

# Gustology with Dr. Gary Beauchamp

## Ologies Podcast

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Oh hey, it's that cup of tea that you forgot about and now it's exactly the right temperature and... It's me, I'm back, it's Alie Ward. Hi. So, what a month or so it's been. If you're like, "What? Hah? Huh? What happened?" So, very quickly, I was in the hospital three times, I had pneumonia, and then I was forced by my doctors and my loved ones to take some time to stare at an ocean and now I'm back. I'm healthy, I'm feeling refreshed, I've been told I'm glowing and I'm doing hella better so victory is ours, I can taste it. Speaking of taste, let's get into it.

So, your tongue is just sitting there on standby to talk, or to tell you if you should swallow, or spit, or gag, or lick. It's just like a disgusting, naked, muscular drill sergeant that lives in your mouth. So, we're going to talk to one of the most celebrated experts on the study of taste who is a delight to talk to and handled my thousands of questions with aplomb. So, I got myself to Philly to do this keynote earlier this summer and I managed to record 11 interviews for various episodes and then, unshockingly after that, I came down with pneumonia, just immediately upon my return. So, lesson learned. But while I was in Philly, I got myself to the Monell Chemical Senses Center, which you can locate in Philly via the giant gold nose and mouth sculpture on the exterior steps. As one researcher told me, it's a good thing that they're not a proctology center. So, I went in with my ears open and my appetite big for gustology, which is a real word, it comes from the Latin for tasting or flavor.

But first, from my mouth, a quick thank you to patrons of the show at [Patreon.com/Ologies](https://www.patreon.com/Ologies) who have been supportive since before episode one, six years ago, and without whom this show would not exist. Thank you to everyone on Patreon who responded to my video about taking a break with such love. I'm so lucky to have y'all as a community. [*"I just love you."*] You can also support the show with merch from [OlogiesMerch.com](https://www.OlogiesMerch.com) or just by leaving reviews and ratings because I read all the reviews and then I pick an oven-hot one to read each week. This one was written by Happy Worldwide who wrote that this show is:

*All So Very Good and the example you're setting by Taking A Vacation is also great.*

So, thank you Happy Worldwide, and thanks to everyone who left reviews while I was out; I caught up, I loved 'em all. Also, we had a little glitch with running some silence bits this past month because of an ad error but it's all fixed. Our bad, it's all good now.

Okay, onto the episode in which we will chat about celebrity-grade hot wings, excitotoxins, umami, medical textbook flimflam, gag reflexes, cats on Pixy Stix, weaning off of sugar, the worst soup on the market, which countries have salt restrictions, why some people like IPAs and some don't, artificial sweeteners and aging, and more, with absolute gem of a scientist and gustologist, Dr. Gary... Bee-champs [phonetic]... [*mutters*] I don't know... something... Gustologist, Dr. Gary... Gary.

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**Gary:** Am I supposed to hold this or...?

**Alie:** Yeah, just kind of hold it and talk into it like an ice cream cone.

**Gary:** Okay.

**Alie:** Imagine you're just on a stage, talking to people.

**Gary:** Singing songs.

**Alie:** Yeah, exactly. You're Linda Ronstadt.

**Gary:** Right. First name is Gary, last name is pronounced poorly, for the French, it's pronounced Beechum. [ph.]

**Alie:** Is it really "Beechum"?

**Gary:** Yeah.

**Alie:** [*gasps*] I definitely would have said [*with French flair*] Beauchamp.

**Gary:** Of course, of course. I was at a ceremony a few weeks ago where one of the winners was French and the first thing she did was chew me out for the way I pronounce my name.

**Aside:** Wow, chewing out a taste expert. We are off to the races.

**Alie:** It's your name, you can say it however you want.

**Gary:** That's right. And actually, it's a very, very well-known name in Britain.

**Alie:** Do you have a lot of doctors and scientists in your family?

**Gary:** No.

**Alie:** No? Really?! Were you the first?

**Gary:** Well, my father was an engineer, I guess that's kind of a scientist. But before that, they were just farmers and working people.

**Aside:** Okay, so it may not have been handed down to him, but he has two sons; one is a playwright, and one is a scientist. So, when it comes to careers, they all have great taste.

**Alie:** Did you always have an inclination toward that?

**Gary:** My story is that when I was three years old, a butterfly flew into my ear, and I caught it, and I was taken by it. From then on, I was pointing toward biology.

**Alie:** Did you start getting interested in how different animals experience different chemicals? Were insect mouthparts something that sparked it?

**Gary:** I was interested in different animals, for sure, and I caught dead animals for many, many years. But I don't think I had a real interest in their sensory capabilities until I was in college. I was focused on how animals engaged in the world, and it really wasn't until I came here to Monell that I focused on the chemical senses because that's what the institute was going to be doing.

**Alie:** When it comes to the way that humans experience chemical and sensory information versus other animals, is there a big difference when you jump from invertebrate to vertebrate, how we experience and understand the world?

**Gary:** The founder of this institute, a guy named Morley Kare, used to say, and he was famous for saying it as was Vince Dethier, who is another famous person in our field, every animal lives in its own sensory world. And that is true; some of them are more similar to others; some of them are more different. It's amazing in some ways how similar, at least in terms of sensory responses, some insects are to humans.

**Aside:** So take, for example, the teeny tiny *Drosophila*, which is a common research focus, it's the humble and fascinating fruit fly.

**Gary:** Fruit flies are an interesting and valuable model for understanding how taste and smell work and what they do in the environment. But there are other species that, for example, have no ability to

taste or no ability to smell or both. And of course, there are blind animals, whatever. So, there's a huge variation, there's no general rule you could make about it.

**Alie:** So, it's really based on need and what they've adapted to?

**Gary:** What I would say that the senses are most important for is getting enough food, mating, reproducing. It depends on what they need. I can take an example right off the bat, which is one of my favorites, one we worked on for many years. I studied cats and their response to various tastes and flavors and smells. We discovered, which was somewhat of a controversy in the literature at the time, that they didn't seem to respond particularly well to sugars like we would. So, we actually found that was true with our domestic cats.

And so, I went to the zoo, which is six blocks over here, and we tested lions and tigers and leopards and jaguars. What we found was that those animals loved things like fat, loved amino acids, which was protein, but as far as we could tell, they had no interest whatsoever in sugar or anything sweet. [*I'm not really a dessert person.*] The way we did this, we had these long pans we stuck under their cages (we couldn't get too close to them). But we proposed, this was late 1970s, early 1980s, that in fact, maybe, an animal which is an obligate carnivore, which cats are, have to have protein, and those animals are not able to detect sugars. That would be the easiest way to explain our behavioral results.

But there was no really easy way to test that at the time until around 2001, 2002 when everybody, including us, discovered something about what the actual taste receptor was in the tongue of humans, of mice, that's where most of it was done first. So, we knew what the receptor was, it's a protein that binds sugars, and then sends a message to the brain that says, "This is sweet." Another part of the brain says, "This is good." [*Alie laughs*] What my colleagues found, I'm not a molecular biologist, was if you could look at the structure of that receptor, that they lost function of that particular receptor. So, none of those cats can taste sweet at all.

One of the most interesting things is that we then looked at many other carnivores that were obligatory, that only ate meat, and they all had some change in their sweet receptor. Almost all of them lost it independently, not one event, but independently in all these species, presumably based on the fact that their dietary needs no longer drove them toward carbohydrates, which is what the sugars are deriving for a good source of calories. But for cats or for many other of these carnivores, they don't respond to it. And in fact, they can't even handle it, it makes them sick.

**Alie:** Really?

**Gary:** So, if you were to feed your cat friend a diet that was very high in sugar, if they would eat it, they would be sick because they don't have the mechanism by which they can break that down into something they can use, which would be glucose. Glucose is also a taste, and they use glucose of course for their bodily functions but they don't taste it, they have to make it.

