

Getting Curious with Jonathan Van Ness & Dr. Charles J. Innis

JVN [00:00:03] Welcome to "Getting Curious", I'm Jonathan Van Ness. And every week I sit down for a 40 minute conversation with a brilliant expert to learn all about something that makes me curious. On today's episode, I'm joined by Dr. Charles J. Innis, the director of animal health at the New England Aquarium, where I ask him, "How are turtles doing these days and are they the same thing as tortoises"? OK. So welcome to "Getting Curious", this Jonathan Van Ness. I'm so excited for this, for this episode today because today's episode is about turtles and tortoises. All things turtles. I have Dr. Charles J. Innis, who is the director of animal health at the New England Aquarium. So you're a literal veterinarian expert of turtles and tortoises.

CHARLES J. INNIS [00:00:49] I work on all sorts of animals, but I do work with turtles and tortoises, it's a big part of my job.

JVN [00:00:54] So when you say that you're a vet, honey, it's you do all the animals.

CHARLES J. INNIS [00:01:00] Yeah. I mean, earlier in my career, I was a regular dog cat vet. I worked in a small animal hospital, but I also took care of people's ferrets and rabbits and snakes and iguanas and whatever anyone wanted to bring in.

JVN [00:01:12] But being a vet is like arguably like harder than even being a doctor because you, like your patients don't talk. And doesn't it take like forever?

CHARLES J. INNIS [00:01:18] It's similar to being a physician where we go through medical school training for four years and then there's years of practice experience afterwards to develop the specialty.

JVN [00:01:29] So once you were doing like, you know, you're like, you know had patients, you had clients, like you're just like, you know, being like, like a gorgeous, you know, veterinarian in the world. And then how did you realize that you wanted to start working like more, you know, at like aquarium and like zoo life and tortoise life?

CHARLES J. INNIS [00:01:44] Well, I was always interested in wildlife and non-domestic animals. And so when I was in practice, I wanted to see people's iguanas and turtles and snakes and things like that. And by practicing on them for a long time, I gained enough skills that I was hire-able into a more specialized position at the aquarium.

JVN [00:02:03] And you weren't just like terrified of snakes? Like you're interested in them?

CHARLES J. INNIS [00:02:05] I love snakes. Yeah.

JVN [00:02:07] Oh my, they really scared the bejesus out of me.

CHARLES J. INNIS [00:02:08] I heard your snake episode.

JVN [00:02:10] Oh yes. Snakes really just scare me to high heaven.

CHARLES J. INNIS [00:02:12] Yes.

JVN [00:02:12] So but you, so you, so once you got kind of that like, you know, in real life experience with like, you know, different sorts of-. What like, what are like different animals called like that aren't dogs and cats? Like non domestic animals?

CHARLES J. INNIS [00:02:26] Yeah. We call them wildlife species or zoological species, non domestic species.

JVN [00:02:31] Ooh! So once you get more experience with those ones, then you got enough experience to like be like hired, like at an aquarium?

CHARLES J. INNIS [00:02:36] Right. You learn how to take your skills that you've learned for domestic animals, things like surgical skills, anesthesia skills, endoscopy, ultrasound and you start applying those to all these other species.

JVN [00:02:49] You have to do that too? You have to do anesthesia?

CHARLES J. INNIS [00:02:51] Sure. Absolutely. All the time.

JVN [00:02:53] Wow.

CHARLES J. INNIS [00:02:54] That's what we do. We do everything we need to determine the health of our patients, including turtles and, and then try to make them better.

JVN [00:03:02] So a vet, there's not like an anesthesia-, or an anesthesiologist specifically in vets? Like the vet has to do all of it?

CHARLES J. INNIS [00:03:11] General practitioners like me do all of it. There are specialties within vet medicine with more advanced training, so there are veterinary anesthesiologists and that's all that they do. But we in the aquarium world often have to do all of those things for all of the different species that we work with.

JVN [00:03:27] So I, so like I learn when I interviewed David Letterman. Well, when David Letterman interviewed me that like when you're a journalist, you're supposed to do a lot of like pre-research on everything. But then I realized that I'm more of like a pseudo wannabe like journalist, adjacent person where I don't like to do too too much because I just like to kind of go in with like knowing what I know and if I, because if I do too much research, then it's like I just kind of like like to learn in real time, you know what I mean? So that's part of like what, you know, we're doing. So. Like and my getting, you know, and just chatting to you, but I can't help but hear the word aquarium and think "The Cove". I can't help it. I watched that documentary in like 2013 or '14. It's like super-traumed me ever since. Which I think it's traumatized everyone that ever watched it. So I was reading about the New England Aquarium where you work, which has not had a dolphin in more than 20 years. So you guys were kind of evolved on like the big animals and aquariums thing a hot second ago. Like it wasn't just a little bit ago.

CHARLES J. INNIS [00:04:22] Yeah. We made a conscious decision that our facility was not conducive to maintaining dolphins any longer, a long time ago. And we continue to make

decisions like that all the time. So if there's a species that we work with that we've been trying really hard with, but we just determined that they are not adapted to our setting. Then we move on from that and we work with other species that do better for us.

JVN [00:04:44] So what do you say to people that like just here aquarium and are like "uuuh", like they just get squirmy? Like what's the importance of aquariums to like wildlife conservation and to wildlife research? Like because I think there's a pretty important role there, but I think it's hard for people to be able to connect those dots, like not having context.

