

Wonderful! 265: Very Science One

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[theme music plays]

Rachel: Hi, this is Rachel McElroy.

Griffin: Hi, this is Griffin McElroy.

Rachel: And this is Wonderful!

Griffin: I've just showered. Can you tell? Do you smell me, babe? Do you smell me, babe?

Rachel: I don't.

Griffin: Aw, man, babe!

Rachel: I mean, I would if I were right next to you, but we—

Griffin: You probably would. I smell exquisite.

Rachel: [laughs] We arranged the office as such that I cannot smell you from this distance.

Griffin: Oh my god, I just realized. I forgot to moisturize.

Rachel: Do we need to stop?

Griffin: Maybe! I've been trying to be good about this.

Rachel: I think it's too late. I think it's over now. I think you missed your window.

Griffin: From what I understand about moisturization...

Rachel: You're supposed to do it right after you shower.

Griffin: You're supposed to do it right after—to lock in the freshness.

Rachel: Uh-huh. Everything's open.

Griffin: Oh god, babe!

Rachel: You gotta fill it up with moisture.

Griffin: All the hard work I've done.

Rachel: Now, what if you go shower again? [laughs]

Griffin: Now we're talking. Get juicy again. Seal that in.

Rachel: Of course then you'll be double dry, and so you'll need to double moisturize.

Griffin: Double moisturize.

Rachel: And then it—

Griffin: I can do that.

Rachel: —you'll be slippery.

Griffin: I can do that.

Rachel: And you might fall and hurt yourself. That's my concern.

Griffin: I'll probably—yeah. I'll try—

Rachel: I need to get you some gripper socks like we have for Gus, you know? With the little treads on the bottom.

Griffin: That would be huge for me, actually. I feel like I have at times owned gripper socks in my life and there's a sense of security.

Rachel: I mean, they give 'em to you at trampoline parks.

Griffin: Hospitals.

Rachel: And hospitals.

Griffin: Those are the two big ones.

Rachel: [laughs] Those are the slipperiest places.

Griffin: To just know... I've got a lot that could and will go wrong. But doing a slip in the kitchen on the hardwood floors is not—is no longer necessarily of those possibilities.

Rachel: Mm-hmm.

Griffin: Because of the gripper socks. I could also just wear shoes all the time. Become a real sneakerhead.

Rachel: No! No, because you know we don't wear shoes in the house, Griffin!

Griffin: That is true. You are wearing slippers right now, which feels like a cheat code.

Rachel: Well, these don't go outside—they don't go outside.

Griffin: I guess they don't.

Rachel: Although sometimes they do when I have to bring the trash can out.

Griffin: Yeah, or a son goes wayward. Sometimes a son will just... fuckin' go.

Rachel: [laughs] Gus is at the point now where he has a fair amount of language skills, but there's also some habits, and one of them is just leading us to the door.

Griffin: Yeah.

Rachel: As if like, "And now we're going outside."

Griffin: "I've determined our plans for now."

Rachel: [laughs]

Griffin: Yeah, we've established a pretty bad pattern with him of... thinking that he is—he is the one that is in charge of our sort of daily direction and...

Rachel: The outside thing gets me so excited, though.

Griffin: Yeah?

Rachel: Because I think I have a deep fear about our children just surrendering to the indoors at a very young age. And so when they want to go outside I will drop everything and be like, "Yes. Yes. Let us go outside, if only but a minute." [laughs]

Griffin: I'm sure they will make that decision eventually. Because we certainly made the decision to be inside.

Rachel: You say that, but I was much more of an outdoor kid, I think, than you.

Griffin: Yeah. I mean, you went to art camp and stuff. That was outside.

Rachel: Yeah, I was outdoors. Like, every summer I was outdoors all the time.

Griffin: Yeah. I mean, I was too, man! I went to—I went to church camp. And sometimes we did, like, capture the flag and stuff.

Rachel: [laughs]

Griffin: So... only we called it capture the bible.

Rachel: [laughs]

Griffin: And we would hide our bible...

Rachel: [laughs]

Griffin: ... not somewhere dirty. 'Cause you're not supposed to do that. Anyway...

Rachel: And then a team would run with it across a field and you'd have to try and tackle them?

Griffin: Mmm... yeah!

Rachel: [laughs]

Griffin: That was basically it. It sounds weird, actually, when someone who didn't do it says it. Like, I feel like you're not giving it a fair shake, maybe. This is Wonderful. It's a show where we talk about things we like that is good and we do like them.

Rachel: Oh, did we start the show? [laughs quietly]

Griffin: And this, uh—this—this week we're gonna start things off a little differently by doing a small wonder. Uh, and maybe you could start us off by doing your small wonder, or I could start us off by doing a small wonder. And... and that's what's gonna happen now. [smacks lips]

Rachel: Umm... I'm gonna say something that's gonna make me sound like a real jock.

Griffin: Aw, shit!

Rachel: I—I, when it comes to hand weights...

Griffin: Here we go.

Rachel: [laughs]

Griffin: Here we go. Let me get comfortable.

Rachel: I really like the kettle bell.

Griffin: Yeah.

Rachel: And I think it's 'cause it seems more fun to me? And it seems like more of a toy than a hand weight.

