Getting Curious with Jonathan Van Ness & Dr. Juli Berwald

JVN [00:00:00] Welcome to Getting Curious. I'm Jonathan Van Ness and every week I sit down for a gorgeous conversation with a brilliant expert to learn all about something that makes me curious. On today's episode, I'm joined by Dr. Juli Berwald, where I ask her: What's a day in the life of a coral reef? Welcome to Getting Curious, this is Jonathan Van Ness. We have such an interesting episode for you today. So welcome to the show, Dr. Juli Berwald, who is a science writer living in Austin, Texas. Yes, Austin, Texas! She's the author of "Spineless: The Science of Jellyfish and the Art of Growing a Backbone." Her new book "Life on the Rocks: Building a Future for Coral Reefs" is out now. Our guiding question for today is: how deep can we dive in coral reefs? Or on coral reefs, really, however you want to think about it! But first of all, how are you, Dr. Juli?

JULI BERWALD [00:00:53] I'm so fantastic, and this is so wonderful to be on Getting Curious. I can't believe it. It's, it's really a dream. Thank you for having me.

JVN [00:01:01] Ah! Well, thank you for having us. So let me tell you about why this kind of, like, started. My husband and I went to Turks and Caicos for our honeymoon last year and we got to, like, go snorkeling in this, like, stunning coral reef. And I realized that there was, like, all of this, bleaching, like, a lot of, like, the coral was getting bleached. And I was asking our tour guide, "Is this like the thing that I was reading about in the news?" And he was, like, "Yeah, like, when I was little, it wasn't like this. And now it's, like, all like this." And I was, like, "No!" So that's how I got curious about coral reefs. Coral Reefs 101: this is going to be, you know, deep. I hope you can handle it. Just kidding. What is a coral reef?

JULI BERWALD [00:01:45] It's a really good question, because until, like, really, the 1700s, people didn't know what coral were. They thought they were plants because they look so planty. It turns out corals are animals, just like we are. And they have nervous systems, and they have a stomach, and they have digestive juices. [CROSSTALK] Yeah, and they make eggs and sperm. They're animals, they're totally animals, but they're, like, the craziest kind of animal because they have made what I like to call the badass merger with an algae. So these algae live in their skin and they photosynthesize, like all green things do, and they feed the coral 90 percent of the sugar that they make from photosynthesis. Coral live in tropical oceans and tropical oceans, they don't have very many nutrients, and so there shouldn't be so much life in tropical ocean waters. But because the coral have made this alliance, they have made the coral reefs into, like, the most productive ecosystem on our planet. So the, the algae make all this sugar from the sunlight and they feed the coral, the sugar and then the coral have so much sugar that they turn that sugar into the reefs, into making limestone. And they make that limestone just outside their bodies, like, underneath their foot. And that's what the reef is made out of.

JVN [00:03:107 Is it their poop?

JULI BERWALD [00:03:09] No, it's more like their bones. It's more like their bones, except for they make them outside their body.

JVN [00:03:15] So they kind of poop bones! But their bones are, like, cool and, like, grow really, like, big, cool structures that are, like, pretty and, like, aren't made of poop.

JULI BERWALD [00:03:25] Yes. And, like, they're the biggest structures made by any biological—even us—on the planet. Like, the Great Barrier Reef is the size of Italy. Like, you could take the Great Barrier Reef, lay it across the west coast of the United States, and it would drip off down to Tijuana and off the top into Vancouver, like, it's massive. And these little teeny coral that are just, like, two tissue layers thick made it because of the algae that they've, like, formed this incredible alliance with.

JVN [00:03:59] Okay that's so genius. It can't stand it. [CROSSTALK] So why are these reef structures so critical to life in the sea and beyond?

JULI BERWALD [00:04:07] So a quarter of all marine species live in coral reefs at some point of their life. It's because those skeletons, you know, they create all these like intricate habitats. And so an animal that likes to be up on top can be in the sun, and one that likes to be in the shade can be in a little cave underneath. And you know, they can drill down into the old skeletons and kind of just pop their tentacles up. And, you know, they can do all kinds of things in this, like, complicated city structure that is in the tropical oceans.

JVN [00:04:35] I've definitely, like, seen exactly what you're talking about because it's, like, it's so diverse and such, like, a little space.

JULI BERWALD [00:04:43] A quarter of all marine species depend on coral reefs for their life, but about between a half a billion and a billion people also depend on coral reefs for their primary source of protein like fish. So people around the world require the reefs to be healthy in order to fish and get their primary source of protein. So it's also a humanitarian issue that the coral reefs are struggling right now.

JVN [00:05:05] Dang, I also just got distracted cause your blow dry looks really good. Sorry, had to say it. It's giving me, like, when you got really serious about the importance of, like, the humanity around, like, coral reefs, like, like, your hair started bouncing and it was like, no, like, the movement, was like, really pretty. So where are, like, coral reefs commonly found? Are they, like, all over the oceans or more just kind of, like, select spaces?