**Aside:** For more on cats on keto, you can see the study, "Cats and Carbohydrates: The Carnivore Fantasy?" from the journal *Veterinary Science* in 2017 which stated, "Evolutionary events adapted the cat's... diet [to one] strictly composed of animal tissues and led to metabolic peculiarities of carbohydrate metabolism." Though a cat's body needs glucose to function, it's not being absorbed from the gut, rather, it is produced by the kitty body via gluconeogenesis, which means making glucose. So, cats lack some enzymes to even break down carbs which explains the paragraph in this study that reads: "High carbohydrate intake in cats therefore increases... adverse digestive effects, such as diarrhea, flatulence, and bloating." Smelly cat, what are they feeding you? Carbs. It's carbs. [*Al voice: "Kitties plus carbs equals farts."*] I asked our Felinology guest Dr. Mikel Delgado about this

and she said that they do have a special taste receptor for adenosine triphosphate which is basically a signal for meat. "True killers," she says.

**Alie:** What about dogs?

**Gary:** Dogs are a little different. Dogs are much more Catholic in their interests. [*both chuckle*] Some people say they'll eat anything, they'll just gobble it down, which is what it looks like sometimes. But dogs have not lost their ability to taste sweet. So, I think if you go to most pet foods and you look at what they're actually made out of, the ones for cats don't have anything that would resemble a sweetener, the ones for dogs have carbohydrates that might be sweet. That's one reason cat foods are more expensive than dog foods.

**Alie:** [*softly*] I had no idea.

**Aside:** So yes, the 2007 study, "Cats Lack a Sweet Taste Receptor," says verbatim that "Dogs prefer natural sugars... Overall, cats and dogs respond very differently to sweet-tasting stimuli, although both species belong to the Order *Carnivora*." So, I'm sorry cat people, science has proven that yes, dogs are sweetie-peeties. But I'm not biased, all right?

**Alie:** You know, I wasn't planning on asking this, but as long as I've got you here, I have a tiny, cute, adorable daughter, she's a dog. Whenever she tastes something that she's never tried before, like a tiny bit of mango juice, or a little bit of a type of ice cream if we let her have a little taste, she does this thing where she goes, "Myam-myam-myam-myam-myam." It's only on new foods she's never tried, and we have no idea what's going on.

**Gary:** She's testing it obviously.

**Alie:** Is she trying to get it up into her snoot?

**Gary:** Well, she probably just... That's her way of getting a better sensory response. One of my other areas is olive oil... And it's like wine too, [*quick inhale through mouth*] the tasting, if you do that, you're driving it more up- Actually, that's more olfaction probably than taste, but you're driving up to the olfactory receptors. And particularly if it's something novel, it's very, very wise for an animal, including [*chuckles*] humans to be wary because the real world is really dangerous from what you eat. Most things out in the real world are poison or semi-poison because they're defending themselves, and so people always complain about babies don't like vegetables or whatever, [*"Get that out of my sight."*] but they're wise not to like them at first [*Alie laughs*] because all through evolution, until a few hundred years, a few thousand years ago, that was the real world and one had to be very careful about what they put in their mouth.

**Alie:** And from what I understand, we lose taste buds as we age. Is that correct? Can you walk me through the minefield in your field that is taste buds? What are they doing? Who tastes what? What's going on?

**Gary:** Well, so... What you just said is controversial at best. [*laughs*]

**Alie:** [*laughs*] Good, good. Correct us.

**Gary:** Well, many studies suggest there is a loss of taste buds. Taste buds are these little bumps on your tongue, you can just look at them in the mirror; although the ones you see that are taste and the ones that do other things are very hard to tell the difference, certainly in the mirror. But on those little buds are taste receptor cells and they respond to sweet, sour, salty, bitter, umami, which is amino acid perhaps, and maybe a few other things. The counts of those, like everything else with aging, I have to say, which I'm doing...

**Alie:** Aren't we all?

**Gary:** ... is downhill. It's downhill. But the evidence that older people really don't respond well to tastes is very, very poor.

I have a story about this that is almost one of my favorites, it involves my father-in-law. So, my father-in-law was getting older, he was 92 years old, and my wife and I had to take him, put him in a nursing home, most horrible thing. And so, we got calls a little bit later from the nursing home saying that he wasn't eating, and they were worried about it. We knew he ate well; I'd fed him! So, I went to the nursing home and spoke to the people there and they said, "Yeah, he just won't eat this food." And I said, "Well, I'll try it." So, I went to his lunch and I started eating the food and it was terrible. [*Alie whimpers*] It was terrible in a very specific way that I think I was particularly able to discern, which was that there was no salt whatsoever, [*Alie groans*] no salt. One of my real expertise is in salt. So, I went to the person who was in charge of food, and she said, "Well, you know, salt causes hypertension." And my response was, "This man is 92 years old. He has no high blood pressure problems whatsoever and I know that he loves salt. Please, please put it into the food."

**Aside:** So, your health may vary, and ask your doctors about how much salt is right for you, especially since some studies have found that the older you get, the more you might gravitate toward saltier foods. According to this 2022 study out of Japan, older adults' perception of taste intensity increases slowly after they take a bite, but it remains lower than that of young adults. So, it takes a minute before they're like, "Mmm, okay." But it's still lower than when you were younger. This study suggests that older adults "Savor and chew sufficiently during eating to optimize their perceived salty taste." So, give it a good chew because it might take a second before it tastes good.

And I'm sorry, I have one million questions for this man, and I want to move forward but something was nagging at me, so we've got to go back.

**Alie:** And I want to circle back really quick because I'm dying to know, when you were feeding sugar to lions, what was going in the pan? Was it cotton candy? Jellybeans? What were you feeding them?

**Gary:** That's a great question because what we were feeding them was what scientists do, which is not such a great thing, we were feeding them sugar and water; so, we were giving sugar water or salt water or amino acid water. Fats are a little bit tricky, so we were trying to get a liquid fat that was in the same kind of format at least. But it's a real good question [*"Thank you."*] because when this paper was published and we were on NPR a few times about this, the claim was, this was a long time ago now, I'm sure it's not true anymore, that they got more responses to this particular issue than almost anything else. [*Alie laughs*] We were getting people calling and saying, "My cat loves ice cream. My cat loves cake."

**Alie:** [*laughs*] There's so much fat in there though!

**Gary:** There's so much fat, absolutely. You got it right away. [*both laugh*] The one problem I had was with marshmallows because, to me, there's nothing much there but a structure and sugar. And it turns out that one of the groups of animals that have no interest in sweets are the alligator-crocodile family, and yet I've watched them eat marshmallows, so I don't quite know what's going on there. [*"It's a mystery."*] But for the most part, what you said is right; the ice cream, the cake, those kinds of things, it's really the fat they're responding to.

**Alie:** I mean if I were a big lizard-looking beast and somebody threw something made out of horse gelatin that looked like an egg at me, I think I'd be like, "I'll take another one of those."

**Gary:** Well, that may be. And your point may actually be true, that what they're responding to is the visual signal, maybe not the sensory signal at all. Although the tactile thing may have something to do with it as well.

**Alie:** Boing-oing-oing-oing.

**Gary:** Yeah, yeah.

**Alie:** What about you personally? Do you have a sweet tooth or a sweet taste bud?

**Gary:** Sure. Everybody does, I mean almost everybody does. In fact, there's almost no evidence— There is some genetic evidence that we differ a little bit in our responses to sweets, but I would argue that it's the most profound innate stimulation that humans and many other species respond to. It's immediate, it's right at birth, before birth, it's working, and we all have it, all of us. So, I like sweets in some, certain circumstances, but I'm not a big sweet fan. If I had to make a judgment between sweet and salty, I'd usually go salty. But some people claim they're characteristically sweet lovers or salt lovers. The evidence is, I think it's more dependent upon what they've been eating, what they've recently had, and what they've had over their lifetimes.

**Alie:** We call this, in my family, the onion dip test: would you rather have a piece of cake or the onion dip? And my sister cannot fathom wanting the cake. She's like, "I would eat a whole bowl of onion dip with a spoon before cake." And I'm wondering about how we acclimate to certain tastes. If you put a lot of sweetener in your coffee every day, chances are you are used to that but if you never have your coffee sweet, a little bit probably tastes like a lot. So, what's happening between receiving the chemicals from our taste buds to our brain saying, "Too much. Too little?"