CHARLES J. INNIS [00:05:00] Yeah, the aquarium where I work in many aquariums and zoos worldwide contribute a lot to global wildlife conservation. We contribute as much as some of the big name wildlife conservation organizations that your listeners might be familiar with. So annually, the team that I work with is out in the field studying whales, studying dolphins, studying sustainable fishing practices. We do a lot of sea turtle rehabilitation and through the aquariums' messaging, in the building itself, when visitors come to us, they're getting educated about the ocean, climate change, problems facing wildlife and what they can do as individuals and what their communities can do to deal with that.

JVN [00:05:40] I love that. So were, so it really is, or I mean, it just it when you're working in these, in these like settings, it's like you're just getting such a different kind of like experience, because I don't think I'm ever going to hold a tortoise like I mean, or maybe I already have.

CHARLES J. INNIS [00:05:57] You could.

JVN [00:05:57] I guess I could.

CHARLES J. INNIS [00:05:57] If you wanted to.

JVN [00:05:58] But it's like and you're having such a, you know, intimate experience with these animals that like are thousands of, I mean, there's been tortoises on the world for like a hot second, right?

CHARLES J. INNIS [00:06:07] Millions. Yeah. But round 250 million years, the turtles have been on earth. Longer than dinosaurs or before dinosaurs.

JVN [00:06:14] So what's the difference between, because I was just asking right before, I don't know if we got on, but it's like tortoises and turtles. Word on the street. They're not the same. Who knew?

CHARLES J. INNIS [00:06:22] Well, it's mostly language usage thing. In the English language, we tend to use tortoise to apply to things that live on land and turtles for things that live in the water. But there's also the word terrapin, which is another word for an aquatic turtle. And in different versions of English, it's different too, like in England, they refer to a lot of freshwater turtles as terrapins. But in the U.S., we mostly refer to terrapin for one particular species that lives in salt marshes around here.

JVN [00:06:50] Interesting.

CHARLES J. INNIS [00:06:51] Yeah. And there are some tortoises, sorry, some turtles that live on land, but we don't refer to them as tortoises just because that's the vernacular. So a thing like a box turtle, which you find around here as a kid is actually a land turtle, but we still call it a turtle. You know, some people might call that a tortoise. So there's not a scientific distinction.

JVN [00:07:10] So the New England, the New England Aquarium, for instance, like you mentioned, rehab. Is that like something that happens at a lot of places? Like we, like, like what happens to turtles?

CHARLES J. INNIS [00:07:20] Well, turtles need rehab for a lot of reasons. Many turtles around here get hit by cars every year, which is pretty sad. Sea turtles get hit by boats. They got, get caught in fishing gear. They get caught on fishhooks. They can be injured due to weather patterns. We're just seeing in New England right now a stranding event that we refer to as cold, stunning, or these sea turtles wash up on the beaches of Cape Cod every year when the weather gets cold like it is right now. So when I left the hospital last night, we had 66 sea turtles in the hospital that just came in in the past few days.

JVN [00:07:55] So what happens to them?

CHARLES J. INNIS [00:07:57] Well, most of them recover. We have about 80 percent of them that recover and we can release them back to the wild. It usually takes about six to 12 months before they can be released again. But some of them come into us and they've been very cold for a long time, so they may have pneumonia or other types of infections.

JVN [00:08:13] Oh my god, there's turtle pneumonia.

CHARLES J. INNIS [00:08:15] And so we have to treat them medically for a long time to rehabilitate them before they can be released.

JVN [00:08:20] So, OK, you're minding your own business. You're at work. A call comes in. There, we got 66 fuckin', almost frozen turtles on the, on the beach.

CHARLES J. INNIS [00:08:30] Yes.

JVN [00:08:30] So what happens?

CHARLES J. INNIS [00:08:32] Well, we have a big team. My colleagues and I deploy our team and we have a system in place where the turtles are picked up by a network of volunteers on Cape Cod that's run through the Mass Audubon Group. They drive all the turtles to our hospital in Quincy, Massachusetts. And we have a sea turtle hospital.

JVN [00:08:47] Oh, my God. Sister city of my hometown.

CHARLES J. INNIS [00:08:51] Is it?

JVN [00:08:51] Yeah.

CHARLES J. INNIS [00:08:52] Where are you from?

JVN [00:08:52] Quincy, Illinois.

CHARLES J. INNIS [00:08:54] Oh, beautiful.

JVN [00:08:55] And it turns out that Quincy, I was on stage and I was like, "Oh, that's our sister city. Except for it's spelled with a 'z'." And then everyone's like, "No".

CHARLES J. INNIS [00:09:02] It's just how we say it.

JVN [00:09:04] Yeah. Like were like, "No it's not. It's just how we fucking talk". And then everyone's like, "Dummy". And I was like, "Oh". Who knew?

CHARLES J. INNIS [00:09:10] So in Quincy we have a sea turtle hospital. We have lots of big tanks and we have X-ray machines and blood analyzers and ultrasound equipment. And we determine exactly what's wrong with each individual turtle. We treat them specifically for what's wrong with them. We have a lot of volunteers that come in and help feed them every day and try to get them eating well. And it goes on for weeks to months until they're ready to be released back to the wild.

JVN [00:09:36] What if they're, is there ever a turtle that's like too sick or too little or too much of a baby? And they just-

CHARLES J. INNIS [00:09:40] It's very rare. But it does happen. We have turtles sometimes that die on their own. They usually die within a day or two of arriving to us because they are almost dead when they get to us. And some of those will not survive. It's very rare that we have to euthanize a turtle, though. They are very resilient animals and almost always if they survive the first few days with us, they can be released back to the wild. But occasionally there is a illness that's so bad that the most humane thing to do is to euthanize them.

JVN [00:10:09] Is there any like crazy turtle illnesses that like we don't know or that like I don't, that like a normal person wouldn't know about?