JULI BERWALD [00:05:26] So coral reefs can only live in tropical waters. They have to be in warm water. They have to be close to the surface because they have to give the algae enough sunlight to grow and give them all that sugar. And so they're confined to these tropical places around our planet. But the problem is we have climate change happening, and the oceans

have taken up about 90 percent of the heat that the carbon dioxide in our atmosphere has been holding so, like, the oceans are already a degree and a half or so, on average, warmer than they used to be, you know, in the 1950s. So when the water temperature increases by two degrees for, like, about a month at a time, we don't still know why, but the algae will abandon the coral, and we don't know who throws the first trigger. So, like, bleaching has been known for about a century, but usually it was just, like, a kind of thing that happened at low tide when the coral was close to the surface and it was, like, a really hot summer day, the algae would leave. And it was noticed back in the early 1900s. But there was never, like, these massive bleachings that we're seeing today. Those started in the late 1980s, where just these huge swaths of reefs will turn white because when the algae leaves the coral, the coral doesn't have any color of its own. All of its color comes from the algae. So then it just looks like bare bones.

JVN [00:06:51] Hmm! So what's the anatomy of a healthy coral reef?

JULI BERWALD [00:06:56] So they're unique ecosystems everywhere they exist. And, like, in the Caribbean, talking about the hard corals, the one that make the skeletons, there's only about 44 species of those there. And in the 1970s and 80s, it was always this, like, jungle of what are called Acropora species, which are these branching and sort of, like, they look like elkhorns and staghorns. You know, they were, like, these jungle systems. And then within that, there were these kind of more massive corals that look like columns or like boulders or like brains. In the Pacific, it's even more complicated. There's ten times more. So there's 400 species of coral there, and coral are so weird because they can hybridize really easily. So, like, "What's a species?" is a question that isn't really settled, but so there it can be even more kind of fairyland-looking where there's, like, filigrees and, you know, tables and plates and, like, all kinds of different structures of coral. And, and so it's magical.

JVN [00:08:00] In a reef, like, what's, like, the top of it do? What's the bottom of it do? Like, is there, like, a system of function within, like, the wider reef that would mirror, like, a human or like a car?

JULI BERWALD [00:08:12] There is zonation on a reef: you'll find certain more light-loving, warm, loving animals near the top. And then you'll find a little more of the shade-loving cooler animals near the bottom. And then reefs can't get too deep because they need that light for the photosynthesis of the algae.

JVN [00:08:29] Well, that's really interesting. I'm obsessed with that story. What's, like, the Indian Ocean reefs like?

JULI BERWALD [00:08:33] So the center of diversity of all coral is what's called the Coral Triangle, and that's between Indonesia, Palau, and the Philippines. And then it kind of, like, smears out to both, you know, the East and the West. And so as you go into the Indian Ocean, you still have a ton, like, two or three hundred species of coral. In fact, the coral reefs around

Egypt and Israel in the Red Sea are some of, maybe, some of the most well positioned to survive our heating planet because there's like a lump in the ocean in order to get to that part of the ocean. So they had to pass through this warm part of the ocean even to get there in the first place so they've kind of been, like, pre-selected for warmth. And also, they're sort of north. So as our planet warms, they've got, like, a really good chance of surviving. And what's really cool is, like, not to get a little political but, maybe to get a little political. The next COP meeting, where we talk about climate change, is positioned right in Sharm el-Sheikh, Egypt, which is right on the edge of these reefs, which are literally, like, their survival, depends on what decisions are made on shore, right, a few miles away.

JVN [00:09:48] Wow. Wow. [CROSSTALK] OK, so now we're going into coral. So now this is the deep dive, so coral as a literal animal, which I think I didn't totally grasp my mind around that. So how does it reproduce?

JULI BERWALD [00:10:03] Coral are hermaphrodites. They're all, yes, they all have male and female sides to them. In fact, they don't have really clear X and Y chromosomes. There's this one coral that these students were telling me about when I was in the Dominican Republic and they're, like, "Oh, that thing, that thing? That thing just spews a lot of spawn when it spawns." And, and I was, like, "Wow, so, like, it's, it's, like, tons of sperm coming out?" Because they named it Romeo. And they're, like, "Oh, no, Romeo is now releasing eggs." So coral spawn, they're so romantic, because they spawn once or twice a year in the summertime, and they time it. You know, like, they can't get, walk over to find, like, someone to reproduce with. So they have to release their eggs into the water. The best chance of having those eggs and sperm find another mate is to time it, perfectly. And so a few days after the full moon, like, nine days after the full moon in August, at a certain amount of time after sunset, they–, each species has, like, their forty-five minute period, where they each release their eggs and sperm into the water. And it's, like, it's, the water becomes like a reverse snow globe, and it's just it's, like, magical.

JVN [00:11:27] So some of the corals, like, they release, like sacks, like, where, like, the egg is in one in, the sperm is in one, or they're together in a packet or they're always together?