**Gary:** Okay, so you jumped one step ahead. [*laughs*]

**Alie:** [*laughs*] Okay, tell me what the middle step is.

**Gary:** So, the one step ahead you jumped is your assumption that we like what we're used to or whatever is reasonable, it's valid, and it's mostly true.

**Alie:** [*through giggles*] Okay.

**Gary:** But it's not so clear that it's true. You're asking questions that are so much in my daily work that I'm not even too embarrassed to try to answer them. Go back to salt. During the '60s and '70s, there was real concern about consuming excess salt and the question was, why do we do it? I can remember going to meetings and the poobahs of the blood pressure group said, "Well, you just stop eating food with salt in it. I did it and it was no problem." But it is a problem. And the question is, to what degree do we come to like the amount of salt we consume?

And so, we got interested in this a long time ago, not even because of the health reasons but to see what effect it would have if people who were eating, say, normal levels of salt, were put on a really low salt diet. Would they acclimate to that? The study was a very small study at the time. We took students from, just in Pennsylvania here, maybe not the average person but that's what we had. And part of the time we put them in the hospital so we could really control what they ate. [*"I made you dinner."*] And we lowered the amount of salt in their foods. Sometimes we did it with people from outside too and we tested how much they liked salty foods.

Basically, what we measured was if you were looking at a cookie or some sort of cracker, we got someone to manufacture the crackers with different levels of salt so we could look to see which ones they liked best, and we made soups. We were the world's largest consumer at the time of Campbell's low-sodium vegetable soup because no one else would eat it. [*Alie laughs*] And we used that as the base, and we made levels of salt. So, we tested them before they went on low-salt diets. And what happened, of course, was that when they immediately went on these low-sodium diets, they were miserable, they hated them. [*voice moans "I haaate it."*] But it turned out, they gradually came to think they were okay. And when we tested them, we found indeed the same thing; they

liked the level of salt which, surprising, *surprising*, Campbell's Soup put in the soup. [laughs] But after a while, that was too salty, and they began to like less salt. The same thing with crackers.

And it turns out, of course, we were not making a novel discovery. There were two other classes of discoveries that we found that had already done this. One was an Arctic explorer named Stefansson.

**Aside:** Oh wow, I could do a whole episode about this dude but let me throw down bullet points, okay? So, it's the early 1900s, there's this young explorer by the name Vilhjalmur Stefansson, born in Manitoba to Icelandic parents and he's leading an exploration in the far north. He hires an Inuit guide and a seamstress, he gets very romantic with the seamstress, who goes by Fanny Pannigabluk, and they have a son. Later in life, he would have another affair with a different woman named Fanny, and maybe Fanny was like the Brittany or Jenny of the time, I don't know. That's a lot of Fannys for one man. But back to 1913.

So, he studies Inuit populations and diets and that year, his ship gets marooned in sea ice. He says to the crew, "Hang tight, chill on the boat, play some cards, whatnot. Nobody panic. I'm going to go ashore; I'm going to hunt us some meat." But then, as he's ashore he's like, "Psych, smell ya later!" and he leaves the ship to sink. 17 of his crew members were killed. Such a party foul, Vilhjalmur.

It's 8 years later and he has an understandably sketch reputation, but he bounces back, and people keep giving him chances and money – not much has changed since then – and he decides to colonize an island off the coast of Siberia. And Russia is like, "Umm, that's ours." And Britain meanwhile goes, "We're so sorry about this Canadian guy, we don't know what he's doing. Ignore him." Four out of five researchers on the expedition die. Guess who doesn't? Vilhjalmur and his new Inuit seamstress who knows what the fuck is up and knows how to survive in Siberia. Also, their cat named Vic makes it out alive, probably cost it several lives though. Later, Vilhjalmur really botches a plan to domesticate Norwegian reindeer, the reindeer are like, "Get bent, we hate you." ... Excuse me, what does this have to do with anything? Let's get us on track.

So, Stefansson did make notes and found that the Inuit diet had a really meaty base of the food pyramid with about 90% of the food being meat and fish, pretty much doing keto or zero-carb for much of the year, and when eating like this, all of even the non-Native explorers, they were in great health. Everyone doubted him because he was dubious as hell but at some point, later in his life, a study was conducted, it was funded unsurprisingly by the American Meat Institute. It found that when Vilhjalmur and his cohorts ate only fatty meat, they had no deficiency problems and their health seemed to be great, even their stools were smaller and "Did not smell." But then when they ate lean meat, Vilhjalmur got the runs wicked bad and then couldn't poop for, like, a woeful 10 days. I bet he wrote poems about it.

So, that is who Dr. Beauchamp is talking about, this guy named Vilhjalmur Stefansson, who, it turns out, I did a little more digging, he was not born Vilhjalmur Stefansson. Rather, his name was William Stephenson and he changed it for optics. He was also said to have been, "the greatest humbug alive." Real rapsallion, this guy.

**Gary:** And they ate raw fish and other things, and when he got there, he was miserable because he wanted more salt, he wanted to put salt on it, and he didn't have any with him. So, he reports that after one, two, three months – which is exactly the same amount of time we found with people here – he began to think that low salt was okay.

Even better, in one of *Gulliver's Travels*, Gulliver goes to a low-sodium country and he's miserable with the food, he just almost can't eat it. But after two or three months, it's okay. When he comes

out of that low-sodium food country, everything tastes too salty. So, we were just proving something that everybody already knew. *[laughs]*

But it turns out that our little study has been replicated now many times with much bigger studies and forms the basis for the FDA and the CDC recommendations that companies uniformly should lower the amount of salt they put in foods, they say gradually. Some people really need to go on low-sodium diets, but the epidemiologists tell us, and I certainly believe them, that the best way to do this is to get everybody to shift downwards. This is, of course, very controversial. I was on a national academy committee that recommended the government enforce this by law and it is enforced by law in some other countries now, by the way.

**Alie:** Oh wow! Have they seen any benefits in health?

**Gary:** They claim they have in both Finland and in the UK.

**Aside:** Okay, so news to me, but according to the World Health Organization's Sodium Country Score Card, 25% of the world's humans live somewhere with a mandatory sodium reduction plan. And I can list them all, but no one wants that. But I did find that some nations even have implemented a tax on sugary or salty foods including the country Hungary.

But what you should know is that most populations are eating around 9 to 12 times the amount of salt that we need and that reducing salt in diets is apparently "the most cost-effective way of reducing noncommunicable diseases" because you're cutting down on cardiovascular diseases and strokes. And some people are like, "You can pry the saltshaker from my cold, dead, stroke-afflicted, cardiovascular-failed hands." But the biggest daily culinary offender? Our daily bread. So, a lot of mandatory sodium cuts are to breads, so you can lower your salt intake and then layer mustard and salami and pickles on top of it and shrug because hey man, you tried.

**Gary:** But in a population as a whole, you can see a decline in blood pressure-related diseases. *["Sweet."]* So yeah, step forward to now and the question is, is the same thing true for sugar? And we are actually, as we speak, finally conducting a study to look at this, much better study with the collaboration of the USDA where we are taking people and putting them on low-sweet diets. You've got low-sugar diets with and without non-nutritive sweeteners so we can see if it's the sweetness that's involved. The study should have been completed about three years ago but just as we were starting, COVID hit. So, we are now up and running as of this month. I'm suspicious that it's going to be harder with sugar, but we'll see. *["Just want to tell you both good luck. We're all counting on you."]*

**Alie:** Well, I'm so curious because I feel like I read a long time ago that if you have a diet soda with a meal, you'll end up eating more.

**Gary:** Yeah, yeah, okay. So, that is one of the again, *[chuckles]* controversial issues. The idea there is that the sweetener should stimulate release of hormones that are involved in appetite and if the sweetener is, say, a carbohydrate, which has calories, then that makes sense. The body recognizes that and uses it appropriately. But if it has the sweetness but not the carbohydrates, it really confuses things and maybe makes people more hungry or makes them eat more. There too, the evidence is very controversial.