Griffin: Oh yeah. I'm always playing with these things. I can't stop myself. They're like Funko Pops.

Rachel: The reason I would never go under the label of jock is that I have not consistently incorporated fitness into my life ever. Um, but when I do approach a weight... I like it to be a kettle bell.

Griffin: You watch a lot of sports. We watch a lot of sports.

Rachel: Just hockey.

Griffin: We watch a lot of sport.

Rachel: Sport, period, yes.

Griffin: And you have thoughts about kettle bells. Babe, lean into it.

Rachel: [laughs]

Griffin: You know?

Rachel: I have never possessed a protein powder. I feel like that's the final frontier.

Griffin: What's stopping you? Nothing! Going to the store and buying the protein powder. That's the only—the only gate between you and your destiny. I'm gonna say the Great Wolf Lodge.

Rachel: Yeah!

Griffin: We had our first Great Wolf Lodge experience this past weekend. If you don't know what that is, it is a chain of... resort feels... there's nothing luxurious about the Great Wolf Lodge.

Rachel: No. It—I mean, it's a—

Griffin: It is an entirely utilitarian experience.

Rachel: But it would, like, by definition be, like, a resort... for kids.

Griffin: For children. It is a refreshing change of pace from the things that we usually do. Uh, where, you know, while go to a convention or some sort of event that will be entirely adult-focused and bring our kids with us, and then struggle to find things for them to do. This is the inverse, where you have your bowling, your laser tag, arcades, a thing called Magic Quest which is like... man, I don't know. An interactive—

Rachel: The technology on that?

Griffin: —technological treasure hunt throughout the hotel grounds.

Rachel: Yeah. And then the water park, of course.

Griffin: The water park. It's got it all. We were there for about 36 hours, and I thought I would die at several points. We came home, and the four of us got the best night of sleep I think we've ever—we all slept until, like, 8 o' clock. It was outrageous.

Rachel: [laughs] I think—I was trying to figure out. Like, Disney is obviously much larger.

Griffin: Sure.

Rachel: Why am I more tired than I am at Disney? And I think it's just because Disney, by nature of rides, you are sitting occasionally.

Griffin: Sometimes. Or standing still. Another feature of Disney World.

Rachel: Great Wolf Lodge, no sitting.

Griffin: Always on the move.

Rachel: I got very excited in the arcade. Of course with a almost two-year-old it is very easy to just sit in front of an arcade machine and never pay any money. And there was one, like a Space Invaders.

Griffin: Space Invaders. Yeah, I forget what it's called, but it's—yeah.

Rachel: I mean, that is basically like a chair in front of Space Invaders. And Gus really liked it. And so I got to sit... for minutes at a time.

Griffin: Yeah. It was huge. Huge for us. It was a fun time, though. It wore us out, but it was—

Rachel: It was fun.

Griffin: It delighted the children, and it takes a mental load off to not have to struggle to, like, think of things to do to, like, keep your kids active and entertained and stuff.

Rachel: Things to do is, like, 80% of the reason we moved to this city, you know?

Griffin: That's true.

Rachel: Like, this is very important to us.

Griffin: That's true. Um, you go first this week, I believe.

Rachel: Yes. So, it's funny that you mentioned your smell.

Griffin: Okay? Are you gonna talk about my sme—is your topic my smell?

Rachel: [laughs] No.

Griffin: I would love to hear you sort of put words... put your poet's tongue to... [hesitantly] my body? Wow!

Rachel: [snort-laughs]

Griffin: That one...

Rachel: I want to give space around that. Can we just sit in silence for a while? [laughs]

Griffin: Can we just acknowledge and give that the space it needs and give it a little grace, maybe, even? What's your subject this week?

Rachel: It is olfactometers.

Griffin: This is cool.

Rachel: It is like a device to measure smell.

Griffin: This is sci-fi?

Rachel: This is real.

Griffin: This is Gene Roddenberry sort of...

Rachel: I'm gonna show you a picture.

Griffin: ... holo-project—it better look like a fuckin' nose.

Rachel: [simultaneously] Just to get you started.

Griffin: Well, no. Well, okay. It's a—

Rachel: It's like a telescope.

Griffin: Telescope.

Rachel: For your nose.

Griffin: It looks like an elephant telescope!

Rachel: [laughs]

Griffin: A telephantosco—uh, scope.

Rachel: [laughs] And elephants... scope.

Griffin: Telemph—telephant.

Rachel: No. That just sounds like...

Griffin: Telescope... phant.

Rachel: ... a scope for elephants.

Griffin: Yeah, I don't think that portmanteau's in there. You would think it—it's deceptive. You think there's a great portmanteau there, but there's really not.

Rachel: So I'm gonna take you on the journey that I went on.

Griffin: Telescant? [pause] No. Sorry, go ahead.

Rachel: [laughs] So, this morning Griffin was complaining a lot about the bad smell that our son made in his diaper.

Griffin: With his butt.

Rachel: And then he lit a candle, very fragrant, but in the—

Griffin: A very Christmassy candle.

Rachel: —positive direction, I think. I like that candle.

Griffin: It's a little—it's very balsam-forward... is what I'll say.