JULI BERWALD [00:11:36] They're together in a little—, yeah. So, like, the Acropora, the ones that are kind of the branches. They release these eggs and sperm packets and they're there, like, pretty and, like, pale pink and the ocean waves break them apart into separating out the eggs and the sperm. And then hopefully, they find another one to mate with. And it's really cool, like, they have put in little protein codes in the, in their eggs and sperm that tell them, "Don't mate with, with each other," because that wouldn't be good for the species, like, the reason for reproduction is to mix up the gene pool. So if you're just going to meet with your own self, that's well, that's asexual reproduction. Like, that's one way to do it. But the reason why animals do have eggs and sperm is to mix up the gene pool. [CROSSTALK] They actually put protections, protein protections in there to, like, make sure they don't fertilize themselves. So, but it's amazing that, you know, this, this happens. And what's also amazing is, like, we

really didn't even know that until the 1980s that the, that corals reproduce en masse like that, that they do, like, they have these, like, huge basically orgies ocean.

JVN [00:12:48] So where do they store their sacks, like, in the structure itself, like, in the coral structure?

JULI BERWALD [00:12:53] OK, they're just like a cup, and they have tentacles surrounding their mouth. And they just have one hole, and that hole is both their mouth and their butt, they eat and poop out of the same thing. Like, I said, most of their food comes from, most of their nutrition comes from the algae, but they also can sting their prey with stinging cells just like jellyfish and just like sea anemones can. And look, I'm going to just take an aside on the stinging cell because it is perhaps the most sophisticated biological structure ever. So it's, like, a capsule and inside is like a tubule, and it's made out of the same stuff as, like, spider webs are. So it's, like, strong and stretchy. And then there's, like, a trigger out here on the end of it, and that trigger is almost the same as the hair cells in our ears that allow us to hear sound. And so actually, they're, like, listening for the buzzing of a plankton. And then, when they, when that, like, vibrates at the same frequency as the plankton, the capsule pops open and inside the tubule is, like, a pair of stockings that's, like, inside out and it unfurls the right way.

And OK, I'm just gonna use a little, like–[DROPS PEN]. See that? That's the acceleration of gravity. That's one G. So something falling to the ground. The speed that that tubule the stockings unfurls and fires is five million times faster. Five million times faster! It's the fastest, the fastest known motion in the animal kingdom. And it's, like, yeah, it's jaw dropping. It's, like, crazy that these animals, these, like, simple animals, have this, like, incredible power. And so they can sting their prey, their plankton prey, and then they use their tentacles. They kind of use cilia to move it into their mouth and into their stomach, and then they digest what they can, and then they spit out what they can't digest. And alongside the stomach is where their gonads are. So when the eggs are ready, and the sperm are ready, when they're ripe and ready to be released, they move them into the stomach and then they spit them out their mouth-anus structure.

JVN [00:15:12] Wow! And again, I guess they just really, like, I can't get over this part. So every single coral species, they all do egg and sperm packet, all of them.

JULI BERWALD [00:15:27] No. So some of them will just release, like, Romeo, they released sperm for a few years and then switched to eggs, and then they might switch back to sperm again. So all these polyps are networked together in a colony. So half the colony released eggs and half of it released sperm.

JVN [00:15:45] If the ones do, like, like, Romeo, like, eggs and sperm or like, you know, have does this are they all in little packets or do some of them just they float out little floaty spermies and floaty eggies, not in the packet?

JULI BERWALD [00:15:57] Yeah, yeah. Most eggs have some, like, fats, like, just like an egg, you know, like, a chicken egg does, like, the yolk, right? That's where the baby's supposed to survive on for a little while after it's hatched. So most of the coral eggs have yolky stuff in them, too. Like, that's that. And that actually helps it float up to the surface where they meet their sperm.

JVN [00:16:19] So they meet the sperm on the surface, usually?

JULI BERWALD [00:15:22] Usually, yeah. And then they turn into little larvae and the little larvae looks like a furry Tic Tac. It's, like, eensy weensy eensy. And that the larvae's job is to swim. It kind of spins like a corkscrew kind of, and it swims back down and it finds, like, a hard surface to attach to. And it's like a seed, you know, it has to make this like one major decision of its life and plant itself somewhere from which it'll never, ever be able to move again. And then it starts building its little skeleton and it goes to try to find its algae. Some coral give their baby eggs the algae to to start their new life with, but some coral don't. And so then those that don't have to, like, kind of go fishing for the algae to infect them, and then they may start making their little skeleton and then the first little polyp is there, and then they start dividing and become many, many polyps and becoming a full colony.

JVN [00:17:22] But couldn't the little furry Tic Tac go back down into, like, a preexisting coral reef structure. Or do they all start, like, new ones?

