Getting Curious with Jonathan Van Ness & Dr. Gavin Naylor

JVN: if you know one thing about Getting Curious, you know that I love an animal episode, I love like the animal kingdom. I love a scientist and honey, we gotta learn about animals. You know, over the years we've covered sea turtles, prairie dogs snakes, killer whales. So lately though my algorithm is just giving me shark bite, shark attack, it's giving me Jaws. Like what's going on with sharks? Are they more mad than, than usual? How do we survive a shark attack? Like what's the tea, what's the shark tea to learn all about this? We brought in the one, the only Dr. Gavin Naylor. Dr. Gavin Naylor is the Director of the Florida Program for Shark Research at the Florida Museum of Natural History. He focuses his research on evolution, genetics, biogeography and the natural history of sharks. Dr. Naylor is also interested in the exploration of the biodiversity of certain fishes, which name you guys. I really cro- chondrichthyan fishes, chronda and vicious sounds good. Some little bastard should get this in the national spelling bee competition. Fuck them right on up. They would never know how to spell this thing. Today, we are asking what is going on with sharks? And if you stick around to the end of the episode, we'll reflect on what we learned and what I'm teaming to understand next. But now it's time to get to our interview with Dr. Gavin Naylor. Dr Naylor. Welcome to the show. How are you?

DR. GAVIN NAYLOR I'm fine. How are you?

JVN: Good. Now, you guys, because I just did the intro and you guys heard me say, Dr. Gavin Naylor. I do have permission from Gavin to call Gavin, Gavin. People know I love a PHD around here, a doctor and so we love that. So here's the thing though. I'm hearing about great white sharks off like the Hamptons and like by Fire Island where all the gays go, you know, gay people are already going through enough like much less what you know, like that's so that's one thing. But then I live in Texas and just this last weekend, these four people in, in uh in that one Texas island that island off the coast Texas, they got bit and one like, I mean, good God. And then in Florida they're just biting everybody. And so is it, is it getting too hot? Are they biting more now? Are they biting less? Oh and not to go all over the place. But I saw this other article about these like sharks that like are only in Florida and they're just like spinning around like these fish are spinning and they're dying. So, you know, that's a lot to cover and I know that you are like, literally doing a lot. But what's up with that or does it seem like they're more mad?

DR. GAVIN NAYLOR: So it's a time of year thing every year, everybody always calls us up and says why there's so many bites this year than previously. And, uh, in fact, this year, uh, that being really, it started off as a fairly slow year. There's been fewer bites than normal, uh, until about a month ago. And, uh, as soon as the sharks start biting people, everybody seems to get terrified and, uh, it gets a lot of attention, uh, far more than, than other risks, like, uh, uh, you know, traffic accidents. Um, and so, uh, this year there, there haven't been any more bites than it is difficult for this time of year. There was, uh, some fairly dramatic bites or there were some dramatic bites in Florida of Fort Walton Beach where a 45 year old lady in a sandbar was bitten, uh, quite badly. And thank goodness for the, uh, the, uh, emergency services. She was spirited away very quickly and she seems to be doing ok, but then an hour later, a short way down the beach, a couple of teenagers were in the water and they got bitten too. And so two bites in rapid succession on a tourist beach gets a lot of attention very quickly. Um, and so that got people very primed. And then, uh, just, uh, last on the fourth of July weekend, a couple of people were bitten and one person was injured and

another person, the shark rubbed next to them and their skin is very rough and so that can hurt a lot. So, in fact, two people were bitten but the four people, um, were sort of treated for, um, uh, medically.

JVN: How many fatal shark attacks are there? Like a year in the world?

DR. GAVIN NAYLOR: Pretty low. Last year we actually had 10 because there was a bit of an uptick in fatalities in Australia.

JVN: I swam off the coast of Perth before I did. And can I tell you, I saw this net for the people to swim in and I was like, I should swim in that net but it was more cloudy in the net and it was a little more turquoise, you know, off that little Winslow beach or whatever. That's like, so pretty over there. And so I was like,I was like, oh, and I was ok. I mean, I didn't obviously get eaten or attacked by a shark, but

DR. GAVIN NAYLOR: I think you'd be fine. I think it'd be fine. I mean, Jonathan, you probably do a bunch of different things and all of them have an associated risk.

JVN: No, you're right. Yeah,

DR. GAVIN NAYLOR: I mean, if a life with no risk is a life with no fun. Right. And so you have to decide how you want to deploy a risk and the chance if you go swimming in the ocean or surfing. Um And that's a hell of a lot of fun and the risk rewards are worth it.

JVN: Do all sharks migrate or no?

DR. GAVIN NAYLOR: Just some of them. And so the black tips are the best documented. They're the ones in, in between 10 and 15,000 and they all come down to, um to, uh, so that to South Florida in, uh, in the, uh, in the winter and then they all go, uh, uh, back up to the Carolinas in the summer. And so we got this pulse in around March where there's a lot of them off the coast of Newbury Beach and we can see that there's a incidence of bites goes up in March and then on the return journey in October, we see that there's, you know, a, a blip when they go past New A beach also in October. It's, uh, it's the storm season and we get some really big hurricanes and of course, the surfers love hurricanes because the waves are better. So we get more surfers out there. And so that means more people in the water. So there's a higher probability of being bitten, but not all sharks migrate. You're absolutely right.