Rachel: Yeah. Definitely does smell like several months ago in our house right now. And then I decided I was gonna make like a Thai peanut sauce, uh, like, chicken thing for dinner in our crock pot. And I realized, like, my morning has been full of smells.

Griffin: Very fragrant.

Rachel: Uh, I wonder what there—

Griffin: You say this. You were not there for...

Rachel: I wasn't.

Griffin: And let me just say, I've been—

Rachel: I'm sorry you were alone.

Griffin: I've been interfacing with diapers for six years now. This one was—this one was special. This was a specially bad one. I don't want people to hear you say "Griffin smelled a diaper and got scared."

Rachel: [laughs]

Griffin: This one was bad. This one was—

Rachel: [through laughter] It was basically the first thing you said to me when I came down this morning.

Griffin: I wanted you to share it with me, 'cause you had missed the inciting event. You just came downstairs. You were like, "Is it Christmas?" But you didn't have to be there for the un-Christmas... that happened.

Rachel: [laughs] Um, yeah. So anyway, so I was thinking about smell. And then I was thinking about, like, what is the science of smell? And I'm not really interested, I think, in how humans smell. I'm more interested in, like,

the science around determining smell? Uh, and whether or not there's, like, a whole field behind it. And of course there is.

Griffin: Yeah.

Rachel: Um, the thing I found first, though, was the St. Croix Sensory descriptor wheel. Which was published in 2002.

Griffin: Ooh.

Rachel: That lists types of smells, and then subcategories under that.

Griffin: That's fascinating.

Rachel: So we've got floral, we've got fruity, we've got vegetable, we've got earthy, fishy, chemical, medicinal, and then finally, offensive.

Griffin: Okay. I'm—I would push—eh, vegetable smell...

Rachel: And under each of these categories they have these subheadings.

Griffin: Oh, wow, okay.

Rachel: 'Cause sometimes you're like, "Oh, I wonder, you know, what would we call..".[pause] I don't know. Most of these are pretty clearly... a fit where they would fit.

Griffin: I was gonna push back against vegetable, but then I thought, like, does, you know—

Rachel: Celery. Corn. Cucumber. Dill. Garlic.

Griffin: Grass? Grass?

Rachel: Grass I think would be earthy.

Griffin: Oh, yeah, sure.

Rachel: Uh, yeah. But offensive I think is an interesting category. [laughs quietly]

Griffin: Offensive feels like it's a catch-all for everything that's not anything else.

Rachel: A lot of it is like, you know, decay, you know, waste-y kind of smells. Um, but burnt is also in there.

Griffin: Okay.

Rachel: Which is kind of fun.

Griffin: Sure.

Rachel: Um, and so then I was like, well, tell me—

Griffin: But burnt can be good. Like, campfire smell is good. But then I guess do we wrap back around to—I mean, it's burning wood. Now, is that earthy?

Rachel: Mm-hmm, mm-hmm. Burnt wood is earthy.

Griffin: Okay, cool.

Rachel: It's under the earthy list.

Griffin: Cool. Asked and answered. That's what we do on this show.

Rachel: So when I found this St. Croix Sensory descriptor wheel, of course I was like, "Well, I gotta find out about this St. Croix Sensory." Which is a lab located... there's actually two locations now. It started in Minnesota, and there is now one in Canada, specifically—

Griffin: The got different smells up there.

Rachel: —Toronto. [laughs]

Griffin: Yeah.

Rachel: Uh, and then I found a New York Times article that really just kind of got the whole thing together. So it got basically the guy behind this St. Croix Sensory. This is an article published January, 2022 by the New York Times, and it's all about Chuck McGinley, who invented that machine, the nose telescope. He calls it the nose ranger.

Griffin: Now, wait a minute. Is that a double barrel nose telescope? Or is he using two of them?

Rachel: I think we're seeing—we're seeing the side more with the dial, whereas in that other picture...

Griffin: Oh, I see. Okay.

Rachel: ... we didn't—you know, we couldn't. But the dial is over here.

Griffin: Now I see it. Okay, cool.

Rachel: Mm-hmm. It's just a different vantage point.

Griffin: How on god's green earth could that machine possibly work?

Rachel: So, there have been machines like that for a while. This of course, the nasal ranger, is the most precise.

Griffin: [singing] Go, go, Nasal Rangers!

Rachel: [laughs]

Griffin: I need the Nasal Ranger to come fuckin' morph my shit.

Rachel: [laughs] Um, olfactometers were invented more than a century ago.

Griffin: That's... okay. I can't believe that this thing exists, let alone has existed for over ten decades.

Rachel: Well, so here's the thing about smells, right? So a smell, you know, it can be just a like, "Oh, hey, this smells like this." Or it can be like a real warning. Like, you know, pollution and different hazards can cause severe effects to, like, your eyes, nose, and throat, you know? And so—

Griffin: Like the dia—like this morning's diaper.

Rachel: Like this morning's diaper. [laughs] Which would be in the offensive category, which we know now. Um, but this guy, Chuck McGinley, got started—it's actually interesting. So, a lot of this falls under the vantage point of, like, environmental protection. And so he got connected to it through the Minnesota Pollution Control Agency. Before that, he was at 3M, and he was involved with the creation of scratch and sniff technology.

Griffin: That's... amazing.