JULI BERWALD [00:17:32] Well, so, OK. So, likem coral are, you know, there's like so many species, like I said, and, and when they live too close together, there's like territorial battles that they have with each other. So yes, they have special tentacles which are called sweeper tentacles. And, and so when a coral like wants to invade on their territory, they'll like, throw these sweeper tentacles out and, like, fire those stinging cells off at another colony to, like, clear the space because they want their territory. So if a baby, a baby coral, probably wouldn't want to be too close to an established colony because it might get sweeper-tentacled. So yes, you know, they, they are, but it does want a hard surface to live on. And so in some places where reefs have been destroyed and turned to rubble, there is not, when the rubble whirls around, it's not a good surface for the coral to establish itself on. And then that's, that's when coral restoration can really be helpful because the, the baby coral, it really needs a stable place to, to lay down its initial skeleton.

JVN [00:18:46] OK. I think I understand. And then how can we tell, like how long a certain reef has been alive?

JULI BERWALD [00:18:54] We have to drill down into the reef and you can count sort of the generations of coral that have been there. Modern corals have been around for some tens of millions of years and there were corals around before that for hundreds of millions of years. Those coral species kind of went through some extinctions, like, as our planet has gone through extinctions. But yeah, I mean, the reefs are millions of years old.

JVN [00:19:22] And how have they, like, evolved from those, like, older ones that went through extinction events to, like, now?

JULI BERWALD [00:19:29] Evolution, you know, has this ability to cause gene mutations and the ones that can better handle the environment persist and the ones that don't get weeded out. It's a slow, slow process. But, you know, the corals have been able to do it for millions and millions of years. And now we're hitting this point where we're changing the ocean so fast there's significant questions about whether they'll be able to keep up.

JVN [00:19:56] So how, how have, like, scientists like understanding of reefs evolved, because, like, you were saying that we didn't really even know how they reproduced until the 80s?

JULI BERWALD [00:20:05] Well, I mean, we knew that they did, like—, we knew there were eggs and sperm and all of the business, but we didn't know that they did it, like, to the light of the moon, several nights. Really, the reason is, is because scuba diving, I mean, we think scuba diving has been around forever, but you know, like, Jacques Cousteau basically invented it. So, like, it has only been around for 50 years or so. And once coral scientists were able to get in the water and watch the coral, that's when they discovered these huge mass spawnings in Australia in the 80s, and we didn't really know that was happening before then.

JVN [00:20:44] So we know that, like, warming waters is a huge threat to coral. But what about, like, habitat destruction?

JULI BERWALD [00:20:52] Yeah, it's also a big deal. So in the Caribbean, the corals have been really suffering since the 70s. And part of that is probably due to fertilizer runoff changing the water quality. Coral, you know, like I said, coral live in this part, they like to live, or they've evolved to live in places where there's not many nutrients in the water—and fertilizer are nutrients for whatever we're trying to grow on land. And that leads to a lot of coral disease. So the Caribbean has been really hit with tons and tons of coral disease. The largest barrier reef in the world is the Great Barrier Reef. The second longest one is from the Yucatan down into Belize and Honduras. And then the third largest one is from Miami, down to the edge of the Florida Keys. That one’s about 300 miles long. But in some places, only two percent of the coral that used to be there still exist in the Florida Reef Tract. And that's a lot to do with lots to do with water quality issues due to runoff.

So pollution is a big deal. In some parts of the world, people use explosives to, to fish, they throw bombs, and it's called blast fishing, and it happens all over the Pacific and in some places around Africa. And it's because of poverty, you know, it's, it's less, it takes less time to fish using a bomb. But when you throw a bomb in the water, it destroys the coral underneath the bomb. And then there's another thing, a lot of places, people really want to buy live fish before they eat them. You know, they, they want to have the fish swimming in the aquarium and then you pick that one out and you have that one for dinner. And so they'll use cyanide,

they'll go down with a water bottle full of cyanide and squirt at, like, a coral trout or something. It blocks its hemoglobin so it can't get oxygen. But it also blocks the oxygen from the coral, which are animals and need to breathe. And so you'll get, like, these huge scars from cyanide fishing also. So there's a lot of threats to the coral reef out there.

JVN [00:23:08] And then, God, and then what about sunscreen?

JULI BERWALD [00:23:12] Yeah. You know, so sunscreen is a, it's a really great question. And when I started writing the book, I was really curious about sunscreen, too. And when I went to see some coral restoration projects, like, in Indonesia, I was really careful to use mineral sunscreens and not use any sunscreens with oxybenzone, which is the chemical that's been implicated in coral health. But I also, when I got home, I, like, did a really deep dive into the question of sunscreen and coral. And there were some studies done that showed that sunscreen was really negatively affecting coral and specifically the coral larvae, the little baby Tic Tacs we were talking about. But those studies were never repeated. They weren't. No one was able to repeat those studies. So within the coral community, the question of sunscreen and corals seems to be taking a backseat to these other bigger issues, like the blast fishing, the cyanide fishing, the pollution, and the climate change.

JVN [00:24:22] I'd never heard of bomb fishing. How common is bomb fishing?