**Aside:** Okay, quick, quick, quick. Insulin is squirted out of your pancreas, and it clears glucose from your blood. The hormone ghrelin is known as the hunger hormone and it can influence insulin secretion and back and forth, back and forth. If you have something sweet without actually increasing your blood sugar at all, some researchers think your appetite gets wonky. Like in a 2016 article that found artificial or non-nutritive sweeteners kicked off a sweet versus energy imbalance. Fruit flies in this study experienced hyperactivity, insomnia, glucose intolerance, and a



sustained increase in food and calories consumed, all of which just reversed when they kicked the sucralose. Also, what does a hyperactive fruit fly even look like? Augh, to be a fly bouncing off the wall in that laboratory.

Anyway, there are a ton of studies on this, some that say you'd need to eat 20,000 servings of Splenda before ghrelin was affected, others that say not so. There was a 2021 Polish study titled, "Aspartame– True or False? Narrative Review of Safety Analysis of General Use in Products," in the journal *Nutrients* and it stated that:

*Aspartame use has also been associated with increased risk of type 2 diabetes, cardiovascular diseases, nonalcoholic fatty liver disease, microbiome disruption, hormone-related cancers... And is suspected of causing behavioral disorders in humans... And neurodegenerative diseases like Alzheimer's, Parkinson's, multiple sclerosis, and brain tumors.*

And in July of this year, researchers via the World Health Organization said that there was limited evidence that aspartame caused cancer in humans, but they classified it as "Possibly carcinogenic." Yet, if you were to saunter over to the Wikipedia page titled, "Aspartame Controversy," the first paragraph says that "Potential health risks have been examined and dismissed." ... Did a Diet Coke write that? We may never know.

**Gary:** We have to be careful because it's not just controversial, there are people that are very seriously angry about it if you take one side or the other.

**Alie:** Really?

**Gary:** I'm a sensory person, I really stay away as far as possible from the medical thing. But of course, we're talking about things that are medically important. But from a sensory point of view, we've got to get the studies right, and then the physicians can tell us. As my doctor said the other day, "We are not scientists, we are physicians."

**Alie:** Oh! [laughs] That's a great line.

**Aside:** Okay so, the distinction is research, essentially. Most researchers have a doctorate, a PhD, but not all MDs, or medical doctors have done lab research. It's linguistically very confusing and it's like a deep-cut Blu-ray nerd humor. It's very cute.

**Alie:** You mentioned about 90 days to wean off of sodium, is it similar if you are going for a no-sugar diet? Is there something about that amount of time to make new connections in the brain?

**Gary:** Well, we don't know. That's a big problem with our study. How long do we have to go to see whether it might work? The only thing really that we had for humans was the salt study so ours is going three months, and if it takes longer for sugar, we won't see it. So, that's a problem. The other part of your question which is the more profound one really though is where is this happening and how is it happening? One presumes it's in the brain somewhere ["Up top."] but exactly where the effects of this experience happen and how they modify neural structures, we're going to need a good animal model to study that. Maybe with fMRI you could do something with it, just nobody has worked on that.

**Alie:** You know, I have something called postprandial reactive hyperinsulinemia.

**Gary:** God, that sounds very official.

**Alie:** Isn't it? It just means that I sugar crash more so than most people. So, I had a no-sugar diet for a long time.

**Gary:** Oh yeah?

**Alie:** Yeah. I fell off the wagon, horribly.

**Gary:** But did you, as I'm describing it, [*Alie laughs*] did you have this effect that when you first went back on it that it was too strong or...?

**Alie:** I think that what happened was that my brain knew that I wasn't allowed to eat it so when I ate it, it was like, "Oh, go to town." It was so forbidden that when I did have some, I couldn't stop. It was like a dog with a toy just like, "Gahhh." So, my relationship to sweets became more psychological.

**Aside:** For more on insulin ups and downs, you can check out the recent encore episode with diabetologist and type 1 diabetic, Dr. Mike Natter. Also, some people take umbrage to the term diabetic as a noun, others prefer 'person with diabetes.' So, I took a poll via Twitter or X or whatever, and three to one, people with diabetes prefer the term diabetic because it's such a large part of their lives and their identity, so don't come at me for that. And Dr. Natter responded, "I prefer the term my-busted-pancreas-peaced-out." But yeah, either way, my pancreas is a little bit of an overachiever in the insulin department, causing some blood sugar crashes and then sugar cravings and may, like me, one day burn out.

**Gary:** That's really interesting you say that because there are anecdotal reports of exactly the same thing where those people really had no exposure all their lives, this is an anecdote and I'm trying to remember it from some other time. But the sugar one as I recall was very quick, that it was a taste, maybe even almost a spitting out at first but then quickly realizing, "Wow, this is something."

**Alie:** Have you had to look at any studies of how to get off of sugar? We can tell that pancreatic illnesses and insulin responses and type 2 diabetes, definitely having some problems there, and I know for me personally, my life would be better if I did not eat sugar. And yet, every day, I put a little sugar in my coffee this morning. [*laughs*] Have there been any studies out there of trying to break that...?

**Gary:** Well, that's what our study is about.

**Alie:** Let me know if you need any subjects for it. [*laughs*]

**Gary:** Our study actually comes back to you. Do you think it has to be sugar or can it be any sweetener?

**Alie:** I feel like when I get acclimated to sugar in my coffee, or sweetener in my coffee, like a Splenda situation, I'm used to it and I expect it when I drink it, and the less I put it in the less I want it. I do feel like I've weaned off it a little bit at least.

**Gary:** One of the things that's interesting about the sweetener response, at least from the sensory point of view, which is what I know about, is that as I said, in 2002, we... And it's happened so many times. Five other groups at the same time, discovered what the receptor was. Very exciting time. I think we were first, but we didn't get to be published first. [*laughs*] [*"Bummer."*] That's another story. But the other sweeteners are discriminable from the carbohydrate sweeteners, that seems pretty clear. But the carbohydrate sweeteners like sucrose, fructose, glucose, from the sensory point of view, taste identical. But there turns out to be another receptor, another class of receptors that is particularly responsive to the small molecule carbohydrate receptors, mainly glucose, that goes through a different pathway that we may or may not be conscious of them. So, there are ways to discriminate, our body discriminates between these, but maybe we don't discriminate up here.

**Aside:** So, the tongue is kind of a sweet, happy bimbo saying, "Yum, yum, yum! Love it." But our bodies have all kinds of tubes and goop that know what the fuck is up on a molecular level. Speaking of talking, in tongues...

**Alie:** I'm curious a little bit about our taste buds themselves. From what I understand, and maybe this is outdated, but they look kind of like an orange with sections for different receptors for bitter and

umami, instead of having a bunch of bitter taste receptors on the back of your tongue, and some on the side. When you're looking at a taste bud, the ones that are detecting salts and carbohydrates and maybe proteins and amino acids, is that what's happening? Little tiny orange sections that are tasting different things?

**Gary:** Yes.

**Alie:** Okay.

**Gary:** But they're not... Again this is one of the things that drive people in our field nuts [Alie laughs] was this drawing, in all the medical textbooks showing that in the back is bitterness, the front is sweetness, the sides are salt, and they didn't even pay attention to amino acids. And of course, that's not true. They're distributed all through the tongue and the palate actually and actually fairly far back. But what is true is that you're sort of more sensitive to more bitter in the back and maybe more sensitive to the good things in the front. So, there's a little bit of truth to that.

Again, it makes kind of sense. If you think about what bitterness is for, this is even controversial, but I still totally believe it, that the real evolution of bitterness is to make sure you don't kill yourself with poison. And you think the last chance to stop from eating something is if you get it here and can [coughs] get rid of it. And when you look at babies' response to bitterness, newborn babies, you see this very distinct facial expression, rats do the same thing [makes hissing sound] trying to get rid of it. ["As if"] And the negative things are much clearer than the positive ones. People claim that babies smile when they get sugar right at birth, I don't believe it. But they certainly are calm, and they certainly appreciate it by sucking on it. So, there is something to that that there's this differential thing and particularly for very bitter things that they're avoiding. But the idea that it's only in these various parts. But each taste cell, presumably, this is also a little controversial, each taste cell responds to only one of these tastes.

