching. What would you be? What would you do if you could do anything? Or be anything?

Christy:

That's a really hard question. Part of me would still be a gardener, just like my father, but a gardener who gets to work with things that you don't normally garden. So - it's funny, I can hear the pauses that I'm making, because I haven't thought about this question intensely. I really want to explore our food system from the ground up. And that when I say be a gardener, I think that's part of it. Understanding how it is that something as simple as a seed planted in the ground can become wheat that I can then harvest and thrash and grind and turn into flour and then bake and turn into bread and then go feed someone that system is really simple but so complicated. And I think I want to follow that, or, frankly, be a spice buyer.

Dr. Biology:

Well, my wife would join you on the gardening. And I often said that farmers, certainly, gardeners, scientists, but I'll let you get away with that.

Dr. Biology:

Last question, what advice would you have for someone who wanted to be you? This can be a young scientist in school still, or it could be someone that's decided, you know, I'm tired of a desk job and I would like to explore X, Y or Z.

Christy:

Go for it, is my advice.

Christy:

My career has come about through a series of goals that I set when I was a teenager. And one of those goals was that I wanted to go to culinary school. And so when I was unhappy working at a job I was very good at and the opportunity came because I got a raise to go to culinary school I spent my entire raise on going to culinary school. And that opened doors and every opportunity I've had has come about in part because of seeing something that potentially opened a door or window or just broke down a wall for me to continue expanding out on those dreams that I had written down on a piece of paper, as a teenager, of things I wanted to do or explore. And I think the one thing that I haven't done as well as an adult is keep writing down those dreams. But that's not to say I can't

Christy:

And so yeah, follow your nose. Okay, it's gonna lead you somewhere fun.

Dr. Biology:

Well, Chrissy, I want to thank you for sitting down on Ask A Biologist. It's been a pleasure.

Christy:

Thank you.

Dr. Biology:

You've been listening to Ask A Biologist and my guest has been Christie Spackman. Her research explores the world of smell and taste with a focus on our experiences of eating and drinking. If you'd like to explore more of Christie's research, we have a link to her website from this podcast. The Ask A Biologist podcast is produced on the campus of Arizona State University and is recorded in the Grassroots Studio housed in the School of Life Sciences, which is an academic unit of The College of Liberal Arts and Sciences. And remember, even though our program is not broadcast live, you can still send us your questions about biology using our companion website. The address is askabiologist.asu.edu or you can just google the words - Ask A Biologist. I'm Dr. Biology.