JULI BERWALD [00:24:27] So I went to this really cool coral restoration project in Sulawesi and unbelievably, like, the Mars Candy Bar Company are the people behind this restoration project, and the head of—, one of the grandchildren of Mars. His name is Frank Mars. He just really, really loves coral. And he also noticed that, like the people who work in his chocolate factories in Sulawesi, like I mentioned about that protein source, they were struggling to have the protein they had always relied on because their reefs were declining so badly. So he was, like, "What can we do to restore the reefs?" And in this part of Indonesia, blast fishing is a really big deal. So he came up with this, like, these, like, structures that look like stars, kind of, made out of rebar and you network them together and they stabilize the reef and they–, it's unbelievable what he's done, like, within three years, the reef is vibrant, beautiful, like, I saw sea turtles and sharks and all this stuff. And where, where there had been last fishing scars. But every time I went diving on those reefs, I heard one or two bombs go off underwater.

JVN [00:25:37] Wow.

JULI BERWALD [00:25:38 So, yeah, and that was just the times that I was underwater, you know, which—

JVN [00:25:45] Yeah, not, like, so much time, like, it wasn't like you were down there for a long time.

JULI BERWALD [00:25:48] Like, yeah, I went, like, yeah, you can only stay down for about an hour. And I probably dove, you know, five or six times.

JVN [00:25:56] So what happens when the coral dies, like just the animals leave? And, and what else?

JULI BERWALD [00:26:02] Yeah, I mean, it's like, you know, it's like clear-cutting a forest or something, like all those quarter of the marine species that depend on the coral reef don't have anywhere to live. And you have a huge ecosystem that is collapsed. So it's, it's pretty horrible. One of the cool things, though, is when I was in Sulawesi is they're, like, listening to the sounds of a healthy reef. And just like when you walk through a healthy forest, you know how it sounds like you can hear the birds tweeting and you can hear like the squirrels, scattering up the trees. And you know, it's, it's kind of a noisy place. So is a healthy coral reef. And when they're doing these restoration projects in Indonesia, they're actually putting speakers out with the sounds of a healthy reef on the restoration, and they find that the animals come in to colonize the reef faster if you play them, like, basically the music of a healthy reef.

JVN [00:27:00] Oh, how interesting.

JULI BERWALD [00:27:01] I know! Yeah. And, you know, it's really important, like, coral, coral are kind of, when they're starting to establish themselves, they're, they're, like, in a race with algae to, to cover the surfaces faster. And one of the things that really helps them is if there's fish that eat algae, not—, and I'm not talking about the algae in the skin at this point, I'm talking about, like, kind of more, like, mossy stuff. And there's fish that will come in and do that, but only if they feel like the reef is a healthy place to be.

JVN [00:27:33] I love that it's so interesting!

JULI BERWALD [00:27:34] I know!

JVN [00:27:36] So what, like, how much lasting damage has already been done to reefs?

JULI BERWALD [00:27:41] Probably every reef on our planet has experienced bleaching and death because of, of climate change. I don't think there's one that hasn't experienced it. Since 2016, it's almost been a constant mass bleaching somewhere in the world. When coral bleach, they lose their nutrition, and they can kind of survive it for, like, a few weeks or so because they can eat food using their stinging cells. If the water cools down, the algae can actually come back in and reinfect the coral and they can survive it. But if the, if it stays hot, they can't survive it and they die.

JVN [00:28:28] Hmm. So who's working to protect and restore coral reefs? You mentioned the, the story in the Indonesian place with the Mars people? [CROSSTALK] Who else is doing cool stuff?

JULI BERWALD [00:28:41] So in the Caribbean, the corals, they're so sick that they aren't really even reproducing so well by themselves. So they're doing, like, these massive in vitro fertilizations, where they collect the spawn, they take them to a lab, they mix them all together. A lot of them turn into little larvae, and then they put them in these giant boats and let them kind of, like, float out there in the water and settle down, like little kind of tinker-toy looking things that they can re-put back onto the reef, just, like, by the thousands. The problem is coral reefs are so big and they take up, they're so important, we really have to scale up these efforts, and I mean, this is, this is one of the big problems is, like, not enough people are doing stuff to help the coral. And there's a disconnect, I think, between—the scientists are working really hard to try to figure out, like, how to cause more reproduction to happen, how to support the corals that are out there, but, like, the funding has been really, really limited for it.

The United Nations has these Sustainable Development Goals and they're, like, all the things we would want for our planet. So, like, getting rid of poverty and having, having food for everybody and educating everybody and, you know, all these wonderful things. And one of them, Number 14, is "Life Below The Seas," and it receives about .56 percent of the funding, .56. So, you know, we just really have neglected our oceans and the coral are kind of the first ecosystem in our ocean to have this existential threat facing it. And it's a real problem and, and yes, like, Mars is doing some things, there's hotel chains, like, that are doing some things to protect their coral reefs. There's a business called Coral Vita that's trying to do, like, on-land farming of corals. There's this thing called the Coral Restoration Foundation in Florida that grows coral in orchards under the seas. There's a lot of small groups that are working to try to protect the coral, but it's, it's really lacking in terms of the scale of what's needed.