Rachel: He said he had a very small part. He was very quick to say in the interview, "It was not me. I was not the guy. But that's where I came from."

Griffin: Okay. I respect that.

Rachel: Mm-hmm. So he... [laughs] in the interview in the New York Times he talked about moving to the Minnesota Pollution Control Agency, of kind of talking about his experience, and the interviewer for him in this position at the time says "The odor position pays more."

Griffin: That's cool. That's not would I would want to be called.

Rachel: So he was hired as part of the agency's odor inspection team.

Griffin: This feel—this feels like some real blue collar comedy tour—like a bit.

Rachel: [laughs]

Griffin: You know what I mean?

Rachel: Federal odor inspector.

Griffin: Yeah.

Rachel: Mm-hmm.

Griffin: I could see... Lawrence the Cable Gentleman being like...
"[exaggerated southern accent] Yeah, he—he—my wife is a odor inspector,
but not by choice!"

[pause]

Rachel: That's really good, honey.

Griffin: I—that—I tapped into something there.

Rachel: [laughs] Uh-huh? Um... so Chuck and his son, Mike, are in charge
of this lab, St. Croix Sensory. And initially it was all around pollution. Their
clients were largely, like, sewage treatment plants, people who were
concerned basically about putting out smells into the world.

Griffin: Yeah.

Rachel: But now they take on some fun tasks, including testing work for
food and consumer goods as well as recipes for immersive theater troupes
and museums.

Griffin: Cool.

Rachel: So some of the examples... for a local theater production he
created 22 smells, including one to mimic an old woman's apartment.

Griffin: So a real 4DX experience.

Rachel: Mm-hmm, mm-hmm.

Griffin: In live theater.

Rachel: Uh, the other example—when a detergent company wanted to test the smell of freshly laundered towels that had previously been mildew, it couldn't spend six months waiting for towels to mildew. So Mike developed a mold smell.

Griffin: They couldn't wait six mo—how urgent was... this—I mean, I guess you don't just keep mildewy towels in—

Rachel: When you invest resources, are you gonna pay a bunch of people to sit around for six months and wait for a towel to mold?

Griffin: Well, no. I wouldn't have a full-time mildew watcher.

Rachel: [laughs] But these are salaried employees who've got nothing to do.

Griffin: Yeah, that's fair.

Rachel: This one's interesting. A group was hired to... they were trained to categorize and describe smells. So, like what I was telling you. Floral, earthy, whatever. Uh, and then they conducted a test for a cat litter brand. So they worked in a room lined with stainless steel boxes, each with a small hole designed for nasal masks, which is another invention that this McGinley guy made. Uh, and inside the boxes were different litter formations, and a control, which was sand. All freshly deposited with urine and poop.

Griffin: Oh, it's the worst room!

Rachel: That they had sourced from feline-owning friends.

Griffin: I heard about this! It's the worst room!

Rachel: [laughs]

Griffin: The worst room. They were trying to figure out, what's the worst room we could make? And then someone was like, "What if we made a room that was just cat litter that had different pees and poops in it, all over it?" And it won the prize!

Rachel: So these people had to go through and deeply smell.

Griffin: Worst job!

Rachel: Mm-hmm!

Griffin: Worst job, worst room!

Rachel: Yeah. [laughs]

Griffin: I'm glad someone's doing it, I guess.

Rachel: Okay. So, the way the nasal ranger works is it quantifies the perceived odor level as dilutions to threshold. This is determined as the number of dilution needed to make the ambient air odor just detectable. So they start out at kind of the highest level, and then they, like, dial this thing to a point, and then they measure how long that dial is to determine.

Griffin: So it measures the power of the stink.

Rachel: Yes.

Griffin: Interesting. Okay, that kind of makes sense to me. I thought it made it so you could smell far away stinks better. But it sounds like it's more a... measurement of atmospheric non-stink to stink.

Rachel: Yeah. There's a video online, um, and I showed you a still from that video. And the woman is explaining how to use it. And basically she's like, "We come out to the site, and we just smell what we can smell normally. And then we put up the nasal ranger and we start at, like, a 60, and then just dial until we get to where it disappears."

Griffin: That's fascinating.

Rachel: Mm-hmm.

Griffin: Everything you've said today has been fascinating so far.

Rachel: I know!

Griffin: I feel like I knew about some of this just from my brother's inexplicable obsession with fragrance and the fragrance market.

Rachel: So, this was recently featured on Stephen Colbert. Apparently a location, I can't remember where, had enlisted the services of this lab and the nasal ranger 'cause they were trying to detect marijuana fields.

Griffin: Okay.

Rachel: So they were trying to figure out where they were, and they wanted to use the nasal ranger to, like, pinpoint it.

Griffin: That's fascinating. That's fascinating. I could think of about a million more fun ways of using a machine like this.

Rachel: [laughs] Mm-hmm.

Griffin: But I suppose, you know, do with it what you will.

Rachel: Mm-hmm.

Griffin: How do I get my hands on one of these things?

Rachel: Uh, so they're, like, \$3400.

Griffin: That—worth it. Sure.

Rachel: Okay. I mean, you can go to the website and get hooked up.

Griffin: Okay. Well, if you see a transaction in our bank account...

