

Carnivorous Phytobiology with Hali'a Eastburn

Ologies Podcast

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Oh heeey, it's that omelet that set off your smoke alarm, Alie Ward. And get your calendar ready, May 4, 2022, World Carnivorous Plant Day. Did you know that? I didn't, until I dove headfirst into the watery wonders and the spikey jaws of this episode. Plants that eat... meat. [*softly*] Whaaat?

What makes a carnivorous plant you ask? That's a good question. They have to capture, kill, and digest their prey, and use the absorbed nutrients to grow. I know you're thinking, "Carnivorous plant, got it. Venus flytraps." And what else? So much. There are pitfall traps, like pitcher plants; there are sticky flypaper traps; there's bladder traps, which sound painful, they're like insect vacuums; there's lobster pot traps, that have spikes you can't pass back through if you're a bug. Augh, this is a good one! So, in the northern hemisphere, carnivorous plants tend to flower from May to July, so just get ready for a new obsession to bloom.

But first, I'm obsessed with you. Thank you to everyone at [Patreon.com/Ologies](https://patreon.com/Ologies) for supporting the show since before it was even born. You can join for as little as a dollar a month. And thank you to everyone who leaves a review. I read them all. Like this still steaming one from Kitteywov, who said:

The only podcast I had while living on a cruise ship, 5/5 stars. For the podcast, not the cruise ship, that was like a 2/5.

Thank you Kitteywov, we're glad to have you back.

Okay, Carnivorous Phytobiology, flesh-eating plants. They exist, they're all over the place. And this ologist has been doing really great outreach out of her soggy field. She did an undergrad in Biology, *cum laude*, from University of Florida and is now finishing a master's at Texas Christian University and graduates in May, very, very soon with a thesis titled, "The effects of nutrients and pollen quality on the reproduction of carnivorous plants."

And this ology, this episode, covers so many ologies in one; phytology, conservation ecology, bog-ology, plus the chemistry of digestion, the physics of trap mechanisms. There's symbiosis, there's tricky things, there's tattoos, there's pop-cultural lore, historical gossip, death, and snacks, and survival, and flowers. So, tuck in your bibs, get ready for Carnivorous Phytobiologist, Hali'a Eastburn.

Alie: Oh, hello... Are you there? ... Hello? Can you hear me? ... This is some real fumble gore... Hiii.

Hali'a: Hiiii.

Alie: [*laughs*] We're here!

Hali'a: Hello!

Alie: I mean, it's been months of Twitter back-and-forths. We're like, "Let's get this on the books." And then you know... COVID happened.

Hali'a: The holidays, Omicron.

Alie: The holidays, Omicron.

Hali'a: Injuries.

Alie: A concussion on my part. [*Hali'a laughs*] Nothing like a little head trauma to push back all of your intended times.

Hali'a: Yes. [*laughs*]

Alie: First thing I'm going to have you do, can you say your first and last name and your pronouns?

Hali'a: Yeah, my name is Hali'a Eastburn, my pronouns are she/her.

Alie: Sweet.

Aside: Plants that eat animals; the tables are turned. Let's get right into it.

Alie: Do you have to get in tight with the ento community to be like, "Hey, what's the scoop on bugs, man?"

Hali'a: Yeah, so actually, one of the reasons why I got into carnivorous plants was because I was taking an entomology class through my undergrad. And I'd been growing carnivorous plants as a hobby and just kind of like, "Oh these are cool, they look really fun and, like, they're easy to grow." And then when I took an entomology class I was like, "Okay, woah, woah, woah. Now I have to reassess these plants and look at their relationships." There are so many different things going on, they're eating bugs, they also need bugs to pollinate them. And then there's bugs interacting with them like just, you know, in the environment. So, my education and entomology actually helped enrich my understanding of these plants.

Alie: It's like understanding gardening before you understand cooking, kind of.

Hali'a: Yeah, yeah.

Aside: Only the bugs are the garden, and the cooking is the plants that devour the flesh. Flip flop, everything's upside down.

Alie: Let's get the big question out of the way.

Hali'a: Okay.

Alie: All right. How old were you when you saw *Little Shop of Horrors*? [*"Feed Me" plays... "Feed me Seymour"*] What effect did it have on your life? [*Hali'a laughs*] Or is that the most annoying question that a carnivorous plant biologist could get?

Hali'a: It's a very common one.

Alie: I know! [*Hali'a laughs*] That's why I had to ask it.

Hali'a: I honestly don't know what age I was when I saw it... I was born in '86 so I think it was a little before me. So, I might have seen it when I was really young. And then I think the most recent time I watched it was maybe, like, 5 years ago and I was like, "Oh this is different than I thought this was going to be." [*laughs*] It was, like, total flash to the past though, so it's fun. It's a fun movie.

Alie: Has anyone named any carnivorous plant species Audrey, or Aubrey, or Aubrey II? I forget what it was called.

Hali'a: I'm sure. Right now, there's a million cultivars of Venus flytraps. People breed them for all these different looks and things like that, so I'm sure there's an Audrey cultivar or something.

Aside: Okay so, this aside is meaty and I'm sorry. The rest are shorter. Did I spend two hours looking this up? Of course I did. Maybe three. I'm not in control, it's my brain. But first off, I found out plants that respond to touch are called sensitives; that's the word for them and I love that. The Venus flytrap was first called the Flytrap Sensitive until some naturalist in the mid-1700s was like, "Yo, come on, two halves of a shell, hmm? Kinda dewy, rimmed in hairs, sensitive to ye touch? Hehe" So, these horny botanists named the flytrap after Venus, goddess of love. They were like [*soft, mischievous laugh*]. And if you don't get it yet, the common name for it back then, the 'tipitiwitchet', which was not derived from any indigenous language, as previously assumed, but rather it was just straight up slang for a snatch.

So, let's continue to gossip. The prominent southern Governor, Arthur Dobbs — who first described the flytrap and would send seeds around the country to fellow enthusiasts, including presidents — lapsed on his horticultural duties when he became a newlywed and two fellow botanists talked shit in a letter and are quoted as saying, "It is now in vain to write him for seeds or plants of the tipitiwitchet. He has got one of his own to play with." Ew. The catch? He was 73 and his bride was 15. And even though they are said to have had a loving marriage based on letters they sent each other; I don't like it. I don't like it at all. But Venus flytraps can live to the age of 20, so it is possible that he had plants older than his wife. What is my fucking point? That is a good question.

So, I was looking for cultivars named after Audrey II or after *Little Shop of Horrors* and I stumbled into the open maw of a website called FlyTrapCare.com. And it listed all kinds of tweaks on the species. And there are cultivars named after sunset, after a shell, *en français*, after the B52s, there's one named after the titular alien in the *Alien*, and they also have cultivars named Creeping Death, Polish Dracula, Bart Simpson, Kim Jong-Il, and Buttcheeks. But no Audrey II. But they do have one named Justina Davis and I was like, "Who is that? Probably a jazz singer I'd never heard of." Oh no, Justina Davis was Dobbs' 15-year-old bride. Got it. Get it? Didn't need it. And I'm going to spare you the part where I researched species named after famous people and discovered a pair of researchers who named trilobites after 1980s goth bands. Yes, I emailed them.