**Aside:** As described in the paper, "Taste buds: cells, signals, and synapses." So, in mammals, each taste bud is this compact cluster of cells. It kind of looks like "A garlic bulb, with 50-100 elongated cells," and in general, there are the most type I cells and fewer type II and type III cells, but their concentrations differ in different parts of your mouth, or a lot of people's mouth provided that the person is a mammal and has a tongue.

**Gary:** Unlike the olfactory system, the smell system, there really are these basic, fundamental things which I've argued, and many people have argued, not just me, that the taste system is designed as the most important sensory system we have, and I can defend that if you let me; the most important sensory system we have. This is the thing that's going to help us decide, is this something I can put in my body, or is this something I should not put in my body? ["Don't put that in your mouth."] I mean, if you can't figure that difference out, you're dead. So, I do think that that kind of carries over to salt too. If you're sodium deficient, which, humans are never sodium deficient in our system, everybody has plenty of salt.

**Aside:** Okay, so I looked this up, and even in countries reporting the lowest sodium intake, Kenya and Malawi, folks there consumed about five times what an active, healthy human needs to survive in terms of sodium.

**Gary:** But during evolution, that wasn't true, so finding salt was really, really important and I think we're built to find salt and we respond particularly when we need it. There's a lot of study on lowered sodium and how rats in particular respond to it, not so much in people of course.

**Aside:** So yes, both medical doctors and scientists don't let gustologists deprive human test subjects of regular soup for too long... They're like, "We know you hate it, here's the regular soup... Thank you for participating."

**Gary:** Amino acids are a little different story and that's a long and weird history about what the amino acid taste really is and whether umami and glutamate are the mechanisms underlying our ability to detect and respond to protein. But certainly, under certain circumstances, the amino acid glutamate, which is the main one for MSG, is highly attractive to children and to adults. And it is in fact true that if you substitute monosodium glutamate with pure salt, you can reach the same level of liking with lower total sodium because the glutamate part stimulates presumably another receptor, and that compensates for the lower salt. So, that's one of the recommendations actually from the CDC, I think, to use that substitution for some foods. That won't work for everything, and it only reduces it, the maximum would be 40-50%, but that's substantial if people use it. So, salt is a very, very interesting substance, that's for sure.

**Aside:** Just a side note on how this works. So, glutamate is an amino acid and it hops into the receptor on your tongue that's primed for umami and it tells your brain, "Yum, yum, yum, yum." Now, if you combine glutamate with a nucleotide like inosinate or guanylate, which is in beef and fish and packaged foods and fermented veggies, then it heightens that umami flavor by extending the taste sensation. And yes, MSG got a real bad rap in the late 1960s when one dude, *one dude*, wrote a pissy letter to a science journal about his own woes with a condition he dubbed, "Chinese restaurant syndrome," and then the western world just freaked out in a misplaced gesture of bloated panic and just straight up xenophobia.

Now, in reality, bound glutamate is in a ton of foods naturally, a bunch of protein sources. And free glutamate, like what's in MSG, also naturally occurs in cheese, seaweed, tomatoes, peas, cow milk, human milk, and in additives labeled autolyzed yeast extract and such. Now, for more on this, you can see the *Annals of Nutrition and Metabolism* 2022 study called, "Glutamate: A Safe Nutrient, Not Just a Simple Additive." However, some neurobiologists have looked into the relationship between free glutamates and specific medical conditions like fibromyalgia, OCD, and what's called Gulf War syndrome, but more studies may need to be done on that. This was surprising to me but I'm actually a podcast host. I'm not a medical doctor so you can just tell that to your lawyers in terms of what you should eat.

**Alie:** And I was going to ask, where do capsaicin and excitotoxins, like monosodium glutamate, where do they come into this?

**Gary:** Okay, so first of all, I wouldn't put those together at all. *[laughs]*

**Alie:** Okay, yes, yes. *[laughs]*

**Gary:** Let me go back in history. If you look through all of history and you look at different cultures around the world, everybody agrees that these basic tastes are sweet, salty, sour, bitter, and something, one or two things that are irritants, like capsaicin. And of course, they have a different pathway, a different mechanism, they don't go through the taste system at all, they are pain. The capsaicin literally has the same set of receptors that if you put a burning match in your throat, it would do it. I mean, it really is burning by our language.

**Aside:** So, Dr. Beauchamp did a study on this in 1996, it was titled, "Ethanol Consumption and Taste Preferences in C57BL/6ByJ and 129/J Mice." I linked that, so you don't have to google it. But he found that no, mice did not like the solution that was liquid del scorcho hot, which is why in the Chickenology and squirrel episodes we talk about lacing birdseed with hot pepper to keep the rodents out of your feed bags because birds don't give a shit about spicy, they can't taste it, they don't hate it.

But in the same study, Dr. Beauchamp and colleagues also found that in rodents, they drank more of a boozy solution, possibly because of ethanol's sweet taste and that, "The proclivity to drink

alcohol is associated with elevated sweet preferences.” So, if you’ve got a sweet tooth and a drinking problem, or you quit drinking and now you’re reaching for candy, perhaps something to look at. It even happens to rodents. But yes, our main tastes are sweet, sour, bitter, salty, and umami, and then the burning hot ouch tongue stuff is just in its own painful joy, sickos.

**Gary:** So, they have those seven or six and they are universal, only four or five of them are taste, and the others... But you could see why nobody would know; they don’t know the anatomy and they’re in the mouth. Of course, you put capsaicin in your eye or your nose or other places, it will burn there too [“*Down south.*”] and it won’t taste sweet if you put it in your eye so that’s a little bit different. So, it’s not the same thing exactly. [*Alie laughs*]

MSG is different, I’ve studied MSG a lot and I particularly think that it’s a useful and good substance, if not consumed in excess. Again, I don’t like to speak on the medical side because I didn’t do any work in there but I’m pretty convinced that the studies that show that it has any negative characteristics when eaten in reasonably low concentrations, the evidence is not good. Other people would disagree with me probably. But if you took MSG, the glutamate, glutamate is a brain receptor, it is a toxin in the way you were using the word, but in order to get toxic consequences in your body, you have to inject it or put– I mean, the original studies were actually putting it in the brains of monkeys, literally right in the brain.

**Alie:** [*hushed tone*] Oh my god.

**Gary:** And of course, that really messed things up. And those studies were, I think, used to make people worry about it. But through the oral cavity, not much.

**Aside:** Let’s go back though and get another helping of hot sauce, god help us.

**Gary:** The really interesting question is why in the world do people love to consume something that hurts?

**Alie:** It’s a great question. Have you ever seen *Hot Ones* on YouTube? *Hot Ones* is just a show where it’s a guy interviewing a celebrity and they have a range of hot wings.

**Gary:** Oh no, I’ve never seen that.

**Alie:** I mean, it goes from mild all the way up to like, call-the-paramedics level. To watch people go up and up and up and see how hot, I mean... [*clip from Hot Wings “I’m, like, gushing tears.” Burps. “Fuck this.”*] Are you someone that puts a lot of hot sauce on things?

**Gary:** I do but I’m not a fanatic. [*Alie laughs*] I’m not a fanatic. Actually, my son is more of a fanatic than I am, so I don’t know what that shows about anything. [*Alie laughs*]

**Aside:** I’m not sure if this is the scientist one or the artist, but if I had to put money on it, I would say the playwright because pain is beauty. [*sings*] Drama, delicious.

**Alie:** Do people do that a lot when you come over for dinner parties? Are they like, “Well, he’s an expert in taste, this better be good marinara.”

**Gary:** I try to avoid that. [*Alie laughs*] People that know me well know that I’m no specialist.

**Alie:** You’re not a food snob about it?

**Gary:** I don’t think so. No, no

**Alie:** Yeah, you don’t strike me as such. But what about just like if I’m eating a pear but I have anosmia? My friend Micah lost his sense of smell as a baby when he had a fever.