CHARLES J. INNIS [00:10:16] Well, I think a lot of people are surprised just to know the turtles have most of the same types of illnesses that we have.

JVN [00:10:22] I didn't know turtle pneumonia.

CHARLES J. INNIS [00:10:23] Yeah, and they have all the same organs that we have for the most part.

JVN [00:10:26] What About STDs?

CHARLES J. INNIS [00:10:27] There are actually. There are herpes viruses that turtles can carry that we think are transmitted by direct contact and sexual contact would be one way.

JVN [00:10:36] Does it affect their eyes like how cat herpes does?

CHARLES J. INNIS [00:10:37] It can affect their eyes. If you look online to turtle herpes, you'll find all of these big tumors that grow on their faces and on their flippers and sometimes internally in their lungs and other parts of their body.

JVN [00:10:48] That are herpes?

CHARLES J. INNIS [00:10:49] Herpes virus, not human herpes viruses. There's a lot of herpes viruses in the animal world and they're not all the same type that humans get. Most animals have their own types of herpes viruses.

JVN [00:10:59] So how do most turtles have sex?

CHARLES J. INNIS [00:11:03] Pretty sure they all do it the same way.

JVN [00:11:05] Really?

CHARLES J. INNIS [00:11:06] Yeah. Yeah.

JVN [00:11:06] Like water or some-.

CHARLES J. INNIS [00:11:07] If you think about the shape and you know, there's not that much soft tissue exposed on a turtle. So they have to navigate around their shells.

JVN [00:11:13] But they have like a penis and a vagina?

CHARLES J. INNIS [00:11:15] They have one penis. A male turtle has a penis. There's not really a vagina. So turtles like birds and fish and amphibians have a cloaca. Right? So everything exits through one opening. And so the male turtle puts his penis-

JVN [00:11:31] Oh my god. Wait, wait, wait, wait, wait, wait, wait, wait, wait, wait, wait, wait, wait, wait, wait, wait, wait, wait, wait. So a cloaca is basically a, it's an, but so the poop and the pee and all of it's in one hole basically?

CHARLES J. INNIS [00:11:43] And the reproductive structure.

JVN [00:11:44] So there's not a butt hole and a vagina? There's just one.

CHARLES J. INNIS [00:11:49] Correct.

JVN [00:11:49] So poor female turtles, birds and who else?

CHARLES J. INNIS [00:11:53] Everything other than mammals. Fish. Amphibians.

JVN [00:11:55] Oh my God. And so they understand the pain of a bottom, honey. Poor things. You don't understand what this is, but it's like, wow. Poor fish and turtles.

CHARLES J. INNIS [00:12:04] It's actually a lot simpler in some ways, right?

JVN [00:12:06] Well, no, it's not, honey. That's spoken as someone who's never been a bottom. Yeah, yeah. That's a different podcast and I don't want to traumatize you so.

CHARLES J. INNIS [00:12:14] Ok. Very well.

JVN [00:12:14] Yeah. Poor turtles. So they all have a cloaca and a penis and then they diddle but then that, what's the, where and then the lady turtles have eggs?

CHARLES J. INNIS [00:12:23] Yeah. So there's sperm that's produced by the male that goes up inside the cloaca. It goes up in the oviducts. They have ovaries and their follicles ovulate like in other species. All of the ovaries' follicles get fertilized in the oviduct. And then those have shells put around them just like bird eggs do. So after the shells are made, the turtle digs a hole somewhere, lays its eggs and the babies incubate. There's no maternal care in turtles. Right? So they-

JVN [00:12:51] So some turtles don't do mater-, so none do?

CHARLES J. INNIS [00:12:54] Well, there's a couple of species that dig these nest mounds, and they lay their eggs and they'll protect them for a few weeks, but not for the full time. And they don't care for the babies after they hatch.

JVN [00:13:04] Ok.

CHARLES J. INNIS [00:13:05] Most turtles just lay, lay eggs in a hole. They go away, the babies hatch and there's no mother around.

JVN [00:13:10] Ok. We're going to be right back with more turtles. More questions. More Dr. Innis right after the break. Welcome back to "Getting Curious", this is Jonathan Van Ness. Hot off the press. We're talking about turtles. So no turtles have maternal instinct?

CHARLES J. INNIS [00:13:24] Well, there's a few Southeast Asian species that will protect the area where they lay their eggs for a few weeks, but that's only part of the incubation duration. So they eventually leave. And when the babies hatch, there's no mother around at that point.

JVN [00:13:38] So, OK, switching gears a little bit, but still tortoise. What are the difference between? Is there like fundamental differences between like sea turtles and land turtles or whatever? Like did, like do they have gills and land-? Tell me everything.

CHARLES J. INNIS [00:13:51] No, there's no gills. So sea turtles did evolve from land turtles and freshwater turtles about 200 million years ago and they colonize the ocean. And living in the ocean is different than living in freshwater or on land. Mostly because of the chemistry of the ocean.

JVN [00:14:07] So there is freshwater turtles?

CHARLES J. INNIS [00:14:09] Sure.

JVN [00:14:09] Saltwater turtles?

CHARLES J. INNIS [00:14:11] Yeah.

JVN [00:14:11] And then land turtles?

CHARLES J. INNIS [00:14:12] Yeah.

JVN [00:14:12] And then there's some that do both?

CHARLES J. INNIS [00:14:14] Not really. There's a few like around here in Jamaica Bay, there's the Diamondback Terrapin, which lives in salt marshes. So they're kind of halfway between freshwater and saltwater, but they are one of the only, only examples that sort of straddles fresh and salt.

JVN [00:14:30] OK, that's interesting.

CHARLES J. INNIS [00:14:31] Yeah.