JVN [00:31:13] So who needs to step up and get involved that hasn't done it yet? Governments?

JULI BERWALD [00:31:18] Yes, governments. Like, here's an example: there's a terrible, terrible, terrible disease raging through the Caribbean. It started in Miami in 2014. It's called stony coral tissue loss disease. And it's, it's basically, I mean, it's basically like the, the coral's tissue falls off its body, like it, like Ebola, like it causes the tissues to just turn to mush, and it affects half the species in the Caribbean. So 20 of them. And there was $4 million, so $2 million from Florida and $2 million from the federal government, that was put together to fight this disease. And it's, like, so little, like, it's a rounding error in any government budget. And when you look at how much, like, the coral reefs support, like, almost a billion dollars worth of tourism in Florida every year. And so that, the delta just doesn't make sense. And the problem is, is, like, our infrastructure isn't really in place to support coral reefs, either. So it's such a hard question, like, "Who needs to step up?" Like, kind of everybody. And, you know, maybe

there's some progress being made because last year, for the first time, the United Nations tried to put together this thing called the Global Fund for Coral Reefs, and it's a half a billion dollars for the first time. Like, you know, it was hundreds of millions, and they're trying to fund it. So it was supposed to be, like, public and private partnerships coming together. And whether that will happen, I don't know. But at least, like, this is the first large scale initiative for coral reefs that's ever been proposed. And it's tough.

JVN [00:33:08] So your book Life On The Rocks is also a personal narrative. And can you share some of that aspect of the book with listeners?

JULI BERWALD [00:33:18] Yeah. So when I was writing the book and kind of going around the world and, and seeing a lot of the sickness, but also some of the hope that exists and just kind of how badass corals are in general. But, but a lot of sickness on the reef. And at the same time, there was this kind of growing sickness in my own home, which was that my daughter, who is amazing, started suffering from really severe mental health. And initially, we didn't know what was, what was the cause of it, and, kind of, I started to see some parallels between the sickness on the reef and what was happening with my daughter. And I started writing about it almost, like, "This doesn't belong in this book." But the more I wrote about it, the more I felt like there were these, these parallels, which is that, like, mental health is often invisible, like we can't see it and what's happening to the coral is just also so invisible, like, we're terrestrial creatures. And it's really hard to see, like, Jonathan, you saw it when you went on your honeymoon, but most of the time we don't see it.

And yet, I mean, I think, as you know, mental health is so foundational to everything else that makes life beautiful and in the same way, the coral reefs are so foundational to all these things that make life in the ocean so beautiful. So I felt like these stories did have a place that wound together in, in the book. And when I told my editor, like, "I'm not sure, but I think these things belong together." She was just, like, "Let me see it." And then she agreed, like, "This is, this is your best writing." So that's, that's what happened. And I should say this, like, you know, I ask Isabel, like, my daughter, "How do you feel about me using your story?" And I will say I tried very hard to say it from a mother's point of view to not ever assume what she was thinking or feeling. And so it's the mother of someone with a mental illness story. It's not, it's not her story. She, she gets to tell her own story, but she felt strongly that that it was, it was important because, and she's become such an advocate for mental health, which I'm so proud of her for because we don't get anywhere by not talking about these things.

JVN [00:35:47] That's incredible. And I think. That's just so cool, and I love that I think that so much of life is about sharing our stories and sharing our experiences of pain and, you know, healing through that. So I just think that's really beautiful. What was it like to connect, like, your scientist side with your home life? Was that just, like, a completely new experience?

JULI BERWALD [00:36:14] When I wrote Spineless, the first book, I was, I was a scientist, I'd become a science writer, but kind of more of an educational media science writer. And I

actually got asked to write for, write the text for this photography book, and I wrote my heart out. And then I got fired. The photographer was, like, "I want someone more famous than you to write this." And that's when I kind of realized, like, "I want to write a book, like, I want to be an author." And then I started reading, like, a ton of nonfiction books that I thought could be, like, guides for me. And I would always finish them and put them on my night stand and be, like, "I can't write a book like that." And a lot of times it was because the voices were, like, male, really authoritative voices. Not that I don't feel like I'm authoritative. But one day I put a book down and I was, like, "I can't write a book like that." And then, "Wait, you can't write a book like *that*. I can only write a book like I can write," you know, and it just, like, I shifted that inflection.

And suddenly I realized, like, "I could only write a book that's about a scientist who's a person, who has, like, struggles and wonders and makes mistakes and does, like, stupid things." And so Spineless is about me and this really bad boyfriend I had in grad school. And all the mistakes I made and, and how I had to learn to grow my own spine as, like, a writer, as an author, as a citizen. And so when I went to write Life On The Rocks, I did, I thought for sure, "This time I'm not going to include my personal story," and then, like I said, it wound its way in. So it may be the only way I can write is to tell my readers, like, "Look, this is who I am, and this is what I'm struggling with. And all scientists are– scientists aren't people in white coats who are in a bubble or silo. They're people, and they're trying their best, and they're making mistakes, and they're hoping that they are coming up with things that matter, that makes sense of our world." And I think that if we break down that boundary between scientists and human, it would be really good for everyone.