Okay, *Little Shop of Horrors*, getting back to it. It's a movie made the same year Hali'a was born, but it's based on a 1960 dark comedy by Roger Corman. But the idea was maybe poached from a sci-fi story about a man-eating flower, which was itself inspired by another short story about an orchid collector who becomes a victim of his own hobby. But the 1986 film was a cultivar, of a cultivar, of a cultivar, of another idea. So, there you go. Speaking of history...

Alie: Did you start as a hobby and then did you decide, "Fuck, why not get a master's in this? [*Hali'a laughs*] I love this, there's got to be more people studying this." What came first?

Hali'a: Yeah so, I grew up gardening and around plants and all of that. And I moved down to San Diego, and I started dating someone and they were actually growing carnivorous plants, so they introduced me to the hobby. So, we started collecting these plants together and we helped actually found San Diego Carnivorous Plant Society, that's still around today. And so we, kind of, gathered this community together with all these other really cool plant folks down there and we started having meetings and did a show and sale once a year... I did it for three or four years.

Then I graduated, got into working with insects for a while, then I worked with trees for a while, and this whole time after I graduated with my undergrad, I was thinking about

getting a master's, I just didn't know what I wanted to spend so much time studying; I was just kind of like dabbling around, looking for advisors. And then I stumbled upon this posting, and it's this advisor who I'm now working with, asking for someone to come work on carnivorous plants and I was like, "Oh my gosh!" I didn't realize that there were labs that were still working on this. I knew a few people that had been working on carnivorous plants, but they were like, way across the country or places that were really cold and I didn't want to live there. And I was like, "I can do Texas, this is cool." [Alie laughs]

So, kind of on a whim, I applied. The deadline was actually like, the next day, so I was like, "Oh shit, I'm just gonna put this in," applied right away and within a few months, I interviewed with the advisor, we clicked, and then, you know, later that year I was living here in Texas. So, it was kind of a crazy whirlwind; didn't intend really to study carnivorous plants. But again, my curiosity for them has been a very long, long relationship. I guess it makes sense that I am now studying them.

Alie: I feel like most... some people only have exposure to them as cultivars and as hobbies and gardening. I don't even know where carnivorous plants exist because I'm in California. What kind of habitats do they prefer?

Hali'a: So, carnivorous plants are incredibly diverse and I think that's something people often miss because they automatically go to Venus flytraps, but there's tons of diversity within carnivorous plants and they're found on every continent except for Antarctica. [*"Too cold, far too cold."*] You can find them in a lot of places. Where you're going to find them though, is where there's a lot of water, where it's water-logged, where there's a lot of light, and not a lot of nutrients. And that's the reason why they developed or evolved carnivorous traits.

And so, in California we actually have a native species. It's a native species of pitcher plant and it's up north near the border with Oregon in these, kind of like, rocky, serpentine ravines, where water is just kind of rushing down. It's these rivers below and there's constantly water moving through the ground and watering these plants. There's not a lot of trees out there and the soil itself doesn't have a ton of nutrients. It's got volcanic origins so there's not a lot of nutrients there and there's carnivorous plants everywhere. That's where you'd find them in California.

The rest of the United States, there's bogs and swamps that have carnivorous plants, all over the South and up the eastern seaboard into Canada actually, you can find pitcher plants. There are tropical pitcher plants that live in trees on tops of mountains. They're everywhere, they're so diverse.

Alie: I would think in bogs and stuff, there would be tons of nitrogen and things rotting. So, what do plants need to thrive? They obviously need water, they need sunlight, they need carbon dioxide. But what is in Miracle-Gro? And what is in fertilizer? What are the other things that plants need and why they are out there absolutely slaughtering bugs?

Hali'a: Yeah so, carnivorous plants are really different from other plants wherein they need nitrogen, phosphorous, and carbon to build all the structures, reproduce, do all the things that plants do. In bog environments, the soil is so water-logged and anoxic, there's no oxygen, so it actually slows down decomposition of all of the plant matter that's making up that bog. So, those nutrients are there but they're not readily available for plants, so it actually is a nutrient-poor situation. And so, these particular plants in these places have developed all of these different mechanisms to find other sources of nitrogen because they still need it. They still need phosphorous, they still need nitrogen, they're getting carbon

from photosynthesis because they still photosynthesize, but everything else they have to get through insect capture.

Alie: Dude. Also, somehow the scariest plants out there. For some reason, carnivorous plants are so mysterious and so like, “Wait a second. A plant fucking kills bugs? What else can it do??” Was that part of your lure to them? Is like, “Wait, this plant is ento-cidal.” Was that part of why you love them?

Hali’a: Yeah, I think that was part of it. I was just interested in how they even got insects near them. What are they doing to draw these insects in? Because at the store, you’ll often see... they’re called octopus plants or something and they have the sticky tendrils. And I had a few of those for a while, and you set them out near a sunny window, and the next day they’re, like, black with bugs. [*Alie gasps*] And you’re like, “How? How did that happen? What are they doing?” So, a lot of my curiosity around these plants is how are they doing what they’re doing.

They have all these really cool lures that they use. Some of them move; some of them don’t. They use, like, UV attractants to bring in insects. And these mechanisms are different depending on if they want pollinators or prey because they still need to be pollinated, they need to reproduce. And so, it’s really fun to see the differences between those two things and how these plants have had to partition their strategies.

Alie: So, they need some bugs to help carry their pollen, they need others to die so that they can break them down and take their nitrogen and phosphorous. Do they ever get a BOGO? Do they ever do a two-for-one on that?

Hali’a: Oooh... That is really rare. Because most carnivorous plants will set their flowers really, really far away from their traps. So, it’s either really, really high above their traps... Tropical pitcher plants have these long spikes that take the flowers, like, a good few feet away from the actual pitchers themselves. Even Venus flytraps, they set their flowers really high above their traps. So, anything that’s cruising through the bog is just going to hit the flower and keep bouncing along, it’s really not going to stick around and go lower to find anything. So, that’s one of their strategies. And also, they offset the timing of when they put the flowers up and when they open up their traps.

So, a lot of pitcher plants, a lot of carnivorous plants have a down-season, they take a break. So, in winter, they kind of go into dormancy, they stop producing active traps. And before they produce their next crop of pitcher plants, or flytraps in the spring, they’ll pop up their flowers. [*“Timing is everything.”*] So, they get all the pollination done and by the time those flowers are pollinated, then their traps start coming up and start opening up and becoming active so they can catch their food for the rest of the season. And that’s what they spend the rest of the season doing, just filling up on food, kind of like bears, I guess; [*Alie laughs*] filling up on food, store a bunch of it for the next season to get them through the winter, use some of it for that season to get beefy and grow a bunch, and then they go back to sleep again all winter.