JVN [00:14:31] So when did this sea turtles evolve?

CHARLES J. INNIS [00:14:34] Sea turtles. 200 million years ago. They colonize the oceans and they had to develop mechanisms to deal with the salt content of saltwater. So if you or I were to try to drink saltwater as our water source, we would become rapidly dehydrated and we would eventually die. Sea turtles have evolved mechanisms through their kidneys and also through these glands behind their eyes, actually, that secrete salt. And so when you see a sea turtle producing tears, a lot of the tear content is actually salt that they're trying to eliminate because of the ocean environment that they live in.

JVN [00:15:09] Oh, that's interesting.

CHARLES J. INNIS [00:15:10] Yeah. Another mechanism they have to deal with, salt, is they've got these big pointed, we call them papilla in their esophagus. So most animals have a smooth lined esophagus. Sea turtles, if you ever open up a sea turtle esophagus, it's an "oh and ah" moment. They have these big pointy nice spikes in their esophagus. Look it up.

JVN [00:15:32] We have papilla on our hairs. So that makes sense. It's like a spiky.

CHARLES J. INNIS [00:15:34] Yeah, but their's are huge. And so they can eat a meal and the meal gets caught in those papilla and then they can regurgitate all the salt water that they just ingested with that meal. So they're not ingesting all of that salt. And that also helps them to live in the ocean and be able to maintain their electrolyte status.

JVN [00:15:52] That's kind of gross.

CHARLES J. INNIS [00:15:54] Well, it's really cool.

JVN [00:15:55] But I, but I, but it is cool. But like also, like, what are some other interesting kind of like visually icky looking turtle things?

CHARLES J. INNIS [00:16:04] Visually icky looking. Well, the penis that you mentioned earlier is one. So the turtle penis is sort of this short mushroom shaped looking thing. It has a groove down the center of it. So they don't pee through their penis. They only move sperm through their penis.

JVN [00:16:21] Where do they pee?

CHARLES J. INNIS [00:16:22] They pee through their urethra directly into their cloaca. And so, so you can actually-.

JVN [00:16:26] So men have a cloaca too?

CHARLES J. INNIS [00:16:27] No, men's urethra is run through their penis. The turtle urethra runs into the cloaca and not through the penis. So we can amputate a turtle's penis if we have to, which comes up sometimes.

JVN [00:16:39] Why?

CHARLES J. INNIS [00:16:39] And it doesn't affect their ability to urinate.

JVN [00:16:41] Why?

CHARLES J. INNIS [00:16:42] Why? Because they are promiscuous and they can traumatize themselves sometimes. So they will be sometimes mounting things that look like a turtle. They'll try to copulate with a rock or some other inanimate object, and they can injure themselves.

JVN [00:16:57] They'll bruise it?

CHARLES J. INNIS [00:16:58] They'll really damage it. And so we try to save it. We put it back in and try to fix it up. But times come when we have to amputate it.

JVN [00:17:06] Wow. So do boy turtles not have testicles?

CHARLES J. INNIS [00:17:11] They do, but they're internal. They're up near their back, underneath their shell. Yeah.

JVN [00:17:15] And are they balls?

CHARLES J. INNIS [00:17:15] We've actually developed methods to neuter turtles if we have to.

JVN [00:17:18] Are they balls?

CHARLES J. INNIS [00:17:19] They're little round things. Yes. Yeah.

JVN [00:17:21] And so how do you do it? Because you have to go, because you know what?

CHARLES J. INNIS [00:17:24] We do it through laparoscopy. So you've heard of minimally invasive surgery in other species?

JVN [00:17:29] Uh huh.

CHARLES J. INNIS [00:17:29] So we can make these little incisions in front of their hind leg. We go in with scopes and we can see the testis and we can use instruments to remove them.

JVN [00:17:37] And then like the turtle just comes out and they're like not so horny and not trying to diddle everything any more?

CHARLES J. INNIS [00:17:40] Yeah. The same reason why you might neuter your dog sometimes in captivity. We neuter turtles. And we spay turtles, too.

JVN [00:17:47] Has there ever been like giant turtles?

CHARLES J. INNIS [00:17:51] There still are. There's the leatherback turtle that still exists. It's the last remnant of its family that evolved around 100 million years ago. Leatherbacks are about five feet long and they can weigh 1000 to 2000 pounds. And we do work with leatherbacks in New England.

JVN [00:18:06] Five feet long.

CHARLES J. INNIS [00:18:08] Yeah.

JVN [00:18:08] And weighs?

CHARLES J. INNIS [00:18:09] 1000 to 2000 pounds when they're full grown.

JVN [00:18:12] Where did they naturally inhabit?

CHARLES J. INNIS [00:18:14] They're worldwide in warm ocean environments. They're actually really interesting they go through these very long migrations, so they tend to nest in tropical habitats in this part of the world. They nest in the Caribbean, Florida, but they migrate huge distances. So we see leatherbacks off of Cape Cod and Canada in the win-, in the summertime, and then in the wintertime they go back. They migrate all the way to South America and the Caribbean islands during their breeding season.

JVN [00:18:41] Holy shit. So sometimes like leatherback might get hit by a boat or something? And might end up.

CHARLES J. INNIS [00:18:46] Absolutely, yeah.

JVN [00:18:46] Really?

CHARLES J. INNIS [00:18:47] I've seen leatherbacks hit by boats. We also see leatherbacks getting wrapped up in ropes from fishing gear that's in the ocean, just the way we do with whales. So one of our big concerns for leatherbacks and other sea turtles are these industry interactions with shipping and also the fishing industry.

JVN [00:19:05] So is there anything that like any normal person can do to help with that? Is there any like or just donations or something like?