**Gary:** It’s still gone?

**Alie:** It's still gone, yeah. Which is great if you need to fart around him. [*"Nobody's going to know."* *"They're going to know."* Dramatic suspenseful music. *"How would they know?"*] But other than that, it's not good for him. But we've often wondered, if he's having an apple or a peach or something, how much of it is he tasting and how much of it is he missing because he just doesn't have a sense of smell?

**Gary:** Yeah, well he's obviously missing all the good parts except for the sugar. Those things all have sugar.

**Aside:** Okay, so there's this oft-cited statistic that 80% of what we think is taste is really just smell, though many chemosensory scientists are like, "No." They're quick to point out that this is flimflam, never been substantiated. But they do agree that some of taste is in fact smell. My friend's lack of olfaction caused Gary at this point to just shake his head and look down on the ground... The chemosensory scientist, rueful.

**Gary:** And he lost it as a baby, I think people– COVID is awful; the symptoms are a disaster. The one person, the one group that it's good for was the people that study smell because there was this initial smell loss and it was very characteristic, much better than temperature, as a diagnostic for the original COVID. And so, we had a lot of people interested in that, but I think people that lose it as adults or at least later in life, they're able to sort of remember what it was so the disturbance is when it happens right away and when it keeps going forever.

My scientific son did a really interesting experiment, study, where he looked at complaints about Yankee Candles.

**Alie:** Oh! Oh! I love that study!

**Gary:** You know that study? It's my son that did it.

**Alie:** You're kidding me! [*gasps*] Is he a smell scientist?

**Gary:** No. He's a big data scientist.

**Alie:** Oh, my god.

**Gary:** But I think he has an interest in chemical senses because he was brought up in it for all his life.

**Alie:** That's one of my favorite things that has happened in the history of humanity.

**Aside:** Now, for the full report you can see the 2021 paper titled, "This Candle Has No Smell: Detecting the Effect of COVID Anosmia on Amazon Reviews Using Bayesian Vector Autoregression," by the Department of Political Science at Northeastern University professor, Dr. Nick Beauchamp. Yes, his son. And he tweeted this belated hat tip to both @TerriDrawsStuff and Kate Petrova, citing the particularly great work Kate Petrova did. And I'm just tickled by this. I'm so glad that they followed the data trail and sniffed it out.

**Gary:** You know, what's kind of too bad about it– No, it's not too bad, it's good, is the subsequent variants of COVID, the smell loss is not so prominent.

**Alie:** Interesting.

**Gary:** But it looks as if whatever it was that differentiates the first COVID, the first year or so, and the subsequent ones that seem maybe to not be so bad, or maybe just because most of us have vaccinations or have had it already, the smell loss is still there, and taste loss by the way as well. But I think the consensus really now is that the smell loss from the original COVID is due not to an effect on the smell receptor cells themselves but the cells around it that swell up and block the odor from getting to the receptor. So, that's not so interesting from the mechanistic point of view of

smell. Obviously, you know when you have a cold you lose your sense of smell for a while and it's just because it's blocked up. So, that may be not so interesting.

**Alie:** What about the taste part of it?

**Gary:** The taste part is a little puzzling to me exactly. There are demonstrations that some of the receptors involved in COVID are on the taste cells as well so that may be a receptor effect. And the taste was not so prominent in the original publications, but there's good evidence that taste and smell are both affected.

**Aside:** So, this fresh as hell study came out in the journal of *Laryngoscope* literally a few weeks ago and it was titled, "Smell and Taste Loss Associated with COVID-19 Infection," and it found that about 60% of COVID patients experienced a loss of taste and smell and the severity of the infection correlated to the amount of taste and smell loss. Overall, 70% of people recovered their smell and taste and on the other side, about 3% just did not, that is if they survived, which over a million Americans have not, so far. But from infections to inquisitions...

**Alie:** I asked listeners if they had anything to ask you...

**Aside:** But before we do, let's give away some cash. So, one donation is going to the Monell Chemical Senses Center which is the world's only independent nonprofit scientific institute dedicated to basic research on the senses of taste and smell. Their world-class scientists, including Dr. Beauchamp, are unlocking some of the most fundamental mysteries of what makes us human. So, that donation went to Monell.org.

And we're making a secondary contribution in the honor of Gary's wife, Faye, who works with the Philadelphia Young Playwrights which brings playwriting into classrooms and community settings with these intensive writing residencies providing literary skills, creativity, communication, and collaboration. And the great news about visiting PhillyYoungPlaywrights.org is that you do not need to know how to spell Philadelphia on the first try, which I did not, correctly. So, links to those orgs are in the show notes, and donations were made possible by sponsors of the show.

[Ad Break]

Okay, we are at the Patreon questions part of the show, and some folks wanted to know about the awkward afterparty that's happening in your face.

**Alie:** A couple of very smart listeners had this question; Zombot, Lisa, and Nico Price. Lisa wants to know: What causes there to be such a difference in phases of taste? They want to know about aftertaste. What's going on with taste versus aftertaste?

**Gary:** That's a great question and actually, COVID really comes to the fore there because one of the treatments for COVID, of course, was this Paxlovid, this drug that people took, and I took it because as an older person, I was able to get it right away. I guess it worked, I don't know, but I had the rebound effect so I'm not so sure. [laughs]

**Alie:** Oh, I had a friend who had the same thing, yeah.

**Gary:** The greatest thing. But in any case, the most striking thing to a taste person was the aftertaste. [Alie shudders] It was just awful.

**Alie:** Oh no! [laughs]

**Gary:** Horrible! And it was really profound.

**Alie:** Was it in tablet form? Or how did it ta-

**Gary:** Yeah. That's the interesting part because it was in tablet form. So, that drug was made up of two different drugs, one of which was the anti-viral. The other was a drug that I think, I was told, made it last longer.

**Alie:** Oh!

**Gary:** What we think is going on is that that drug is somehow going through the bud system to saliva and is being excreted in the mouth, on the tongue. We have a colleague here who has looked at the receptor. There are 25 beta receptors and he knows which receptor is being responded to. I wanted my chemist friend here to take my saliva and see if they could see the drug and presumably COVID in my saliva. He wouldn't touch it because, of course, he could get sick. That was pretty stupid of me to want to do that. [*Alie laughs*]

**Aside:** I love where his head was at, I'm not going to lie.

**Gary:** So, I think the main mechanism for the aftertaste for a lot of things is, coming back, some of it can be regurgitated from the gut, but some of it gets into the blood. And there's medical practice, I don't think it's done anymore, something to do with your heart function and they would inject saccharine into your veins and time how long it took for you to taste sweet.

**Alie:** Oh wow.

**Gary:** And so that really shows that it is going through the blood system and presumably the salivary system because the taste buds are all covered with blood vessels. If you've cut your tongue, you know it bleeds like a banshee. [*Alie laughs*] So, I think that is the pathway for most aftertaste although some of them are coming also more quickly from the gut and from gas coming up.

**Alie:** Mm-hm. Well, Katie Hultman had a question: How does chemo affect your taste buds? If you get, say, a metallic taste or... My friend Simone had a brain tumor and radiation, and she said the metallic taste was something that was really difficult for her. Are those chemical? Are they structural? What are those tastes?

**Gary:** Well again, that's a complicated story but I think some of the ones, the people who are describing the metallic taste, probably are doing just what I suggested. The drug itself is being somehow brought to the saliva and it's causing this taste. The idea of metallic taste has been very controversial over the years; some people claim it doesn't even exist and other people say that's crazy.

**Alie:** Well would it be a salt taste because sodium is a metal and potassium...? [*Gary grumbles*] No?

**Gary:** Potassium is possible because potassium has a bitter taste. But there are some people that tested metallic taste by putting nickels in water and showing that it had a taste. [*"No thank you."*] One of my colleagues claimed it was almost all smell. I don't know. I don't know about that.