Aside: For more on this, you can see the two-part Ursinology episode on bears. Plus, there’s a Carnivore Ecology episode with Dr. Rae Wynn-Grant. But yes, let bog death plants be your inspiration. You deserve a snack *and* a break.

Hali’a: So, a huge problem with carnivorous plant ecology and their conservation, and even like, people knowing about them, is the fact that their habitats have been significantly reduced

or degraded. The amount of wetland habitat that we would have normally found these plants in has been reduced by, like, 85% worldwide.

Aside: 85% of habitat is gone. And the reason that I, as a Californian, am shockingly ignorant about carnivorous plants is because the entire central valley of California, used to be boggy as all get out. In the pre-Gold Rush 1850s, there were 4 million acres of bogs and wetlands in California, which are now drained and are home to almond orchards and alfalfa fields. The Venus flytrap is endemic to a really small area of North and South Carolina but only 3% of its natural habitat remains. And biologists report that the local pine savannas have been swapped out for golf courses and parking lots which, yes, is depressing. But people like Hali'a are on the job.

Hali'a: So, worldwide we've gotten rid of all of these wetland environments where these plants have to live, this is the only place they can live. And as that's happened, as we've reduced them in size and quality, they've kind of turned into these fragments, these islands. And we're not quite sure how they are spreading around their genetics, if they are at all. Because we need the genetic diversity, long term, to keep these populations healthy and thriving.

My project is looking at this one particular island of plants here in east Texas, where the populations have been reduced significantly. And the nearest *Sarracenia* bog to mine is about 10 to 15 miles away. And these plants are only pollinated by bumblebees; they're the sole pollinator as far as we know. [*"I just want to tell you both: good luck, we're all counting on you."*] And bumblebees only forage about one, maybe two, miles in their whole day. So, it's likely that bumblebees that are pollinating our bog aren't bringing in any pollen from any other bogs. So essentially, all the flowers within our bog are pollinating each other.

So, by looking at the impacts of distance between pollen donor and pollen recipient, we can maybe get an idea of how big these bogs need to stay if we're going to conserve them. Or if we're going to restore them or recreate them in any sort of natural habitat, how big do these need to be? How much genetic diversity do we need for these bogs to be self-sustaining? They don't need to be, maybe, the huge sprawling bogs that we had hundreds of years ago; we just need to have pockets of them. What are the qualities of these pockets? How close do they need to be to the next bog?

Aside: So, if there aren't any nearby bogs, chances are that the bumblebees visiting the bog's flowers come from that bog, which means less genetic diversity. And she's also studying how the level of nutrients a plant has affects their offspring from a genetics level. Because that can slip scientists some extra intel on what's happening in the local bogcore scene.

Alie: Are you ever tempted to brand yourself as like, "I'm a bog bitch." [*Hali'a laughs*] If I spent most of my day in bogs, looking for carnivorous plants, that would feature heavily in my personal brand.

Hali'a: [*still laughing*] I never thought about "Bog Bitch" but I love that. Maybe if I spent more time in bogs, but I spent like all of last spring and summer, but I don't live near any bogs. I'm from California and that's where I plan to go back to after I graduate; we don't really have bogs around California.

Alie: That's a good point.

Hali'a: So, it's not really my native habitat. [*Alie laughs*] I'm more of a forest, mountain girl but man, I love a good bog, I like a good bog slog. [*Alie laughs*] And so, it's not something...

Alie: There's someone out there.

Hali'a: I know.

Alie: I want to see who is out there using the hashtag #bogbitch and I am going to track them down and we're going to see what their — I want to see what their personal branding is like.

Aside: Just a head's up, look up the hashtag #bogbitch on Instagram and it will lead you to... @haliapedia. Yes! She did it. So, enjoy pictures of her bog tromping past flutes of pitcher plants and doing microscopy on sticky little trickers. Speaking of variety...

Alie: Can you walk me through some of the types of carnivorous plants? Because I feel like we mostly hear about Venus flytraps but what are, like, pitcher plants and fly paper? What do they look like?

Hali'a: Okay. So, let's start with pitcher plants because those are the ones I'm working with. So, pitcher plants, they have these big rhizome structures, for one... I know a lot of people wonder if they have roots and flowers and things. Yeah, they're definitely like other plants. Except their leaves have evolved to turn into, like, little tubes and at the top of a tube is a lid, and the lid doesn't close, everyone thinks the lid closes on these but they don't. But around the lid and the lip of the tube there's all of this nectar; there's actually lines of nectar that extend up the tube to the mouth of the pitcher and these serve as guides for insect prey that are going to come into the lip of the tube, it's kind of slippery and slick there, there's a bunch of yummy nectar and stuff like that, and they're going to slip inside and fall into the bottom of the tube. [*clip from Alice in Wonderland: "Wow, after this I shall thinking nothing of falling downstairs."*]

Aside: So, what is at the bottom of that slippery trap tube? Nothing but death and microbes. It's delicious.

Hali'a: At the bottom of the tube in *Sarracenia*, most *Sarracenia*, it's just a lot of fungus, bacteria, and other insects actually collecting there, and they actually help digest all of the food; they break it down and then the plant absorbs what it needs through its tissues of the pitcher. So, those are *Sarracenia*, those are the ones you're going to find, here in Texas, Mississippi, Alabama, Louisiana, Georgia, Florida. They are beautiful, tall, gorgeous pitchers, they can be up to three or four feet tall, and they come in all different colors: red, white, yellow, pinks, purples. They're gorgeous. They're easy to grow too; they're similar to roses where you can just, like, breed them together and get all these really beautiful, colorful plants and they grow fairly fast. Within a couple years you can have them flowering and then the pitchers themselves are so showy.

So, those are *Sarracenia*. There are some species of *Sarracenia* up in the eastern seaboard and up into Canada, *Sarracenia purpurea*. They make a liquid at the bottom of their pitchers. They're kind of short, little tubby pitchers and they're filled with water, and they often get flooded and so they will eat a lot of stuff that, like little larvae, or little frogs that live in them. [*Alie gasps*] They eat larvae sometimes.

Alie: Whaaat?

Hali'a: Yeah. They fill with water and enzymes that help them break down their food. So, those are a little different from Texas *Sarracenia*, but those North American pitcher plants.

Alie: Woah, is the frog in there for a while taking a dip and then it's like, "Holy shit! My skin's falling off!"? Or is it immediate toxicity, where the frog is like, "I'm so thirsty," and then, "I'm dinner."?

Hali'a: Yeah, I'm not sure. I've seen some dead frogs in pitchers, and I've seen frogs living in pitchers.