CHARLES J. INNIS [00:19:13] Well, from the boating perspective, we think that a lot of sea turtles that get hit by boats are actually hit by recreational boaters. And so if you are in areas like some parts of Florida where sea turtles are very common during their nesting season, we ask that boaters really be paying attention. Try not to have your boat on super-fast autopilot while you're partying on the back. You know, be looking straight ahead and making sure that you're looking out for all the animals that might be in your way.

JVN [00:19:39] So there could be the gigantic leather turtles in Florida?

CHARLES J. INNIS [00:19:42] Yes, they nest in Florida, usually in the early springtime, late winter. Yeah.

JVN [00:19:47] Really?

CHARLES J. INNIS [00:19:47] Juno Beach is a hot spot. If ever there in the late February, March into early April, you may see leatherbacks nesting. Yeah, it's really cool.

JVN [00:19:55] When I was in the Philippines in 2013, I was on this island called Palawan on with my cousin.

CHARLES J. INNIS [00:20:00] I was in the Philippines in 2013 on Palawan.

JVN [00:20:04] What month?

CHARLES J. INNIS [00:20:05] When you were there? I don't know. Maybe July.

JVN [00:20:06] I was there in February.

CHARLES J. INNIS [00:20:07] I was there in July.

JVN [00:20:08] Oh, we weren't there.

CHARLES J. INNIS [00:20:09] There was a big turtle confiscation there. That's why I was there.

JVN [00:20:13] Well, there was these, when I was on the beach and there was these like nets up around like, you know, like like box nets like. And then they're like, "Oh, these turtles aren't going to hatch until like whatever date". But then the next day, these little baby turtle hatchlings came up and they were called like the olive turtle, I think.

CHARLES J. INNIS [00:20:29] Olive Ridley. Yep.

JVN [00:20:31] Yeah. And I saw these little baby sea turtles, but they said that they'd take them to a turtle sanctuary.

CHARLES J. INNIS [00:20:35] Great experience.

JVN [00:20:35] To like, let them, like, get big so because they were like if they just let them out of those little things right? Then like only one would survive. But they said they take him to this other place, like let him get bigger and get their shells hard and stuff.

CHARLES J. INNIS [00:20:43] That's called head's starting. So we do that with some turtles that are very prone to predation when they're babies. We can raise them in captivity for six months or a year, get them to a much larger size so they'll survive.

JVN [00:20:54] Do they learn? Do they lose their little wild instincts when you do that?

CHARLES J. INNIS [00:20:57] No, we don't think so. Turtles are pretty hardwired and we take precautions not to imprint them too much when they're with us. So we have good results, good data to suggest that head started turtles that are released actually do survive pretty well.

JVN [00:21:12] Because you give them like a little collar or something?

CHARLES J. INNIS [00:21:14] Not necessarily a collar, but some sort of microchip or a radio tag or a tissue marker that we can implant on them. Yeah, there's various ways.

JVN [00:21:23] What was the turtle confiscation of 2013?

CHARLES J. INNIS [00:21:25] So there's a there's a turtle called the Palawan Forest Turtle. That is very rare. They're only found on that island in the whole world. They were only discovered about 20 years ago. And because of their rarity, they're prized in the illegal wildlife trade. So people will spend thousands of dollars for one individual of that species to have it in their private collection. And that's true of other species of wildlife that are in the wildlife trade. So there was a giant confiscation. Almost 3000 of these turtles had been collected by poachers. They were stationed in a warehouse ready to be shipped off the island when they were intercepted by the local authorities. And then they called in veterinarians from around the world to go help with all of those turtles, rehabilitate them. And we released the majority of them back into the forests on the island.

JVN [00:22:15] Were they OK?

CHARLES J. INNIS [00:22:16] Not all of them. We had about half of the group initially that looked OK, but the other half had been captive for a long time. We saw a lot of pneumonia, a lot of shell infections.

JVN [00:22:27] What do shell infections do?

CHARLES J. INNIS [00:22:30] A lot of eye infections. Well, in the worst case scenario, shell infection eats all the way through their shell and exposes their internal organs and they die. If we catch it soon enough and they're still shell left, we can surgically clean it up, get them on antibiotics for a long time and they can regenerate parts of their shell.

JVN [00:22:46] I wanted to ask about that. So is that a thing? Shell regeneration?

CHARLES J. INNIS [00:22:51] Yes, the shell is bone. It's the type of bone that our ribs and our vertebrae are made of. So that's how those shell evolved is from expansion of the bones that form your vertebrae and your ribs. And so it has bone healing properties like other bone does. So if the bone has blood supply and we prevent infection and we get the bone edges near each other, it can heal just like any other broken bone can heal.

JVN [00:23:17] That's pretty incredible. So-

CHARLES J. INNIS [00:23:19] Yeah, it's amazing.

JVN [00:23:19] So if, so if there's, but if there gets to be a hole in the shell.

CHARLES J. INNIS [00:23:25] It can still heal. So turtles are really amazing in that if there's a full thickness hole in their shell and the bone is gone, they will start laying down layers of scar tissue. We call it fibrous connective tissue and it's sort of this spongy pink soft tissue. But over time, it fills in the void. And over years, it mineralizes. So it turns into new bone. And we are just working on trying to document that on a microscopic level, it's never really been thoroughly described. And we see it with our naked eye when we watch turtles heal. But we're really interested in how they can regenerate bone to that capacity because that could have implications for bone healing in other species too.

JVN [00:24:06] That's incredible.