JVN [00:38:35] It's definitely a more, like, holistic approach. So what's, what's next for you and for your research?

JULI BERWALD [00:38:41] OK. I mean, I'm working on a young adult novel about a 16-year-old girl who saves the world from climate change. So, we'll, we'll have to, we'll have to see. I just said it out loud, so that means I have to finish it, right?

JVN [00:38:59] I love that!

JULI BERWALD [00:39:01] Yes, I'm scared of fiction, but I'm going to give it a shot and I'm working on some other just articles. And I am also working on another story, which is about this jellyfish scientist who survived the Holocaust by hiding in the Natural History Museum in the Netherlands. And it turns out a bunch of people hid there and so I'm trying to tell that story to save; I have two kind of books I'm working on right now.

JVN [00:39:31] That's so interesting. So if people have listened to this episode, they're, like, "I got to get into research, I got to get into science, I, where do I even start," if they're just like, really keen on the coral they're keen on, like, ocean science, but maybe they're, like, really,

like, where do they start to, like, research into, like, what do you study? How do you become, like, a marine science expert?

JULI BERWALD [00:39:55] I grew up like you did in the Midwest, and I never snorkeled or anything. Growing up, I mean, my parents, I think, took us to the beach, but they didn't know about snorkeling, either, you know? So in college, I went to Israel for my junior year and, and I was kind of miserable and I went, there was, like, this little sign, like, you know, that thing you pluck off the side of? [CROSSTALK] And it was, like, "Marine Ecology Course." And I was, like, "Okay, I'll take that!" And I I went down to Eilat, which is in the Red Sea that we were talking about earlier and they, like, gave me fins and a snorkel and said, "Get in the water." And I went into this fairy world and I was, like, "Oh my gosh, we live on the same planet as that. Like, how did I not know this my whole life?" But it was too late for me to switch my major. So I just graduated from college and then I applied to, like, work at a marine station in the summer where I like basically washed dishware for graduate students and made coffee and photocopied things back when there was photocopies. And, and so, you know, I think that's, like, one way to do it is, like, get a summer job somewhere where there's a ton of, there's marine stations around the country and around the world. Spend some time in the lab and just see if you really like it. And so then I very slowly kind of cobbled my way into grad school by doing a bunch of these internships until my resume look good enough for me to get into grad school. But my grad school degree wasn't about coral, although I loved coral from the very beginning. I ended up working on satellite imagery of the ocean.

JVN [00:41:34] That is so cool. I mean, everyone has their own way.

JULI BERWALD [00:41:37] Yeah, exactly. And I don't think that getting a Ph.D. is necessarily what you need to do. There's these coral restoration groups that you can work in. There's a lot of tourism industry that has, like, guide programs where you can learn about the ecology of an area, like, in Australia, they have these, this incredible guide program where you can learn about the ecology of the Great Barrier Reef and then you're licensed, then, to take people out onto the reef and show them what's out there. So there's other ways into the marine world. And policy, like, please, please go into policy, like, try to get our policymakers to pay more attention to the ocean.

JVN [00:42:24] One thing I forgot that I wanted to ask you about, I remember, like, in the early aught 2000s, there were all these stories of like coral reef restoration. I remember seeing it on like Dateline in 2020, but then I remember reading these articles, like, three or four years later that were, like, "The coral fucking hated those like tires. And now there's, like, a bunch of just, like, shitty junk in the ocean, like in a field." Not that it's funny, but what happened with those stories?

JULI BERWALD [00:42:46 I think you're right. Yeah, the coral did fucking hate that shit. So I guess–

JVN [00:42:51] It was, like, tires and, like, metal beams and stuff. And they were just, like, "Ew, what is this?" They hated it.

JULI BERWALD [00:42:57] Yeah. And that's why the Mars restoration that I saw in Indonesia was so impressive because coral really liked it. But yeah, you know, you can't just throw trash in the ocean and expect coral to live on it. So, like, it does have to be done properly. And I have seen like, you know, I went, I went to Bali after I was in Sulawesi and I saw some restorations that look like just mossy messes. And so it doesn't, it's not automatic that the coral will grow on anything you throw down there. It does have to be done right.

JVN [00:43:28] And then do people ever have to, like, clean up the restoration like or, like, try to like, fix the restoration?

JULI BERWALD [00:43:34] You think anyone pays attention to that? No one pays attention to that. Yeah. People, no.

JVN [00:43:40] So is there just a lot of that failed, fucked up restorations all over the place or– There is?

JULI BERWALD [00:43:45] Yeah, sorry to say that.