Rachel: [laughs] Uh-huh?

Griffin: For stinkin—stinkonomics incorporated for \$3400, you will know what that is for. And then you'll see me using it. That'll probably be an even

more sort of explicit clue that I've purchased a stinkometer. I forget what it was called. Nasal ranger. Come on.

Rachel: Nasal ranger!

Griffin: Way better things we could call it than a nasal ranger. Stink... st—

Rachel: See, to me it conjures like an Old West kind of, like...

Griffin: Okay.

Rachel: Like a—like a... a lone hero.

Griffin: I mean, the Lone Ranger. You've—

Rachel: Yeah. [through laughter] That's what I'm thinking of.

Griffin: You've just added a word to the—yeah.

Rachel: That's what I'm thinking.

Griffin: Hey, can I steal you away?

Rachel: Yes.

Griffin: Cool.

[ad break]

Griffin: My topic may surprise you. [pause] It's not exactly on brand for me. But what is my brand? Lotta critics are talking—

Rachel: Eating bananas.

Griffin: That was the most hurtful...

Rachel: [laughs] Eating bananas without taking the peel off.

Griffin: That's the most hurtful thing you've ever done to me.

Rachel: Putting Amiibos in your mouth.

Griffin: God! Jeez, Rachel!

Rachel: [laughs]

Griffin: You're holding two daggers. Dripping with my blood.

Rachel: [laughs]

Griffin: You're really, really pleased with yourself right now. I'm—I— anybody else? No way. You saying those things and seeing how delighted? You literally have one hand to your mouth like—

Rachel: I'm trying to think of a third thing.

Griffin: [laughs loudly] That's even worse!

Rachel: [laughs]

Griffin: Holy shit! Butterflies. [muffled laugh]

Rachel: [laughs] That's the third thing now.

Griffin: Butterflies. My three things are eating bananas, eating Nintendo toys... not eating, but just sort of admiring butterflies.

Rachel: Uh-huh.

Griffin: I have a note in my notes talking about how I don't want to eat a butterfly, so we're gonna circle back on—we're gonna hit that point really hard.

Rachel: Okay.

Griffin: Um, I'm not a big bug guy. Sort of in general, but objectively speaking. I think the fact that butterflies exist? Pretty fuckin' bonkers. They're pretty wild when you look at the arc of a butterfly. And I would like to discuss that and break that down.

Rachel: Yeah, I mean, they're so pretty.

Griffin: So pretty! You're just walking around and then all of a sudden there's just, like, a little... a little stained glass monster just, like—just hovering by you?

Rachel: There are a lot of bugs that fly, but most of them are not pretty.

Griffin: Nah. Yeah, right? Like, most... I'm sure all bugs are beautiful in the Lord's eyes. But a lot of them leave a lot of opportunity on the table sort of aesthetically speaking. But butterflies...

Rachel: [laughs]

Griffin: ... are living their best lives every day.

Rachel: I'm just picturing you rating bugs like hot or not.

Griffin: I could do that for sure. I don't know anything about bugs, but I don't know what I like, and I like butterflies. And let me say, a lot of people who love butterflies and talk about how much they love butterflies also hate moths. I am not one of those guys. I think moths are great too. Something they're hairy. That's great for me. A nice—a big, fat, hairy moth? Cute! I love all that.

Rachel: Yeah, and moths have patterns too, you know?

Griffin: Sure.

Rachel: Like, that's exciting.

Griffin: Sure. But today we're gonna mostly be focusing on butterflies. Uh, they've been around for 200 million years or so. We've got fossil data sort of

tracking them back that far. They actually did evolve from moths. They just got... a big glow up, I guess. There's some 18,500 species of butterflies, which is a lot, and they're on every continent except Antarctica, because that would be... that would be a very cold butterfly. Um, they are polymorphic, which means that... I mean, it means that animals within the same sort of subset or species can look dramatically different, can have all of these different sort of markings.

Rachel: Yeah, okay.

Griffin: Leopards and, you know, any other number of, uh, patterned animals like that. Their patterns can be camouflage, or they can be aposematic, which means they look poisonous or otherwise sort of threatening to an animal, which makes you not want to eat it. And on that note, I will say, butterflies are crushing it in that regard. I've never seen a butterfly and been like... yum.

Rachel: What's an insect that you have seen and thought, "Yum"?

Griffin: I mean, I have eaten an insect before. Once, at the Cincinnati zoo on a church trip.

Rachel: Oh! Did you have, like, a grasshopper or something?

Griffin: It was like a—like a tiny little mealworm sort of experience.

Rachel: Whoa!

Griffin: Tiny one. Not like a grub. It wasn't wiggling.

Rachel: Oh.

Griffin: Um... I think I've eaten a cricket, too.

Rachel: Yeah, I've had crickets before.

Griffin: Yeah, it's whatever. Um, they're migratory. Everybody knows that, right? But I didn't understand, and I imagine a lot of people don't either, just

how migratory they are. 'Cause you hear about the monarch butterfly, right? Monarch butterfly, originally native to North America, has ended up in other parts of the world for the past couple hundred years, and folks aren't 100% sure. Either a big wind got a butterfly all the way over to, you know, Europe and Asia and Africa, or, you know, they ended up on a boat, which must've been pretty disorienting for them.