But the other thing about radiation of course is that if the radiation is up here around the neck, head and neck radiation often destroys the taste and smell receptor cells. So, it's truly a loss of smell. And particularly the taste loss – and this is another reason that I argue that taste is really important – it's very, very rare for people to lose their sense of taste. Losing sense of smell is pretty common, losing sense of taste is very rare. But the one place it has happened in the past, I think they're getting better at it now, is in head and neck radiation.

**Aside:** So, this is called radiosurgery and we cover it with Dr. Varshana Gurusamy and I'll link that in the show notes. Also, huge shout out to all the radiology techs out there in the world also doing important work. And when Dr. Beauchamp mentions getting better or more precise with radiosurgery, that's in part due to better imaging technology which allows doctors to pinpoint



tumors and zap them via LINAC, which is linear particle accelerator methods, or the very super heroic-sounding, Gamma Knife. But yes, it may affect adjacent taste receptors, and not being able to fully enjoy your boba sounds like not a bad deal in exchange for zip-zapping cancer. However...

**Gary:** It can be so bad that people literally stop eating, it can be a killer actually because it's so difficult, it's incredibly difficult to eat food if you don't have the sense of taste. There are some rat studies now that show that this is true as well, that rats just stop eating and they die, even when the food is there in front of them.

**Aside:** Let's talk about craving dirt.

**Alie:** This one really... I had this question, I wasn't sure if any listeners wanted to know this, but BeckytheSassySeagrassScientist asked: What is the deal with pica? Is it just a brain mix-up or is it a taste bud mix-up too? I know you also like to study moths and butterflies who are out for salts in the rainforest a lot. Is there something that happens to the human brain when we are low on minerals where we like the taste of dirt?

**Gary:** I can say, it's extreme. If an animal, even a mammal, but certainly insects as well, are low or need sodium, they have the ability, most of them, to detect it immediately, they go after it, they consume it, and when they consume it, they stop because they get enough of it. There really is a pathway, a very, very profound pathway, in needing salt and detecting it.

The human literature is much, much more complicated, and the story that people always go to, which is a horrible story which I believe, one of the greats in our field, a man named Richter published this, a child who had profound adrenal insufficiency and basically, in order to keep that at bay, needs to consume salt, more salt. Nobody knew this, his parents took him to the hospital, 3 or 4 years old I think he was, and the hospital did exactly what my father-in-law's feeders did, they put this child on a very low salt diet. The child died.

**Alie:** Oh no.

**Gary:** But before that, the child would climb up on top of the table to get salt, would chew bacon, uncooked bacon, to get the salt. Retrospectively this was found. But they thought that was just wrong, so they prevented it.

**Aside:** So, those with adrenal insufficiency could retain more fluid which waters down the blood, and it leads to something called hyponatremia which is a low level of electrolytes in your blood and thus, tons of salt cravings. And I read one study about a 58-year-old woman who experienced a lack of appetite, malaise, unintentional weight loss, and the study continues, "The patient also recalled developing an unusually strong craving for pickles."

Now, if you're eating for two and you have a human critter growing inside of your body, why would you want pickles also? Are your adrenal glands on strike because of your new residents? Nope, just 26% of you growing another person have decreased salt sensitivity, and hence, you become a pickle hound, in case you were wondering patrons KJ, Kelsey Lore, Audrey Pearson, Amelia Frank's pregnant friend, and Olivia Eliasson.

Now, on the topic of development, patron Shail Thakker asked: How long does it take to develop a taste for something? And fellow patrons, Maren Proffit, first-time question-asker Madelynn D, Nico Price, Alia Myers, Calla Turnbull, Melanie Metzger, Will Clark, Tim and Ashley Flintoff, and S Bartfast...

**Alie:** What about people who want to acquire a taste for something? Do you have any tips for someone who maybe doesn't like black coffee or doesn't like vegetables? Any tips on learning to like something?

**Gary:** My tip would be just what you suggested yourself [*Alie laughs*] which is to gradually increase it over time. I presume it works. I'm drinking black coffee here; some people can't see how I can stand it. I can't stand the idea of putting milk and sugar into it.

**Aside:** Did you know that if you drink your coffee like a baby, with lots of milk and sugar, you're not prissy and weak, you might just be a supertaster. So, 25% of you out there are better at tasting and thus things like hoppy beer, gin, black coffee, kale, brussels sprouts, and grapefruit juice might be gnarly to you. And you might even like salt more than sweets. Why are you so good at tasting? Might be a genetic thing, you might just have more taste buds per square centimeter of tongue, or it might be a combination.

So, if you want to brag about being a supertaster, get yourself some Super Tasting strips, and then you can pass them around at a party and see who gags at the bitterness and who says, "This just tastes like paper, and I love my coffee black. Hey, pass the grapefruit and kale gin cocktail." Now, is a person who tastes less, stronger than you for drinking bitter things? No. Their taste buds are just like a 2005 Honda Civic and you sipping a milky latte are like a tongue Ferrari.

**Gary:** Now, what we did find, profoundly – and this is I think maybe the best discovery we've ever made here, it was a student of mine at the time – that if you can expose people, and we're talking about people that are babies, to a particular flavor very early in life, maybe even in utero because we can show that at least the smell parts of flavor get into amniotic fluid. So, the babies are being exposed to this, their sensory system is presumably working, at least in the last trimester, for sure. The experiment we did first was to take some mothers, three groups of mothers. One group was fed carrot juice during prenatal and postnatal life, the second group was carrot juice during just prenatal life, no carrot juice postnatal life up to about 4-5 months, I think, and the third group was the reverse.

**Aside:** Okay, so some babes got it in and out of the womb, others got it only when in, and others got zero carrot juice.

**Gary:** The two exposure groups responded very, very positively to the flavor and the other one didn't. So, we know they can get information about foods, flavors, probably smells, maybe tastes.

But the other one that's almost even more dramatic is in baby formulas, typical formulas, milk formula, but for infants that for some reason or other don't handle those very well, they make hydrolyzed casing formulas. These are widely used all over the world. When I first got into this business, I was having pediatricians come to me and say, "We can't get the babies to take these formulas." I think some of the better pediatricians who tasted them said, "And I agree, they're terrible! And the mothers say they're terrible. Is there some way you can fix them?" I had no idea.

But it led to the idea that maybe we ought to look at when it is they are fed them and it turns out that this is an incredibly dramatic example of imprinting learning. If you feed these babies these formulas, which to me and you, at the time at least, I think they've gotten better, but at the time, just tasted horrible; they were bitter, but they also had a really hideous off-smell. And what that was, was the protein is broken down into amino acids or peptides, but it's also broken down into volatile things that the receptors could detect. Receptors can't really detect protein for the most part, but they can detect the breakdown products and these breakdown products were horrible, no question. But if the babies were fed these beginning early in life, about three or four months, they were fine with it, no expression of negative response and they continued to be fine, and we have some evidence that they continued to like these flavors into adulthood. But if you waited until four or five months... Eugh! They couldn't get them to do it.

**Alie:** Wow!

**Gary:** Something is happening around three to six months of age about the sensory system and how it's processing these things. Again, you can make a teleological argument that when the baby is born, whatever the mother is eating must be okay because the mother wouldn't have been able to have the baby if it didn't work. And so, the babies are potentially programmed to respond positively to what the mothers were eating, even if you don't know what the mothers were eating. It doesn't matter what they ate, but they responded positively to that situation. So, presumably, it's the best predictor of what their baby is going to be eating when it gets older.

**Alie:** Oh my gosh. No wonder why— My mom, I think, drank a lot of diet soda while she was pregnant with me. There you go!

**Aside:** After this interview, I decided to cold turkey it and I am now proudly six weeks without a diet soda. So, please give me a hearty pat on the back, I've been through a lot.

**Alie:** And usually, I ask your favorite and least favorite thing about your job but since this is one about taste, what's the grossest thing you've ever tasted before? Or what's your least favorite thing to eat?

**Gary:** Okay so, these formulas, as they were made at the time when I started this work, were probably the worst things I'd ever tasted. [*Alie laughs*] And in fact, we had some people that threw up when we were tasting them.