Aside: Okay, I looked this up and yes, some froggos fall to their watery deaths but others treat *Sarracenia* plants just like a *pied à terre*, or like a West Village apartment paid for by a lover. I mean, just listen to Jacob on the YouTube channel for *Sarracenia* Northwest:

[clip from YouTube] Frogs and pitcher plants actually have a beneficial relationship. Frogs will use a plant's pitcher for shelter. They will hang out along the inside of the pitcher, trying to keep cool during summer. Their feet have natural adhesive or suction cups that help them maneuver in and out of the pitchers, so really, they're not at all prey for pitcher plants.

So, it depends on the species, but if you see a dead one, something went wrong for the frog. But if you spot a live one, don't call 911; it knows what it's doing and loves it.

And what are these love nests called? Scientifically speaking? Phytotelmata, and that means 'plant pond' and it's any body of liquid contained within a plant; from pitcher plants to a watery hollow of a tree that serves as a nightclub for micro-critters.

Alie: Is the water getting there from rainfall? Or is it taking in water from the roots and then reallocating it to its pitcher?

Hali'a: So, they make their own fluids. You can add fluids in – like sometimes I've been transporting plants and it spills out – with a little bit of distilled water, but then they add their own stuff into it. That's part of what they do.

Alie: Wow.

Hali'a: Yeah, it's like their little soup, their little digestive soup. It's really cool. *[Alie laughs]* Yeah, so the North American ones. Venus flytraps are found within a 90-square-mile area in North Carolina; that's the only place in the whole world you can find them. And they're incredibly endangered for that reason because people are pulling them out of the ground for some reason when you can just buy them at Home Depot. So, that's where Venus flytraps are from. They're from here.

We also have a bunch of sticky trap species. They're called sundews and those are so numerous. We have some species here; you can usually find them with the other carnivorous plants. Where you're going to find *Sarracenia*, you're probably going to find sundews. And you're probably going to find another family called bladderworts. They are fully aquatic carnivorous plants, and they have these underwater traps which are super cool.

Alie: How does that work?

Hali'a: Yeah, so they're like these little pods and they have trigger hairs at the front of their mouths. And a little micro-organism, a little invertebrate in the water, will swim by, hit a hair, and it triggers the opening of the pod, and the pod creates a little vacuum, sucks it in, and closes. And recent research done, I think, at CSU Fresno, showed that the velocity of the water getting sucked into these traps is, like, 5,000 Gs. *[Alie gasps]* It's ridiculously fast, it's

the fastest moving “predator” on the planet. It’s 100 times faster than the Venus flytrap even. So, these are pretty effective little hunters, yeah.

Alie: Oh my god!

Aside: Okay so, pop quiz. What are the fastest hunters on the planet? Cheetahs? No. Lions? No. Raptors? Nope. Bladderworts. Swamp plants. Augh, we love an underdog! But you can call them, with respect, *Utricularia*, and they look like swamp seaweed with little capsules along the bottom of their tendrily, viney, branches. And I looked up the specific physics on this, and dinner gets suctioned in at a rate of 0 to 60 miles per hour in one millisecond. That is almost 2,000 times faster than the world’s fastest car. Swamp goblins!

And via a 2011 paper called, “Ultra-fast underwater suction traps,” “Little delicious wetland crustaceans get sucked into the space of the bladderwort death pockets with 100 times the Gs that a fighter pilot experiences.” Around 600 Gs. I myself have taken 5 Gs in a military centrifuge for a science shoot and I thought I was dying. I was like, “Shoulda had a will before this.” So, I’m sorry crustaceans, because that is 100 times worse and also you do die, and you do not have a legal will.

But I looked up the work of the team at CSU Fresno that Hali’a mentioned, and I came across the 2021 paper, “Complexity and diversity of motion amplification and control strategies in motile carnivorous plant traps” which explained that plants have stiff cell walls so they can’t use proteins to contract themselves like animals do with muscles. Rather, most plant movement comes from changes of hydrostatic pressure, which is called turgor, and that’s activated through these really energetically costly water displacements from another part of a plant. So, hydraulics, to use elastic energy, just when it’s needed.

And in reading this paper, on Saturday afternoon, I also noticed that two of the authors on it were named Ulrike. Ulrike Müller and Ulrike Bauer. Is that right? That’s got to be wrong. Or that must be weird, for them. I’ll email them and ask them if it’s weird for them. And then later that day, I was delighted to find a note in my box from Dr. Müller, who wrote:

Hi Alie Ward, happy to share. Nope, not a typo, there really are two Ulrikes, and by fluke we both do biomechanics of carnivorous plants. And aside from Ulrike Bauer, I know of only one other Ulrike personally in my entire 56 years of life. Ulrike is a really rare name, so it does warp people’s minds that we are really two people, and it creates a lot of confusion.

But Dr. Müller says that she always knew of Dr. Bauer’s work, and they finally met at a symposium, and they’ve been working together ever since. So, when in doubt, hunt down a good story.

Alie: When it comes to how you describe them, do scientists say that they are hunting? That they’re predators? When does the nomenclature work for plants?

Hali’a: Yeah, I mean, in an academic sense, I don’t anthropomorphize plants because I don’t know what they’re thinking. We definitely know that they feel pain; we’ve anesthetized plants and been able to remove parts of them without any pain signals or pain reactions. And so, they do respond in that way.

Alie: Oh my god.

Hali’a: But I don’t know what they’re thinking as far as, “I’m gonna get that little bug flying around.” Or, you know, “Where’s that fat little bee, I need him around for the season.” So, I

don't attribute too much human behavior to them, but I don't know, sometimes it feels like it.

Alie: Does that freak you out ever? To think, like, if you anesthetize a plant, it won't react the same way. Does that ever mess with your whole... like, thoughts about the universe?

Hali'a: I think every time I remember that I know that... Because I don't know, I have a lot of shit in my brain around plants. And so, every once in a while, I'll re-read my notes and I'm like, "Ohh." And then I kind of feel bad about, like, eating salad or something. Like, does this hurt them? *[laughs]* Maybe stepping on this grass? I don't know! *[laughs]*

Alie: Wow, that's amazing. What do you know about how they are, let's say, hunting or predating? Are they ever using certain scents or signals to advertise, "Come over here, come over here, I'm gonna eat you."?

Hali'a: Yes, they are. That's primarily how they're luring insects in. So, they produce what are called volatiles, which are just different aromas from all of their tissues. It really differs across all the different species, and there's over 800 species of carnivorous plants, so they're kind of doing it a little different. But a lot of the aromas that they exude, some of the pitchers are sweet, kind of earthy smells. At the beginning of the season, the nectars are really sweet because they're luring in insects that are looking for food; for carbs, for amino acids, and proteins are really high-quality foods for insects as well. So, they have their nectaries that line the pitchers, those are putting off a smell, the pitchers themselves are putting off a smell. So, those are bringing in the first insects of the season, when all the bugs are out, they're the first to fall in.