CHARLES J. INNIS [00:24:08] Yeah, yeah. It makes the vets look good but really, the turtles did all the work. We had one last year that had because of frostbite, it lost a large section of its carapace, which is the top shell of the turtle and the bone and all the ribs associated with it sloughed away. And so it's got this, you know, 8 inch by 12 inch wide area of soft tissue exposure. And just under it is it's lung. And when it's breathing, you can see it's tissue.

JVN [00:24:33] There's only one lung?

CHARLES J. INNIS [00:24:34] There's two lungs.

JVN [00:24:35] Oh.

CHARLES J. INNIS [00:24:35] But this is on one side of this turtle. When it breathes, you can see the tissue moving and its lung is right under it. So you could imagine how prone to trauma that would be in the wild. So we're keeping that turtle captive for probably another year or so as that fibrous connective tissue forms. And whenever we think it's mineralized enough and strong enough, we'll release that turtle.

JVN [00:24:54] Wow. So okay. So okay. So there's the turtle, then the turtle shell and then below the shell is just like, like a thin skin and then all of its organs are just floating around in there.

CHARLES J. INNIS [00:25:06] All the organs are in there. So just below on the top shell, the carapace, just below that are the lungs, one on each side. They've got a right and left lung just like we do. Behind the lungs on the top are the gonads and the kidneys. And then below that, like on

the equivalent of our belly, if you go under the plastron, which is the shell that's on their belly, there's the stomach and liver and pancreas, gallbladder, all the usual organs that we have.

JVN [00:25:31] So between the bottom shell and the top shell, there's no shells in the middle?

CHARLES J. INNIS [00:25:36] No, that's right. It's all soft tissue inside there. Yeah. Well, that's true. They've got their shoulder girdle and their pelvic girdle. So the bones that support their front legs and their hind legs are inside their shell.

JVN [00:25:49] So no turtles get new shells and then, like they don't like leave one shell and go to-. No. Like a hermit crab.

CHARLES J. INNIS [00:25:55] No. They don't mold their shell. They do not. That's a common like Bugs Bunny cartoon where the turtle used to hop out of his shell and go on, you know, a race with Bugs Bunny. That doesn't happen. So if a turtle loses its shell to a large enough degree, it will be a dead turtle. Yeah.

JVN [00:26:10] So what? So there's, so is this turtle that's healing now, at the aquarium, that had like the 8 inch by 12-inch like hole, has there ever been a turtle where like the whole back of its back got like bit off or fell off and it like, and the whole thing regenerated?

CHARLES J. INNIS [00:26:26] Yeah. We've seen turtles in the wild where it looks like that has happened, particularly after exposure to fire. So some of the land tortoises that might be burnt during fires. We've actually seen them exteriorize the burned section of their shell. And underneath it, they're growing a new layer of shell. It's pretty amazing. It takes a long time, but it does happen.

JVN [00:26:51] Oh my god, ok. Well, on that note, I'm gonna let you guys go have a little cry and then we're gonna take a really quick break and we'll be right back with more Dr. Innis after this. Welcome back to "Getting Curious", this is Jonathan Van Ness. So we're talking all things turtles with Dr. Charles Innis. So. We were talking briefly about the wildlife trade, illegal wildlife trade. So how widespread is that? How big of an issue is that?

CHARLES J. INNIS [00:27:19] It's huge. Along with, you know, weapons and drugs and human sex trafficking, the wildlife trade is one of the biggest illegal global trades. It affects all species of animals. The popular ones that most people have heard of are the trade in, is the trade in elephant ivory, rhino horns, things like that. But there's a huge global trade in turtle products and live turtles. There's a huge trade in bizarre animals like pangolins, actually, as one of the biggest species that's in demand right now.

JVN [00:27:53] That's like those like rare kind of armadillo looking things.

CHARLES J. INNIS [00:27:56] Yeah. Yeah. They've got these scales. The scales are valued in traditional medicine in some parts of the world. And there are confiscations of thousands and thousands of pounds of pangolin skins.

JVN [00:28:06] Are turtle products, what are turtle products? And what are they lucrative for?

CHARLES J. INNIS [00:28:12] Well, the meat is eaten. So just the meat products themselves. But also the shell is thought to have medicinal properties in some parts of the world. So powdered turtle shell, powdered turtle bone and, and then live turtles to meet the demands of exotic wildlife collectors.

JVN [00:28:32] That's one thing I didn't ever-. So there's like there's exotic turtle collectors?

CHARLES J. INNIS [00:28:37] Yeah. Like any exotic pet niche. People get into their thing and there's definitely collectors that are into turtles. And I actually I myself am sort of a collector. I mean, I got into it when I was a kid. I kept pet turtles when I was a kid. I kept turtles that I bought through the pet trade that now I know better that I should not have bought when I was younger. And I've tried to convert that now into a passion for turtle conservation. So at my home right now, I am still keeping turtles, but I'm breeding them. And they're parts of sanction breeding programs for endangered species.

JVN [00:29:16] Oh, how many endangered species of turtles is there in, in, in North America?

CHARLES J. INNIS [00:29:22] Our native species, about half of them are threatened in some capacity worldwide. Also, we think about half so there's about 350 turtle species in the world and we think about half of them are threatened in some way. And that's due to habitat destruction, the illegal pet trade, disease, being hit by cars, things like that. So globally, humans have had a pretty negative impact on turtle populations in general.

JVN [00:29:51] With turtles, generally, they end up in rehab or end up like injured, is it a plastics issue or is it like boating? And like ropes?

CHARLES J. INNIS [00:29:59] It's varied. Plastics is one thing that I am sort of on a bandwagon about. I think the plastics things for turtles has been overstated actually. Turtles have many bigger problems than drinking straws. The, the drinking straw thing got a lot of PR. It was a viral video. And, you know, it was a sad case. But compared to the number of turtles that are involved with fishing interactions, hit, and hit by cars. Plastics are actually a fairly small component of turtle problems.