Rachel: That seems more likely.

Griffin: Um, the monarch butterfly, they travel coast to coast. They can travel up to 3000 miles to reach warmer climates before the winter strikes. Um, but the British painted lady butterfly performs a migration that spans 9000 miles round trip, going between tropical Africa and the Arctic circle, and it's a route that takes six whole generations to complete!

Rachel: Whoa!

Griffin: Can you imagine? If we were like, "We're going on a road trip. Our great-great-great-grandchildren will be the—will arrive there."

Rachel: Wow, that's beautiful.

Griffin: That is beautiful.

Rachel: I mean, if you think about the immigrant experience, it is often to provide your children a better life, but I think you assume that you're going to get to see some of that.

Griffin: Yeah. [laughs]

Rachel: [laughs]

Griffin: Yeah. Not the—yeah. But butterfly lifespans range pretty dramatically. They can live up to, like, a year, but most of them live a matter of weeks in their adult stage. And everybody who's read *The Very Hungry Caterpillar* knows all about the... the life cycle, right? I'm not telling you anything you don't know. They lay eggs on a leaf, pop out the egg, they eat until they can't—

Rachel: The eat and eat and eat.

Griffin: —they eat and eat and eat until they cannot move, and then they poop out a little bit of, uh, silk to attach themselves to a leaf or a stick, and then they form a chrysalis, and then they turn into a butterfly.

Rachel: Yeah!

Griffin: That process, I'd like to get a little bit deeper into. 'Cause there's—

Rachel: I would also.

[pause]

Griffin: Yes?

Rachel: [laughs] I would like you to do it, because I don't know that I fully understand it.

Griffin: Oh, okay. I don't think we usually do that on this show where they're like—we just are like...

Rachel: [laughs] "Let me take it from here."

Griffin: "You go now." Um, so, first off, some caterpillars—most caterpillars, obviously, chill. Going around eating a leaf, eating through one big, juicy orange, but they're still hungry, right? Some of them are predators. They eat stuff like ant eggs and larvae, some species of caterpillar. Some caterpillars form a symbiotic relationship with ant colonies where the ants will, like, protect them in their larval form in exchange for the caterpillars collecting honeydew secretions for the ant colonies.

Rachel: Wild!

Griffin: There's one—I can't remember. I think it's a blue butterfly? I for—or blue caterpillar? I forget what it's called. It actually tricks the ants into being like, "Let's form a partnership," and then the ants take the caterpillar

larvae to their nest, and the caterpillar just eats all their eggs and larvae and just has just, like, a real nice sort of buffet sort of situation going for 'em. Which is diabolical. Um, obviously the most interesting thing about butterflies is that they, you know, climb into a little sleeping bag made out of skin and then... essentially dissolve, and then they come out two weeks later completely different.

Most butterflies don't spin cocoons. I'm terrible at, like, keeping the mnemonic device straight of like, between moths and butterflies, which ones to cocoons, which ones do chrysalises.

Rachel: There's a mnemonic device?

Griffin: No.

Rachel: Okay. [laughs]

Griffin: That's what I'm saying. They're should be.

Rachel: Okay.

Griffin: Some butterflies do, you know, spin cocoons around themselves, but most of them just do a chrysalis. Uh, which essentially just means that they molt, like, their skin, and so it literally just sort of a skin bag, and then everything inside of it dissolves into goo, and they just kind of hope that in the two weeks it takes for them to turn into a butterfly no, like, super nasty bird comes and has the worst gusher ever.

That process that takes place inside the chrysalis is called holometabolism. And it's the wildest shit in nature. Caterpillars aren't the only bugs that do this, right? There's actually quite a few insects that if you think about their larval form to their adult form or their imago form, just dramatically different. Unrecognizable, right? Butterflies aren't the only one to get away with it. But, uh, their particular steeze is bonkers. They literally, uh, shed their skin, which they do several times throughout their caterpillar lifestyle, they, uh... what's the word I'm looking for? They molt, right?

Uh, and then while they're sort of inside of their own skin, they digest themselves using the same juices that they use to eat and process food. Okay? And then they turn their body into a bunch of what are called imaginal cells, which sounds very, very frivolous—

Rachel: Yeah!

Griffin: —and, uh, delightful. Uh, imaginal cells are basically cells that can be repurposed into anything, right? They can be—you could have your antennae that you dissolve down that could turn out to be part of a wing, because it turns into this sort of freeform building block cell that can be repurposed in every—

Rachel: How have we not harnessed this technology to, like, cure cancer? Doesn't it seem like we should—

Griffin: *Or* become big butterfly men!

Rachel: [laughs] Okay, or that, yeah. Of course that. Uh-huh.

Griffin: Curing cancer, obviously an important sort of target for humanity.

Rachel: To be able to start as one cell and turn into any kind of cell you want, like...

Griffin: It's wild!

Rachel: Yeah.

Griffin: And for a long time we didn't know, like, sort of how it worked. Uh, and we still don't exactly know. But basically there's, like, a deep genome—like, deeply, deeply embedded inside the caterpillar that once it's just this bag of freeform unassigned cells, they start to cluster together into these, you know, various systems that the genome kind of recognizes and then kind of, you know, takes the wheel from there after it reaches a certain tipping point. That whole time that this holometabolism is happening inside of the chrysalis, the caterpillar's immune system is fighting it.