And then, as they've filled up on food... This is kind of gross. As they fill up on food, they kind of stop exuding their own chemicals and they kind of, like, let the smell of the decay from everything dying in them bring in other kinds of animals. So like, "If you're into eating decaying flesh, this is for you. Come on over."

Aside: So yes, they have a rim of delicious sugary sweet at the start of the season and then toward the end, it becomes the odor of death. Kind of like a restaurant that has a great waffle brunch but then at night turns into a goth fetish club.

Alie: What are some of the weirdest things that they eat? Can you run me through some menu items that we'd be... I mean, no pun intended, but boggled to hear about. *[Hali'a laughs]*

Hali'a: So, their main prey are going to be, like, ants and houseflies. The sticky ones love to get all those fruit flies, those are great. Any kind of flypaper carnivorous plant is good for those little, tiny fruit flies, but they'll also eat moths and... Typically grasshoppers can chew their way out so that's not really good food. Beetles will find their way in there. They're very opportunistic, so it's kind of whatever falls in, they'll eat.

In the tropics, the pitcher plants there grow up trees, they trellis up trees, and they have these big pitchers that hang off of them like pots. And those fill with fluid and a lot of things will come check them out. I've heard stories of birds getting stuck in there, little baby mice, little, small mammals, lizards. Like, literally anything that can fit in a trap, it can get digested by that plant. *[laughs]* *["I ate the bones."]*

Alie: Do they eat the bones?

Hali'a: Not that— I don't know if they have the enzymes to digest bone, but they do have enzymes to digest chitin, which is what insects are made out of. But nothing for bone as far as we know. Maybe we'll find something.

Aside: All right, I looked into this for us, and I came across a *Pop Science* article titled, “What’s the biggest thing a carnivorous plant will eat? And should we humans be worried?” Should humans be worried about carnivorous plants eating us?? In the middle of a global pandemic?? With ice shelves splintering into our boiling, acidified oceans? And then I saw that the article was published in 2008, before yet another escalating war between superpowers and predating the rise and the fall of pink pussyhat culture, and the return of baggy jeans.

Anyway, this 2008 article, led me to the work of Dr. Alastair S. Robinson, who sounds dead, but he’s a young guy studying pitcher plants who named one after Sir David Attenborough. In a video, he talked about finding a rodent corpse inside a pitcher plant at the top of a remote mountain in the Philippines.

[clip of Dr. Robinson] Now, we were here approximately one month ago, and the shrew was intact, recently killed. And now, all that is left is bones and some of the fur, which just goes to show how quickly digestion is taking place within the pitchers of this marvelous species.

But it doesn’t seem to be a common occurrence. And also, yes, David Attenborough got a pitcher plant named after him; Obama has a bunch of species; Carmen Electra got a fly; Lady Gaga has a few including a pretty cool aquatic mite; Greta Thunberg is a popular species honor recipient; Beyoncé has a horsefly with a golden butt named after her; and Stephen Colbert begged on TV for someone to name some stuff after him and scientists were like, “Sure, man.” Also, I told you earlier I would spare you this research, and what I did was I lied.

Hali’a: But the cool thing about that is when the tropical pitcher plants called *Nepenthes*, when prey falls in, whether it’s an insect or whether it’s a tree shrew finding its way and defecating inside the pitcher, when anything enters the pitcher, there’s mRNA in pitcher tissues that gets upregulated, and it starts producing enzymes based on whatever it senses. So, whether it’s chitin, or certain proteins, or even ammonium, which is found in some insects, it’ll start producing enzymes to, like, custom break it down. So it could change, depending on what it is. So, there’s a lot of flexibility in these plants. We really don’t know a lot about that stuff unless you’re watching your area of study.

Alie: Are there debates about the intelligence of plants? If they are sensing something and then reacting a certain way, when do you say that is intelligence?

Hali’a: That’s a really good question. *[laughs]* Yeah, I mean, I guess it’s all kind of how you want to define intelligence. They’re definitely aware of their environment, they’re definitely aware of the other plants that are around them, the other organisms that they’re interacting with. So, if you want to label that intelligence it’s... I don’t know, I guess you could do that. It’s not really something that I ponder too often myself. But yeah.

Alie: Someone’s out there thinking about it. I’m sure in the future we’re going to think, “Isn’t it crazy that we used to debate and wonder if plants were intelligent? And now we’re like, ‘Wow, we were such fucking assholes to plants.’” They’re like, “Of course we are, have you seen us?!”

Aside: Also worth noting, there is a field emerging called Plant Cognition and one of the leading researchers in this Dr. Monica Gagliano defines it as, “The cognitive abilities of plants, including perception, learning processes, memory, and consciousness. The emerging framework holds considerable implications for the way that we perceive plants

as it redefines the traditionally-held boundary between animals and plants.” [*jagged inhale*] Like, straight up, salads are trauma, and I don’t know what to do with that information. So, how about we change the subject? Great.

Alie: What about pooping? Do they ever poop or fart?

Hali’a: [*laughs*] Yeah. I remember the first time I got this question. It was like a 5-year-old, I was out doing a school presentation at this kindergarten. This little girl, super cute little girl, she’s like, “So, these eat bugs?” I’m like, “Yeah.” She was like, “So, do they poop?” And I’m like, “Ha-ha— Oh wait, that’s actually a really good question. [*both laugh*] Let me get back to you, I’ve got to think about that.” It’s one of my favorite questions because it’s hilarious.

So, they don’t poop in the way that we think of poop. Usually, what you’re going to find, and again, this is based on the type of plant, their capturing mechanisms and anything like that, if there’s digestive enzymes available, that’ll change what comes out. But a lot of— Like, for pitcher plants, the pitcher plants that I work with, all of the bug stuff just stays in the old pitcher and it just decomposes slowly. So, they break it down as much as they can, they derive whatever nutrients they can, and then the husks of the bugs just kind of sit in there and more insects come and eat whatever they can, and it just becomes a kind of communal compost, which is good, I guess; feed the rest of the community.

Other plants, if you get the flytrap plants, any of the butterworts — which are kind of like, little succulent-looking rosette plants that are sticky on top — when the fly sticks to them, they’ll just stay there, like their little husk will stay and the plant has absorbed the gooeyness I guess, like any of those nutrients, and the rest just stays there. And then those leaves will die, so they just kind of just leave them hanging out most of the time... Which is a little dark, I guess, when you think about it. [*laughs*] I never really thought about it that way.

Alie: Yeah! As goth as gardening gets, you know? [*Hali’a laughs*]

Hali’a: It’s been so normalized to me. I’m like, “Oh no, I guess it’s little skeletons hanging out, that’s weird.” [*Alie laughs*] Yeah, so sometimes they just kind of leave it there.

Alie: Can I ask you some listener questions?