JVN [00:30:35] So what are the biggest threats that turtles face?

CHARLES J. INNIS [00:30:38] Well, just looking out the window here in New York this morning, just, you know, habitat loss is the biggest thing in North America anyway, in Europe, we keep expanding our population, expanding our neighborhoods, expanding our cities and the habitats, the well and habitats and forests where turtles live are becoming fewer and fewer and they're not connected to each other anymore. So turtles are forced to try to find other turtles by moving across highways. The females, when they are carrying their eggs, go listing, look looking for nest sites and they cross-roads sometimes to do that. And so a lot of adult turtles are killed every year by vehicles just due to habitat loss. And then in the oceans, as we mentioned, the big things are fishing interactions and, and boat vessel interactions.

JVN [00:31:26] And, oh can't even handle. So zoos, aquariums. I think it's interesting that you had your own evolution on just you've been a lifelong like person who's been interested in turtles your whole life. You'd like had a evolution on like, you know, captive turtles, as even the aquarium that

you work for or work with has had its own evolution. So it's like where do you see that kind of wider evolution going in aquarium spaces and how it relates to conservation and, and kind of animal care?

CHARLES J. INNIS [00:31:57] I think we are moving in a direction of conservation and sustainable animal collections. The public is no longer tolerant of zoos and aquariums that do a bad job. They don't want to see a menagerie of individual animals in small cages. They want to know that the animals that are in captivity, under human care, being cared for, for educational purposes, are having good welfare. That their social demands are being met, that their psychological needs are being met, that they have big habitats that are interesting to them where they can display their full repertoire of normal behaviors.

JVN [00:32:37] So how do you do that? I just wrote down like "happy animals". Like how do you do that?

CHARLES J. INNIS [00:32:41] Yeah. Happy animals. Well, first, is we think about it all the time. We, I work with a group of a few hundred professionals. And every day when we go to work, our mission is to take good care of our animals, make sure that our animals are healthy, that their welfare is met, that they're doing an effective job at teaching the kids that come through the aquarium every year and the adults that come through that their messages is important and that conservation is important. So we are just constantly reviewing our policies. We have a full time vet team at our aquarium, three veterinarians and five veterinary technicians. We have 100 or more animal care professionals that do all the daily feeding and cleaning and all of that.

JVN [00:33:22] But like generally, is it that you just make sure they have like enough friends, they have enough like plants that they would have in their natural habitat?

CHARLES J. INNIS [00:33:29] Yes. Yeah. So we talk about habitat enrichment, psychological enrichment. We want to make sure that the animals have things to look at, to pay attention to, to be interested in so that they feel like they're in a more natural environment and all of their natural behaviors can be portrayed.

JVN [00:33:48] How do you keep like, you know, like if you have like fish at home, like, don't actually change the water?

CHARLES J. INNIS [00:33:54] Yeah. If you have a small fish tank with no filtration systems or any other life support system, the water will get contaminated with the waste products from that animal. And so in big situations like where I work, we have sophisticated mechanical systems like you would see in a sewage treatment plant where the water comes out of the exhibit, goes through multiple different types of water treatment, mechanical systems and then gets returned in. So it gets disinfected. The chemical waste gets removed, the particulate matter waste products get removed. And if it's functioning well, we have a very stable, chemically stable, environmentally stable system.

JVN [00:34:34] But do guys have to have like a solar generator or something like in case like the power goes out or something?

CHARLES J. INNIS [00:34:38] We do, we have backup systems. We do worry where I am, right on the harbor in Boston Harbor. We get these big storm surges now that are increasing in frequency. And we're talking a lot about our resilience and especially our ability to deal with power outages during storms. So, yes, we have a lot of backup systems to be able to keep all of the systems running.

JVN [00:35:00] That's so interesting.

CHARLES J. INNIS [00:35:02] Yeah.

JVN [00:35:02] So what about like acidification of oceans and how that relates to turtles is like, is that a thing?

CHARLES J. INNIS [00:35:10] So far, we don't think it has much impact on turtles because turtles are getting a lot of their nutritional needs from things that they eat. And the P.H. of the water, the acidification of the water is less of an impact on air breathing animals like turtles than it might be on things like fish and corals.

JVN [00:35:31] So turtles never have gills?

CHARLES J. INNIS [00:35:33] Turtles do not have gills. They have a trachea like we have and two lungs. And so they come to the surface, they take a breath and they breathe just like we do.

JVN [00:35:41] So even sea turtles, they gotta like-, see, in my imagination, they were just down there like Nemo, honey, just like never coming up.

CHARLES J. INNIS [00:35:46] No, they do need to surface to breathe. And that's why sometimes sea turtles can drown in fishing gears if they're caught in fishing net or in a trawl underwater and they can't breathe just from the water, they have to come to the surface to be able to breathe.

JVN [00:35:59] Def.

CHARLES J. INNIS [00:35:59] Yeah. Yeah.

JVN [00:36:00] So how do we really do surgeries on little turtles? Like you just got to-. How does that happen? How does it work?

CHARLES J. INNIS [00:36:07] There's two ways. So historically we used to make incisions through the bone of their shell, which is invasive, as you can imagine. It's like cutting our skull open to do brain surgery, which can be done. But if you can avoid doing that, that's the better way. So over my career, colleagues and I have worked to develop methods of minimally invasive surgery for turtles. So using these instruments that really have been designed for human pediatric surgeries, for laparoscopy, we can make very small incisions in the soft body parts aside from the shell, like in front of the hind leg or in front of the front leg, and we can put a scope into their body and view all of their internal organs. And as soon as you can see it, that means you have an opportunity to do something with it. And so now if a turtle has a bladder stone or a turtle has a fishhook in its stomach. Almost always we can get that out of their body without cutting through their shell. And that's really been an advancement over the past 30 years or so.