Rachel: Whoa!

Griffin: The caterpillar's immune system is like, "I don't know what the fuck is going on in here, but this is not a caterpillar. I am 100—I have one job here, and it's to make sure that the caterpillar's a caterpillar. And it feels like something pretty fishy is going on around here."

But then eventually these genome sort of starts to weave these different systems together, and then the butterfly takes over, and... that's all.

Rachel: I have so many more questions now.

Griffin: Yeah, dog.

Rachel: As a result of this segment. Like, how does a caterpillar know when it is supposed to become a butterfly?

Griffin: This is the—well, I mean, it's—I mean, like so many things, it is instinct, right? It's like, embedded in their—

Rachel: "Go on. Better make a skin bag for myself."

Griffin: Well, literally they are driven by appetite to eat and eat and eat and eat and eat and grow, because they have to, or else they'll die.

Rachel: And then does the skin bag just start forming around them? Without even them doing anything?

Griffin: No, 'cause they have to post up, right? They have to find a secluded place.

Rachel: Yeah, but like, when bears hibernate it's, like, cold. Like, I get there's a trigger. Like, what's the trigger?

Griffin: Actually, some butterfly species can actually, uh, do a—do their pupal stage extended over, like, a couple of months to actually pupate during the winter. Not all of them do that, but it is something that they can do.

Rachel: The smart ones do.

Griffin: The smart ones do, right? But I think it's just that they are constantly molting. They're molting—their, you know, larval caterpillar stage has, like, several phases. And they must just reach one where they have gotten so big, literally too big for their britches. Splitting at the seams. And they're like, "Oh shit."

Rachel: It's just wild, now that you've talked about that immune system being like, "Wait. This—you're not supposed to be this." Makes me wonder, well, like, but their biology is driving them to be this.

Griffin: Yeah!

Rachel: There's a lot of big stuff to unpack here.

Griffin: I mean, when you start to think about, like, what is it? The Ship of These—Thesis? Is that what it's called?

Rachel: You're asking the wrong girl.

Griffin: Does a butterfly remember it was a caterpillar?

Rachel: Hmmmm.

Griffin: If it's fuckin' brain got [wheezes] digested and then turned into a butterfly butt, like, is it capable of being like, "Ah, damn. I should hit up Tony. We used to chop it up when we were caterpillar buds."

Rachel: Are they like, "You know, this butterfly form is okay, but I think I actually liked being a caterpillar better."

Griffin: Yeah. I don't know that that wisdom...

Rachel: Can we bring a butterfly into the studio to ask some questions?

Griffin: I'm literally looking, uh, this up, like, as we speak. Uhh... yeah. It's not, like, completely known how much butterflies, if anything, can remember their caterpillar lives. A lot of it is—I mean, some of the sort of instinct stuff. They did a test... let's see. Researchers at Georgetown University actually did a test where they trained caterpillars to dislike the smell of ethyl acetate, and then they...

Rachel: Ohhh.

Griffin: ... sort of trained them to avoid the smell, and then they transformed into... it was actually moths. Uh, and most of them still remembered to stay away from the ethyl acetate smell.

Rachel: That's a fascinating—I seriously thought they were, like, showing themselves, like, pictures. Like, "Remember this guy?" [laughs]

Griffin: "This is your dad. How could you forget?" No. Right? Like, you talk—memory is such an abstract thing.

Rachel: Yeah.

Griffin: Right? That—

Rachel: I'm picturing them, like, putting little mirrors in front of them every day, and then one day they look in the mirror and they're like, "Wait. What?"

Griffin: I don't know. I mean, we get—when you consider this sort of whole process through a human lens, it is horrifying.

Rachel: [laughs]

Griffin: Which I think is maybe part of the reason why we're so fascinated by them? Partially because they look so cool, but also partially because they literally—they break down at this cellular level, and then turn into something completely—it's not like a direct evolutionary process where you're like, "Oh! That antennae just turned into a bigger antennae."

Rachel: Yeah. I mean, that's the thing. Like, humans transform, obviously, through our lifetime. And, like, times like puberty are pretty big, crazy, weird times. But we still look like people at the end of it, you know?

Griffin: Yeah. Ship of Theseus is what I was trying to remember. It's the thing where they... you take a ship, and then you replace it board by board until it's completely new parts. Is it still the same ship?

Rachel: Ohhh.

Griffin: Right? Uh, I don't know. I don't mean to start a sort of existential nose dive with this segment.

Rachel: Yeah, right?

Griffin: I don't get that and I look at butterflies.

Rachel: [laughs]

Griffin: Uh... I—it—but at the same, I don't know. It is kind of hard to avoid, and it is kind of, like, rad. Right? That we have all of these preconceived notions of what it means to exist, and to have form and function, and then butterflies just sort of, uh, aren't as concerned with all of that.

Rachel: Well, and it's always been used as this, like, symbol of, like... you know, kind of like becoming the most beautiful version of yourself, you know?

Griffin: Nah! It's melting! Yes.

Rachel: [laughs]

Griffin: "You're my butterfly sugar baby." Do you know what you're saying right now?! When you say that?