Hali’a: Sure, yeah.

Aside: But before your questions, let’s scatter some money into the wind and blow it toward a cause of the ologist’s choosing and Hali’a selected two actually, great ones. The North American Sarracenia Conservancy, NASarracenia.org which is dedicated to preserving the natural habitats and genetic diversity of the genus *Sarracenia* — those are pitcher plants — through protection, conservation, propagation, and restoration efforts.

And Kauluakalana.org, which works with native Hawaiian scientists and community members to restore traditional fishponds on O’ahu. Projects like this show that Indigenous traditional knowledge provides relevant and effective tools to combat issues related to climate change, food scarcity, and habitat degradation. So, those are two great causes, and donations are made to them thanks to you for listening, and thanks to sponsors of the show.

[*Ad break*]

Okay, let’s digest your questions. A lot of you, including Slayer, Gustavo Discoteca, Becks Woodruff, Jesse Hurlburt, Diana Staresinic-Deane, Jason Krause, Rochelle Williams,

Annalise De Young, Quinn Newman, Michele Mandula, Alia Myers, Ben W., and Schmitt Thompson all asked if carnivorous plants eat people. Early of Greymalkin was like, “If you boop it... Will you lose a finger?” And Sarah Stallan wrote in, “Do I need to be afraid? Very afraid?”

Alie: Okay, Amanda Spinosa wants to know: Could carnivorous plants theoretically digest very small amounts of human meat?

Hali’a: Yeah, yeah. They eat small mammals so they could probably digest some of your finger or something.

Alie: Well, it’s funny you should ask that because first-time question-asker, Ayla Macko says: If one were to dangle a pinky finger into a pitcher plant for a few days to a week would it start to digest said finger? *[laughs]*

Hali’a: I don’t know. I mean, if you could actually do that for a week, yeah it would probably start working on some enzymes for that. Yeah, I could see that happening. I’m not sure how long it’s going to take, it takes a while though. So, it would be, like, maybe two weeks. It would be better if you just chop your little fingertip in, that would be more effective. *[both laugh]* *“And I put my hand in the slicer, and it got caught because wasn’t paying attention.”*

Alie: Next time you have a kitchen accident, just do yourself a favor, drop it into a pitcher plant, see what happens.

Hali’a: Yeah, you don’t need it.

Aside: Would you like more details on this? Okay, so Barry Rice, the Conservation Director for the International Carnivorous Plant Society and the author of, *Growing Carnivorous Plants*, notes that digesting a mammal takes a while and it could rot the plant. But Dr. Rice answered when opportunity knocked, in the form of a bad case of Athlete’s foot he got from his karate dojo and he writes on his website that he got treatment, but during his foot’s flaky healing period he wrote, “If skin were peeling off my feet like shingles from an old barn in a hurricane, ever-enterprising, I figured, hey, why waste all these skin hunks?” Hunks! Oh, Dr. Barry Rice.

So naturally, he fed some of his own foot jerky to some lobes of Venus flytrap alongside an earwig appetizer for some movement and pizzaz, and a week later when the lobes yawned open, he discovered yes, the plant ate his dried foot. I will put a link to the photo documentation from his website. I’ll link that on my website. You don’t have to click it, okay? You don’t *have* to click it. You might want to, but you don’t have to.

Also, once I did one of those baby foot peels in the early pandemic when I was like, “No one’s gonna see me for a while.” And it is truly revolting. And my dog ate a foot flake of mine, and my first thought was like, “Mmm she’s made out of me now, gross. I love it.” Also, Mark Ehr, you can tell your lovely wife now that it would take a lot of dedication and coaxing and foot issues to even have a carnivorous plant attempt to digest a small bit of you. So, fear not, do not fear these swampy beauties.

And just like our own simmering guts, some meat plants rely on a partnership with microbes to help digest their victims. But could you digest a digesting plant? Rebecca Schon Kilde, first-time question-asker Lori, and Tom Astle, Alyssa Williams-Pierce and Jodi Pierce all had questions about pitcher plants and what’s going on with that liquid?

Alie: Hunter Momberger, first-time question-asker also, asked: Are there any practical applications for the slurry inside a pitcher plant? Can you drink that?

Hali'a: Yeah, so there are some medicines that have been derived from contents of the pitchers, and the plants themselves. They have a lot of antifungal, antimicrobial properties. I've heard that there's visionist traditions in tropical regions of using the fluid for, like, different maladies like stomach upset or eye infections. Yeah, there are some medicinal properties in these plants.

Aside: Okay, I looked into this a little, and Indigenous uses of pitcher plants include everything from using the leaf as a vessel and the roots to treat smallpox and lung illnesses. The leaves were used as a tea to treat fevers, kidney issues, and during childbirth. And there was a small 2012 study that seemed to suggest that *Sarracenia* extract could inhibit viral replication and potentially be active against pox viruses and Epstein-Barr. However, Sarah L, those claims about Venus flytraps curing cancer... Nnhh, jury is still out on that research. But Bingus, AKA Sarah Payne, and first-time question-asker, Darold Wallick, who wondered about medicinal breakthroughs, perhaps one day in the future they'll do more research and carnivorous plants will be our new heroes. But should you be considering them people... we wonder?

Alie: Jess P, who is also a first-time question-asker wanted to know about Venus flytraps and said: Why do we ascribe personalities to Venus flytraps? Is it because they seem animal-like because they have reflexes and chompers?

I wanted to ask about those reflexes, what causes them to close. And Jess asked also: Did I kill my Venus flytrap by sticking a chopstick on its little feelers to trick it into closing? And as someone, myself, who has killed a Venus flytrap by making it perform too much, like a dance mom, how is it closing and how damaging is that?

Hali'a: Don't worry, I've killed a bunch myself. So, in the mouth of a Venus flytrap, you'll see that there's two little hairs on each side of the leaf. They're trigger hairs. And usually, when these plants are grown, they're just kind of like laying out with their mouths open in the nice sun, and they're luring in bugs with their smells and stuff. And the point of these trigger hairs is that when a bug comes by, it'll hit a hair. But it needs to hit a second hair within... 10 seconds, I believe.

Alie: Oh wow.

Hali'a: Yeah, there's an actual number. It's like 10 to 20 seconds, it has to hit the other hair, and then it'll start closing. That's how it avoids closing on accident and wasting energy. Because every time it closes, there's an electrical impulse that actually snaps the leaves together. So, it does require energy for it to move, and quite a bit. And each leaf can open and close three to five times before it's going to die. It can actually do that, and it does that normally, so it's not your fault if you're doing that for fun. [*Alie laughs*] It can eat three to five meals, essentially. It can eat that many times and then that leaf has done its job and it's going to put up new traps and it'll just keep going.

Alie: So, that's kind of part of a normal life cycle?