**Alie:** [*through laughter*] Oh no!

**Gary:** They were really, really profoundly awful.

**Alie:** Oh my god! What about, do you have something that you crave a lot? Your favorite taste. And do you overanalyze it while you do?

**Gary:** No. [*Alie laughs*] No, I really don't think I do. I do think there are times when salt is better than sugar and other times when sugar is better than salt.

**Alie:** What about a favorite thing about your work? Is there something you *love* about this work?

**Gary:** Well, I think the most interesting thing about it is that it is something everybody thinks they know a lot about, [*Alie laughs*] and most people do actually, most people do. But there are a lot of things we don't know, and I think the idea of trying to express the importance of what we do...

**Aside:** Gary pointed to the full scholarly bookshelf behind him, up to a row of leather-bound volumes.

**Gary:** So, there's vision, hearing, whatever. Taste and smell are a very small piece of those books and that's because humans are, arguably and reasonably, much more interested in vision and hearing. Losing your smell, not so bad. Losing your taste doesn't happen much. So, I think that we are a very minute piece of the animal world. If that book was written by cats or dogs or moths or whatever, [*Alie laughs*] you'd have very different-sized volumes of each one.

**Alie:** Well, this has been an absolute joy. Thank you so much for letting me ask you so many questions. And if people want to find more about your published work, they can go to, obviously the site for Monell, they can go to ResearchGate, we can pore through all of your...

**Gary:** You can study it!

**Alie:** Oh, I love it so much. Thank you so much for doing this.

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So, ask very smart people tasty questions because it's really less embarrassing than you think, trust me, and usually they love it. There are links to the Monell Center in the show notes, thank you so much Gary for being on. We also have tons of research and links at [AlieWard.com/Ologies/Gustology](http://AlieWard.com/Ologies/Gustology). That's linked in the show notes.

For a full menu of all of our episodes by topic, over 300 of them, just go to [Ologies.com](http://Ologies.com); we have them all listed and categorized. *Smologies* are also available, they're shorter kid and classroom-friendly episodes if you need them. Thank you, Zeke Rodrigues Thomas, Jarrett Sleeper, and Mercedes Maitland for working on those. Thank you, Erin Talbert, for adminning the *Ologies* Podcast Facebook group. Emily White of The Wordary makes our professional transcripts. Noel Dilworth works as our scheduling producer. Susan Hale is our managing director and fact checker and also does merch. Additional editing is done by Mark David Christenson and lead editor is Mercedes Maitland of Maitland Audio. And these are all people that I'd call my taste buds, they're pals. I love 'em. Nick Thorburn made the theme music.

And if you stick around until the end, I divulge a secret and this week, I'm going to give you a little bit of behind-the-scenes action because it's so exciting. So, when I arrived at Monell for this interview, I was greeted by their lovely communications specialist, Ahmed Barakat, who in the three minutes from greeting me and taking the elevator up to Gary's office happened to mention that:

**Ahmed:** One of my friends who is a squid scientist-  
**Alie:** Wait, what's her name?  
**Ahmed:** Sarah McAnulty.  
**Alie:** I just came from her house!  
**Ahmed:** That's so funny.  
**Alie:** I'm staying in her guest room right now.  
**Ahmed:** You're kidding.

So, thank you to Teuthology guest and squid expert, Dr. Sarah McAnulty, who runs [SkypeAScientist.com](http://SkypeAScientist.com) which pairs experts with classrooms and book clubs and scout troops and such for free. [SkypeAScientist.com](http://SkypeAScientist.com) is amazing. Thank you, Sarah, for being my pal and hosting me for that fun-filled week in Philly. The day after we recorded this, me and Ahmed, and Dr. MackAttack all ended up playing Wingspan at a friend's house while I was there, I went to flush their toilet and I accidentally doused my crotch with their bidet, absolutely soaking wet, just right in the crotch. And I came downstairs, and they said it happens a lot, so all right. Ahmed won Wingspan. Okay, berbye!

*Transcribed by Aveline Malek at [TheWordary.com](http://TheWordary.com)*

#### **Links to things we discussed:**

[Dr. Morley Kare, founder of the Monell Chemical Senses Center](#)

[Taste Recognition: Food for Thought](#)

[Fruit fly offers lessons in good taste](#)

[Cats Lack a Sweet Taste Receptor](#)

[Genetics of Taste and Smell: Poisons and Pleasures](#)

[Effects of ageing on smell and taste](#)

[Pseudogenization of a sweet-receptor gene accounts for cats' indifference toward sugar](#)

[Functional Analyses of Bitter Taste Receptors in Domestic Cats \(Felis catus\)](#)

[Dr. Beauchamp on NPR: Cats Can't Taste Sweetness, Study Finds](#)

[Cats and Carbohydrates: The Carnivore Fantasy?](#)

[Daily/Colbert - Gators Love Marshmallows](#)

[Flavor perception in human infants: development and functional significance.](#)

[Sensory perception and pleasantness of food flavors in elderly subjects](#)

[Early Flavor Learning and Its Impact on Later Feeding Behavior](#)

[High salt intake. Sensory and behavioral factors.](#)

[Experimental sodium depletion and salt taste in normal human volunteers](#)

[Strategies to Reduce Salt Content and Its Effect on Food Characteristics and Acceptance: A Review](#)

[Salt Reduction Initiatives around the World](#)

[Sodium Reduction Initiatives Across the Globe](#)

[Adventures in Diet, Part 1, By Vilhjalmur Stefansson Harper's Monthly Magazine, November 1935.](#)

[Vilhjalmur Stefansson, Arctic explorer, ethnologist, lecturer, writer](#)

[Differences in dynamic perception of salty taste intensity between young and older adults](#)

[WHO's Sodium Country Score Card](#)

[Massive efforts needed to reduce salt intake and protect lives](#)

[Target salt 2025: a global overview of national programs to encourage the food industry to reduce salt in foods](#)

[Sucralose Promotes Food Intake through NPY and a Neuronal Fasting Response](#)

[Aspartame—True or False? Narrative Review of Safety Analysis of General Use in Products](#)

[Artificial sweetener is a growing threat for metabolic syndrome: why is extra attention required?](#)

[New York Times: We Need More Doctors Who Are Scientists](#)

[My Twitter \(X?\) poll on Diabetic vs. Person-First Language](#)

[Congenital sucrase-isomaltase deficiency](#)

[Congenital sucrase–isomaltase deficiency: identification of a common Inuit founder mutation](#)

[Researchers identify Inuit gene responsible for sugar intolerance](#)

[CSID list of sugars and tolerances](#)

[Taste buds: cells, signals and synapses](#)

[The Low Glutamate Diet Effectively Improves Pain and Other Symptoms of Gulf War Illness](#)

[Excitotoxicity via excess glutamate](#)

[Dr. Nick Beauchamp on Twitter](#)

[Kate Petrova](#)

[Smell and Taste Loss Associated with COVID-19 Infection](#)

[“This Candle Has No Smell”: Detecting the Effect of COVID Anosmia on Amazon Reviews Using Bayesian Vector Autoregression](#)

[Ethanol Consumption and Taste Preferences in C57BL/6ByJ and 129/J Mice](#)

[Radiosurgery](#)

[Glutamate: A Safe Nutrient, Not Just a Simple Additive](#)

[Natural products as safeguards against monosodium glutamate-induced toxicity](#)

[Video: What are Taste Receptors? How Does it Work? Animation](#)

**Other episodes you may enjoy:**

[Diabetology \(BLOOD SUGAR\)](#)

[Felinology \(CATS\)](#)

[Biogerontology \(AGING\)](#)

[Environmental Microbiology \(TESTING WASTEWATER FOR DISEASES\)](#)

[Glycobiology \(CARBS\)](#)

[Laryngology \(VOICEBOXES\)](#)

[Radiology \(X-RAY VISION\)](#)

[Indigenous Culinology \(NATIVE COOKING\)](#)

[Foraging Ecology \(EATING WILD PLANTS\)](#)

[Black American Magirology \(FOOD, RACE & CULTURE\)](#)

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Theme song by Nick Thorburn