JVN [00:43:46] So that could be, like, someone else's work is, like, how to, like, turn those into, like, driving things, or at least they just do away with it to maybe let nature take that and fix it or something?

JULI BERWALD [00:43:56] Yeah. I don't know if I have the answer, I don't know if that's, like, worth our effort, either. Like, shouldn't we, yeah, shouldn't we focus on the things that we know will be successful right now.

JVN [00:44:06] Oh yeah, that's true. My mind always goes to, like, that one random, like, last night my—, we just spent our first night in our apartment in New York. And, I, like, the house was, like, so organized, like amazing. But then there's, like, these two pieces of, like, luggage in the bedroom. When I was like, "What are those two pieces of luggage?" Like I just, I focus, I think, the most random, like, things that's not the main issue, but you know, it's like, that's not the point at all. And I'm, like, "Oh, my bad, you're right." So yeah, it's interesting.

JULI BERWALD [00:44:37] And, like, and really, ultimately, let me just say this: is ultimately, the thing we really need to do is get on the ball with climate change, because that will have the biggest impact on coral of all. So if you really do want to help coral, and say you're landlocked or something, you know, please, please talk to your policymakers and tell them how important dealing with climate change is, because that is ultimately the biggest issue for coral, and the rest of it we probably can deal with. But, like, if we don't deal with climate change, it's, it's a big, big, big problem.

JVN [00:45:13] So in Spineless, you, you are, like, an expert on jellyfish, and you also said that they're kind of, like, similar to coral. So are they, like, first cousins? Is that just, like, because they all have, like, the stinging cells?

JULI BERWALD [00:45:26] Yes. Yes, they're cnidarians. So, like, the "cnida" in Greek, I think, means, like, nettle. So like, you know how the nettle plants are stinging things. So all of them have the stinging cell that's like what unites them. And they also have, like, similar body structures with just one hole in and out and tentacles—

JVN [00:45:51] But I want to learn more about jellyfish. So perhaps we'll have to do another episode about jellyfish.

JULI BERWALD [00:45:56] OK, deal. I would love to. Yeah, jellyfish are, jellyfish are cool.

JVN [00:46:01] Do we have any evidence of a gay jellyfish staff or queer jellyfish type? I love gay stuff in the animal kingdom. [CROSSTALK] There's a lot of other interesting things, so if there's not, it's, or there is a little bit of gay stuff with jellyfish.

JULI BERWALD [00:46:14] Well, no, but there are these fish that—, I do want to tell you about these, these fish, they're called the Maori Gobies. And these aren't jellyfish. They're vertebrates. But, like, so they just pair up like whoever likes each other just pairs up. And if it's two girls or two boys, then one of them, when the time to reproduce, one of them just changes sexes so that they can reproduce.

JVN [00:46:40] That's cute!

JULI BERWALD [00:46:41] That's cute. And then there's this worm that again, they just pair up, and whoever is bigger becomes the female, and whoever is littler becomes the male, and then the male grows faster than the females, so it gets bigger. And then they both just switch sexes. And then the one that used to be female is now male and one that's male, that's now female. And then that one, the littler one, the male grows faster again. And so for their whole lives, they're just kind of, like, growing bigger and changing sexes, back and forth. [CROSSTALK] And that's how they just kind of hang out together and, like, they are what they are when they are that.

JVN [00:47:17] Ohmigod, I love that story, but not as much as I love this entire time that we spent with you. Dr. Juli Berwald, you're amazing. This is also now your time to like, is there anything we missed, anything that you want to add? I feel like I learned so much. I'm so excited I can't even see if there's anything they'd be remiss if we didn't add. Now's your chance.

JULI BERWALD [00:47:35] I think we said most things—

JVN [00:47:38] I think we did it! I think it's such a good episode.

JULI BERWALD [00:47:41] Oh, cool and, like, definitely like, yeah, I kind of got on my little climate change soapbox there at the end, so that's good.

JVN [00:47:47] We love a climate change soapbox, and it's very imperative to the future of what you study. So I think that I mean, that was just great, and I'm so grateful for your time of sharing your expertise with us. This was such a good episode.

JULI BERWALD [00:47:58] Oh, I'm so glad. Thank you, Jonathan, for having me.

JVN [00:48:01] Dr. Juli Berwald, the pleasure is all ours, thank you so much for coming on Getting Curious. We're obsessed. Go coral reefs. Go you, and make sure to Read Life on the Rocks: Building A Future For Coral Reefs. It's out now. You've been listening to Getting Curious with me, Jonathan Van Ness. Our guest this week was Dr. Juli Berwald. You'll find links to her work in the episode description of whatever you're listening to the show on. Our theme music is amazing, honey, it's called "Freak" by Quiñ - thanks to her for letting us use it. If you enjoyed our show, please honey introduce a friend - show them how to subscribe. You can follow us on Instagram & Twitter @CuriousWithJVN. Our socials are run and curated by Middle Seat Digital. Our editor is Andrew Carson. Getting Curious is produced by me, Erica Getto, and Zahra Crim.