Hali'a: Yeah, so the reason why you don't want to trigger them without feeding them is because they're not getting any energy back from closing; you're taking all their energy to keep going. It's not horrible if you trigger them once or twice, but give them a treat or something the third time. They like flies, they like grasshoppers, stuff like that. Yeah, so each leaf will eventually die. It's supposed to, they are just leaves. This is the leaf aspect of the plant itself. And leaves have a shorter lifespan and they put out new ones throughout the season. That's pretty normal for most plants.

Aside: So, to patrons Flozz Neave, Alice Rubin, Jamie Kishimoto, CJ Luck, Niki, AKA Dr. Headbutt, who asked: Is it unethical to poke a Venus flytrap to make it close? Just pay it for the performance. And if a leaf dies, that's okay.

Now, what if you have, or are interested in adopting a carnivorous plant? Like patrons Dana Hiett, Addie Capello, Ashley Oki, Hannah Lefler, Ellen Kainer, Danielle Edgar, Nina Eve Z, Becks Woodruff, Jenn 'squirrel' Alvarez, Alicia Henning, Anika's Cat Arya, they ask: Do they make good pets? And Jessica Randolph notes: I've seen them at stores, and I'm tempted, but I don't want to encourage a bad industry.

Alie: What about keeping them as pets? Should they be left in the wild? Or what do you think about that?

Hali'a: Well, we should definitely not be poaching wild plants, ever. And so, make sure that where you're getting plants from is an ethical source because poaching is kind of a problem in the carnivorous plant hobby. Because they grow wild on like the roadsides in Florida and people don't have a lot of— they don't value their existence, and so they're regularly, like, disturbed, and mowed, and stuff like that. People assume that they don't have a lot of, you know, importance in that ecosystem or anything like that.

So, you definitely want to find your plants from an established breeder. There are nurseries across the country that sell really good quality plants so I recommend visiting one of them. There's a bunch of online shops you can buy carnivorous plants from. So yeah, own carnivorous plants, give them a nice sunny window to live in, give them good rainwater or distilled water if you can get your hands on it to keep them nutrient-deficient so they keep looking for bugs.

Alie: Oh, that's interesting.

Hali'a: Yeah, if you give them too many nutrients, they'll stop being carnivorous, a lot of them. They'll just not produce traps; they'll still produce leaves so that they can photosynthesize but they won't produce any traps because they don't need to.

Alie: So, do we have a lot of nutrients in tap water? Do we have enough minerals?

Hali'a: Yeah, so if you look at your local water sources, you have to go to your local water board, they usually have a website, you can look at where your water is coming from and what the TDS is, which is Total Dissolved Solids. And you want your TDS for carnivorous plants to be below 100, ideally that's where you want it. So, pretty pure water, catch rainwater if you can, you can also my distilled water, or reverse osmosis water, if you have an RO system, or a water purifier at home. There's lots of cheap ways to do it. But yeah, you want to maintain this nutrient-deficient environment for them so that they can keep being cool little bug eaters.

Aside: So, keep them a little hungry and look for a reputable dealer. California Carnivores and Predatory Plants are both Hali'a approved, and you can check botany forums for more local suggestions. And it's not all Venus flytraps and showy pitcher plants. What about a sticky little guy that can grab its prey and put it in a sleeper hold, on your windowsill? The drama. Don't sleep on sundews, beginners.

Hali'a: You can try a sundew. Sundews are really great if you've got a nice sunny window. They'll catch all the little fruit flies that you might get in your house. Venus flytraps too are pretty easy plants to keep, but again, you just need the right amount of light, it's just finding the

right spot in the house. If you've got a nice sunny spot, I'd start out with a sundew, get the hang of it first.

Alie: Okay. Ashley Oki had a better question than I did in terms of carnivorous plants in the media. Wanted to know if you had thoughts on Mario Kart specifically. [*Hali'a laughs*] Is there a carnivorous plant in it?

Hali'a: Yeah, there's like those little ones that come up from the pipes when Mario... [*"So they are actually based on a combination of a certain flesh-eating plant and fish."*] The little Venus flytrap ones with the little mouths. Yeah, those are cute. That's probably one of my favorite little monsters that pop out.

Alie: Are there any others that are in the media that you roll your eyes at or you're like, "Hey, good job."

Hali'a: No, I think I just kind of get tired of seeing the Venus flytrap thing because there's so much diversity, there's so many really cool plants out there that we could be representing in the media and I'm like, "Come on guys, let's get creative with something." [*Alie laughs*] So that would be nice, more diversity.

Aside: You know what? Shoutout to Pokémon for modeling the character Victreebel, a fanged pitcher plant after *Nepenthes bicalcarata*, the common name, the fanged pitcher plant. We need more of this in media, so thank you.

Alie: You need producers to come and find you and say, "We need our carnivorous plant expert..."

Hali'a: I know. Let's make a goth-ass show with these weird plants! [*both laugh*]

Alie: It's called Bog Bitch and it's definitely... [*Hali'a laughs*]

Hali'a: I love it.

Alie: We might have to sell a show like this. I imagine when it comes to... If you had to do like a graph of the distribution of carnivorous tattoos, you would find a lot of Venus flytraps and not as many sundews or pitcher plants, right?

Hali'a: Probably. Yeah, I wouldn't be surprised. Although, I don't know, I feel like a lot of people that I see get carnivorous tattoos are deep into the hobby [*Alie laughs*] and so you might see a lot of variety on their arms, something really niche or something like that, "Oh is that like a *Roridula* or something?" Or "Is that a *Drosophyllum*?" Stuff that you can't find at the stores, like, "Oh okay, that's interesting."

Aside: *Roridula*, I think, sidenote, is a plant that grows on the cape of South Africa, and it makes a sticky resin that traps bugs. But wait, it can't digest the bugs. But it has a business deal with the assassin bug, which can walk all over the resin, unharmed, and eat the bugs, and then it shits on the plant's face, which it loves... Not to anthropomorphize too much. Also, we had some technical difficulties again and got momentarily disconnected, during which time I did image search tattoos.

Alie: I did Google "carnivorous plant tattoo," turns out you were so on point and you're right, there's a ton of, like, pitcher plants, there's a ton of sundews, there is good biodiversity when it comes to carnivorous plant tattoos. So, good call. [*Hali'a laughs*] There's even one with a shrew next to it and that shrew is like, "God, I gotta take a dump." And there it goes. [*Hali'a laughs*] It's like a New Yorker looking for Starbucks and I appreciate that.

I also want to ask you about nature's toilets because NanoNaturalist, Darold Wallick, Derrick Allen, Megan Tripney... In NanoNaturalist's words: I NEED to know more about the carnivorous plants that animals use as toilets. Shrews apparently? Shrew potties? What's going on??