JVN [00:37:09] So do you know about like, like what, like what's like the most endangered like turtle ever? Like or like right now that's like still alive?

CHARLES J. INNIS [00:37:17] Right now? Well, there's a couple that just went extinct.

JVN [00:37:20] No!

CHARLES J. INNIS [00:37:20] Or like largely extinct. So we know, you may have heard of Lonesome George, who was the last of the Pinta Island tortoises in the Galapagos. He died a couple of years ago. The Fernandina tortoise in the Galapagos we thought was extinct but one of the National Geographic teams recently just found an individual, we think. And so they're still looking. There's a species in China, the Yangtze River softshell turtle. Giant, huge giant, huge turtle.

JVN [00:37:46] Why is it a soft shell?

CHARLES J. INNIS [00:37:48] Soft shell. It's a type. It's a family of turtles. The soft shells, they have a leathery shell. Instead of having a very bony shell, they have to like this tight, leathery skin stretched over their body. That's the family trionychidae. Anyway in China, there, we think there were two left of this species and one of the females died recently. So there's only a single male left that we know of. We believe there might be a couple individuals in lakes in Vietnam. But as far as we know, for that species, there's only three of them left.

JVN [00:38:18] What if you took like a box turtle and mated it with one of those soft? Would they even do it?

CHARLES J. INNIS [00:38:24] No. There are hybridization observations in turtles, but they're rare and they need to be pretty closely related species to be able to do that. So we think that for that particular soft shell species, we really need to find another female for that male. It's a sad story with that male too, his reproductive structures have actually been damaged at some point in the past. And so the group in China that was trying to work with them was actually harvesting sperm from him artificially and trying to do artificial insemination in the female.

JVN [00:39:00] So. Ok. Cross that. Yes. Yes. Hmm. So, OK, we've reached this point in the podcast where, have you've ever been to yoga?

CHARLES J. INNIS [00:39:10] I've done yoga, I've never gone to a class, but I've done in my living room.

JVN [00:39:13] Oh, OK. Well, if you ever go to a class, there's this time where the yoga teacher say, like, okay, like if there's anything you wanted to work on today, but you didn't get a chance. Like, is there any like major like big like column of things that like we didn't get to in turtle stuff? Like what do we need to know about turtles that I didn't get to? How are they doing these days? Like, how can we be? How can we be more supportive of turtles?

CHARLES J. INNIS [00:39:34] We can support turtles like with supporting other wildlife. Mainly we need to give turtles a place to live and we need to stop killing them. So if we support any efforts to

habitat conservation, just local parks, local nature centers, forested habitats that haven't been developed yet. Any sort of land conservation, wetlands conservation will be good for turtles. And then we just need to keep an eye out for turtles so that we don't accidentally kill them. Turtles have adapted this lifestyle where very few of the babies live to be adults. And so those adults are extremely valuable. It might have taken 1000 babies to end up with that one adult. And so the worst possible thing we can do to a turtle population is to kill those adults that took thirty, 20, 30, 40 years to get to reproductive age.

JVN [00:40:26] How long do turtles live?

CHARLES J. INNIS [00:40:28] We don't entirely know is the correct answer. We believe that there's definitely individuals that have lived over 100 years, but it's only been in the last hundred that we've really started paying attention to this question. So what we really want to see over beyond my lifetime is turtles that were marked as known individuals with a microchip or something in populations now. And how long, you know, can we still find them into the future?

JVN [00:40:53] I wonder what the earliest living, microchipped turtle is now? Like-

CHARLES J. INNIS [00:40:56] Well, not necessarily microchipped, but we have colleagues in the Midwestern U.S. that started marking turtles by these little notches that you can etch on the shell in the 1950s. And some of those turtles are still there and still reproducing. It, and at the time they mark them, they were adults. So those turtles might already be one hundred years old and they're still reproducing.

JVN [00:41:17] Wow. That's really interesting. Wait, but I feel like I cut you off when I was in the middle of asking you the yoga recess part. Like what? Oh, yeah. Conservation, wetlands, conserve stuff. Donate to? Is there any like major league turtle rescue places that you love?

CHARLES J. INNIS [00:41:31] There are. There are major turtle conservation organizations globally. The Turtle Survival Alliance is one of them. TurtleSurvival.org. The Turtle Conservancy is based here in New York City, does excellent work globally. So those two organizations are really looking out for the world's turtles, deploying emergency personnel to parts of the world where turtle conservation is sorely needed. And we're also training people in those countries how to conserve their own turtles. It's hard when countries are faced with more important issues like warfare and poverty and climate change to get them to focus on something as simple as turtle conservation. And so we don't need just turtle scientists to be working on this. We need politicians and lawyers and social justice warriors to, you know, try to get the world to be generally a better place for wildlife.

JVN [00:42:26] Dr. Innis, thank you so much for your time. I really appreciate it.

CHARLES J. INNIS [00:42:29] Thank you. It's been fun.

JVN [00:42:33] You've been listening to "Getting Curious" with me, Jonathan Van Ness. My guest this week was Dr. Charles J. Innis. You'll find links to his work in the episode description of whatever you're listening to the show on. Follow us on Instagram and Twitter at CuriousWithJVN. Our theme music is "Freak" by Quin. Thank you so much to her for letting us use it. If you enjoyed our show, introduce a friend and show them how to subscribe, honies. "Getting Curious" is produced by me,

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