Rachel: [laughs] It's more like when somebody blossoms into a more attractive version of themselves. A lot of times people will say, like, "Oh, the caterpillar became the butterfly." But...

Griffin: But even that's not—it would be like if I... went on a retreat, a solo, monastic, cloistered mission, just me, and then I came back and I was a bicycle.

Rachel: [laughs]

Griffin: My human cells...

Rachel: I'd get nervous 'cause I'd see you eating a lot and I'd be like, "I wonder what's going on with Griffin."

Griffin: "I wonder what's going on." And then I'd be like, "Hey, I gotta go up to a mount—the—the—the Smoky Mountains."

Rachel: Oh man, and you came back a bicycle. And you might not even remember me!

Griffin: No, probably not.

Rachel: That's sad!

Griffin: Unless you start training me now... to be afraid of your smell.

Rachel: [laughs] That's beautiful.

Griffin: Anyway, butterflies are fucking cool. I think, you know, I'm not going around looking at pictures of butterflies all the time. But when I think about how—all of the sort of idiosyncratic ways that they live, it's, uh—it's endlessly fascinating to me. Um, and I was happy to learn more about them.

Rachel: Yeah. That was cool.

Griffin: So that's it for this show. Very science... one.

Rachel: I know.

Griffin: Very science one, this one was.

Rachel: I know. We probably said a lot of wrong things.

Griffin: Oh, for sure! Oh, for sure.

Rachel: Yeah.

Griffin: Um, but they felt right enough to me.

Rachel: Yeah. I mean, you know, and this is like Reading Rainbow. Like, you don't have to take my word for it. Like...

Griffin: Oh, that's good!

Rachel: Like, go look it up. [laughs]

Griffin: [snorts] Uh, thanks to Bo En and Augustus for the use of our theme song, Money Won't Pay. You can find a link to that in the episode description. Thank you to the Maximum Fun network for having us on the network. Uh, wonderful—wonderful bunch of folks there. And, uh... we have a new graphic novel that is out.

Rachel: It's out!

Griffin: This week. It's the, uh, The Adventure Zone: Eleventh Hour graphic novel, the fifth book in the series. It's—if you like Groundhog Day or time loop sort of adventures... what's the Blumhouse—the Happy Death Day I think is one. There's so many of these types of things. This is one of 'em! Except it's wild west.

Rachel: I'm glad that you said that, 'cause I feel like a lot of times you guys refer to the arcs, and for me it doesn't conjure exactly what was happening in the story.

Griffin: Yeah.

Rachel: And so it's helpful for you to be like, "You know, it's the one where they did the same thing over and over again and tried to get different results."

Griffin: But that sounds *bad*... when you say it that way.

Rachel: [laughs] Okay.

Griffin: It's a book where the same thing keeps happening over and over again.

Rachel: No. I like—I mean, that's the kind of sci-fi that I like.

Griffin: Sure.

Rachel: You know? Where it's like, it's not about, like... you know. Crazy monsters with a thousand arms.

Griffin: There are some of those, though. But that's okay. Um, anyway, you can find that at all great booksellers. And, I mean, if you go to mcelroy.family you can find links to just, like, everything, man. Our YouTube channel, for instance. The McElroy Family. We've been doing streams where we play classic Nintendo and Super Nintendo games all together in an online lobby. And that's been a hell of a lot of fun. And you can find a bunch of stuff there, too. That's gonna do it, though, for this episode of Science Corner with Ra—well, we can't say corner. I guess there's four corners in most rooms.

Rachel: Yeah, we're allowed to have multiple corners.

Griffin: We have Poetry Corner. We have Science Corner. I feel like Gaming Corner... maybe I just have my own corner when you sort of have—

Rachel: Just Griffin Stuff?

Griffin: Yeah, where I keep my games and my figurines. All my wonderful, um, you know... [stammering]—I got my big bust of Deadpool, you know?

Rachel: [laughs] We have a lot of corners. I mean, maybe it's just a, you know, it's like a—

Griffin: Octagonal...

Rachel: Yeah, right? Because there's the—there's music, there's nostalgia, there's food...

Griffin: Those don't have to go in the corner. We can scatter those across the floor.

Rachel: Ohh. So what necessitates a corner?

Griffin: Umm... I think it's a place you go when you have to be in a certain headspace for it.

Rachel: Okay. Okay. That's good.

Griffin: When you come to Science Corner, we put on our science hats. And... put away... childish jokes. And... teach.

Rachel: [laughs quietly]

Griffin: Become teachers.

Rachel: [softly] Yeah.

Griffin: That's interesting.

Rachel: The most noble profession.

Griffin: And then when we do Poetry Corner... you kind of do that. But I just kind of sit there and—I'm the pupil. I am in my pupal stage.

Rachel: [laughs]

Griffin: When you read poetry to me...

Rachel: Uh-huh?

Griffin: I turn into a flesh bag, of...

Rachel: [laughs]

Griffin: ... unassigned cells. And—but I come out the other end a beautiful butterfly.

Rachel: Every time?

Griffin: Yeah. It's... really exhausting.

Rachel: Yeah.

Griffin: Goodbye.

[theme music plays]

[chord]

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