Hali'a: Yes! There's a plant called *Nepenthes lowii*, it's found in... I don't know, I forget... Borneo or Sumatra, one of those, in Indonesia. [*"Oh, it's from Borneo!"*] Okay, so these plants have these big old tubby pitchers, and this one in particular, its lid is held open. And on the lid, it accumulates this really thick layer of sugar, like it's white; you could scrape it off and eat it yourself. It looks like a little patch of snow, it's so thick.

And tree shrews that are native to that area know to come to these plants and they sit with their little behinds hanging over the pitcher that's filled with fluid and they have themselves a little snack of this high-quality, high-energy food and they defecate into the pitcher. [*Alie laughs*] And that is the primary food source for that pitcher. For a long time, people didn't know if they were even deriving any nutrients from it because they're like, "Well, maybe it's just an accident." But no, it's a significant amount of energy that comes from that, and I think that's awesome.

Alie: [*laughs*] Oh my god.

Hali'a: And there's another species that's long and tubular, but this one houses bats. And because it's nice and long, the bats can come in, they hang from the bottom of the lid into the pitcher, and they roost there overnight and they're pooping into the pitcher. So, while they're taking a snooze, the pitcher is getting food, then they peace out. Pretty cool, so yeah.

Alie: Unbelievable. We had a couple patrons Sammy Baker and Metatron & Mowly both asked about that, about bats in particular, but it seems like the absolute grossest vending machine ever. [*both laugh*] When you picture a vending machine, it's like, "Listen, you take a dump, some Sunchips are gonna come out." And you're like, "Sounds good to me." [*Hali'a laughs*] So gross, so genius. I love it's just like, "We have a transactional relationship..."

Hali'a: Yeah, very straightforward.

Alie: ... I harvest your turds; you get a snack." What about any myths that you would like to step up on a platform, use this as a soapbox, get your megaphone out, anything to bust?

Hali'a: Okay, there is always a question... I feel like in general, there's no concern about the flowers of these plants, which I have a special love for the flowers of carnivorous plants because they're beautiful, they're gorgeous. And there's a lot of ideas that if you cut off flowers that it's going to benefit the plant, or if you leave the flowers it's going to kill the plant because it doesn't have enough energy now, or whatever.

And I just want to say that you should leave your flowers on your plants. The plant has already requisitioned resources for those flowers, and it's done. As soon as that flower pops up, done, leave it, enjoy it, you know, and keep feeding your plant because then it'll just pop up more flowers. That's part of it. Yeah, enjoy those flowers.

Alie: What about the hardest thing about carnivorous plants? About your job? About dead insects? What's difficult about getting your master's and perhaps your PhD next?

Hali'a: I think the hardest part about getting a master's, in general, is that you're wearing a lot of hats and that's hard to do; you're working, you're doing your research, you're taking classes, juggling the workload can be a lot. And then you also don't have a lot of time in the field to go put your experiment out, you collect everything, and then you're back in the lab,

inside, crunching numbers. So, that can be like, the less fun part of it. Because most of us got into this work because we like to be outside with plants, and then you get stuck inside doing, like, the important part of science which is about the data. *[laughs]* So, that's probably the hardest part.

Alie: That makes sense. What about your favorite part? Or something you didn't expect to love so much?

Hali'a: I really appreciated the community that I found here at TCU. Within the carnivorous plant community, I have so many cool friends. I think just growing plants, getting out in nature, meeting so many cool people, and we're all from different walks of life; I've met a lot of people who are like engineers, but they grow these plants inside, I've met researchers and explorers and all these really cool people. So, I think that's a great part of it, that's what I love about science is the collaboration aspect of it. You get to, like, nerd out with people all the time about your favorite nerd shit. Yeah, that's probably the best part.

Alie: Do you have a lot of people who text you and ask, "I killed my Venus flytrap, what do I do now?"

Hali'a: Yeah. *[Alie laughs]* Mm-hmm, yeah. I'm definitely that friend, yeah.

Alie: And then also, places where people can follow you or anything you want to plug?

Hali'a: You can follow me on Instagram and Twitter at @TheHaliapedia on both of those platforms. Nothing to plug. Please pay attention to your local wetlands and plant native plants in your yard. We need lots more native habitat back after all of the development we've done over the last 500 years. So please do your part, have a little pot of whatever wildflower you love, that will make such a huge difference, just creating that habitat for them.

Alie: Thank you so much for doing this!

Hali'a: It was so nice talking to you!

Alie: Keep up the great work and let me know how your bog branding is going.

Hali'a: All right. *[both laugh]*

So, ask smart plant people, human questions, and plant natives if you can.

I'm in LA and the last few months we've been rewilding this grassy hillside in the backyard. It's been covered with invasive weeds for years, but we've totally redone it with native plants and it's just so cool to see sages and coyote brush growing and blue dick (it's a plant). And poppies are finally sprouting. So, big thanks to my friend David Newsom of Wild Yard Projects for his work in this area and I will link Wild Yards Project on my website too.

More links will be up at AlieWard.com/Ologies/CarnivorousPhytobiology which will be linked in the show notes as well, alongside the two causes that we donated to. Thank you so much to Erin Talbert who admin's the *Ologies* Podcast [Facebook group](#). Thank you to Shannon and Boni of the *You Are That* podcast, for helping out as well. Thank you, Susan Hale, for handling [merch](#) and quizzes and so much else. Thank you, Noel Dilworth, who wrangles schedules and so much else. Emily White of The Wordary makes our professional transcripts and Caleb Patton bleeps them. Those are available for free at AlieWard.com/Ologies-Extras.

If there was a sponsor that you need a link or a code for, that's on my website as well. Thank you, Kelly Dwyer, for making my website, she can make yours too. Every few weeks we put out a classic *Ologies* episode that has been whittled down and de-filthed; it's safe for kids. They are called *Smologies*. Thank you to Zeke Rodrigues Thomas for those, those are linked on my website as well. Thanks to Stephen Ray Morris for the assist, and huge thanks to the gooey slurry of my heart, lead editor, Jarrett Sleeper of Mindjam Media for putting all the pieces together each week. Nick Thorburn made the theme music.

And if you stick around until the end of the episode, you know I tell you a secret and this week's secret is a little raw... I might have COVID... Either that or I'm fighting it off. Here's the deal: I went to a birthday party on Thursday. Didn't know it was going to be so indoors... at a restaurant, and I was like, "Oh no, BA.2... What do I do?" And our dear friend whose birthday it was, was running a couple hours late because he had to work late, so we were just kind of hanging out for him, for a while. Anyway, I found out, my friend we were sitting next to has COVID today.

So, I am feeling like I'm fighting something off. Rapid test said negative but hmm, going to be doing a PCR tomorrow. But I did have to cancel a trip up to help my dad go to the hospital because of it. Not happy about that. [*deep breath and sigh*] Be careful, you know. Just be careful and you can still wear a mask. Doesn't matter if anyone makes fun of you for it, keep it on your face. Okay, berbye.

Transcribed by Aveline Malek at TheWordary.com