JVN: So they do all migrate.

DR. GAVIN NAYLOR: No they don't. They absolutely do not. In fact, uh, most sharks are pretty small. They are about 2 ft long. There's 530 different kinds of sharks and only about uh 30 of them have ever been implicated in biting people.

JVN: Oh, only 30 species?

DR. GAVIN NAYLOR: And the ones that we most hear about are the ones which result in fatalities such as white sharks. You mentioned tiger sharks and bull sharks and occasionally oceanic White Tip sharks. But those are the sort of four that are most responsible for fatal bites.

JVN: How come we hear about these great white sharks off the coast of Fire Island and like the Hamptons. But then they're also over in fucking Australia. Like why are they all over the

fucking place like that? If they're not migrating together, like how they get all over the goddamn place in the fucking first place? These fucking, I mean, no offense in the sharks. I mean, I'm sure they're great. I just don't wanna meet one in the wild and I just wanna like not do that.

DR. GAVIN NAYLOR: So you're absolutely right. So white sharks are everywhere. They're all over the ocean.

JVN: Oh and also speaking of that, are we not saying great white anymore? Is that very jaws? Is that very like the -

DR. GAVIN NAYLOR: The scientists say white sharks, and they get a little bit irritated but you know, you can call them great white sharks, you can call them.

JVN: No, I don't want to, I want to be, I want to be a good student.

DR. GAVIN NAYLOR: Just white sharks. White sharks is good.

JVN: How many species of white sharks are there or is there only one white shark?

DR. GAVIN NAYLOR: There's just one species of white shark. There's three populations of them that are genetically a little bit different.

JVN: But there’s just one thing that happened in wales.

DR. GAVIN NAYLOR: That's right. Yeah. Absolutely.

JVN: So, the, so the three populations of white sharks are off the Hamptons

DR. GAVIN NAYLOR: Off of the North Atlantic.

JVN: Ok.

DR. GAVIN NAYLOR: They're in South Africa and Australia and then the other ones in the Eastern Pacific.

JVN: Eastern Pacific. Oh, yeah. Yeah. Yeah. So there's one population off California, like all of California or is it more southern California

DR. GAVIN NAYLOR: All over, all over all of the population is the same from California all the way across to Japan. The entire Pacific Basin is one popular. I mean white sharks can move like 3000 kilometers in a few months. So they move all over the place. So the reason we see them right is the human bias. Humans see white sharks when they come to the surface, white sharks come to the surface when they're preying on mammals. So we find white sharks, surprise, surprise, New England where there's close to seal colonies um down in South Africa, close to seal colonies, Australia, close to seal colonies and California close to seal colonies. But a lady once called up and said, Doctor Naylor, there's been a, a white shark recorded and tagged in the Gulf of Mexico. Does that mean they're expanding? And they're all gonna come and eat us I'm like, no, they've been in the Gulf of Mexico for thousands of years, but there's no seal populations in the Gulf of Mexico. So we don't see them that we only see them when they come to the surface. Right. So our view of white sharks is completely biased by where we see them. It's called, uh, you know, uh, uh, uh, confirmation bias, right. So we expect to see them there at the surface and we only see them where they're feeding on seals. But juvenile white sharks feed more on bony fishes. So it's

really quite interesting because they sort of transition from feeding on bony fishes to marine mammals when they are about teenager size, about 11 or 12 or 13 ft long. Well, it's being shown in Australia that there's a hierarchy in white sharks that some of the juveniles are displaced or the smaller ones are displaced by the big females. So if you're feeding on a resource and there's AAA seal colony, the large females are likely to monopolize the key spots and all of the juvenile sort of 1013 ft uh uh sort of teenagers are gonna be pushed to the margins. Well, in New England, the white shark population has been expanding because the seal population is expanding. So, more and more white sharks are there. The big females are circling around where the the key plum spot is and all the other uh sub uh lower ranking animals are pushed to the margins while some of those margins may interact with where people are swimming on the beaches. So if you're a juvenile white shark that is just transitioning from feeding on fishes to feeding on mammals, and you see somebody flopping around, you know, on a board or on a boogie board, they kind of, and you're just transitioning just learning how to target animals floating at the surface, then a human flopping on the surface looks a little bit like an unaware seal. And so we've got the confidence of the fact that you, you know, large female white sharks in New England don't un very rarely responsible for shark bites on people.

JVN: We learn from Dr Giles, how like the, like the like how like the different like populations of killer whales are like literally like genetically, like distinct, like they're totally different from each other. Is that true of the white sharks as well?

DR. GAVIN NAYLOR: Excellent question, Jonathan. And we don't know, but I suspect it might be the case and the reason I say that and this is speculation. So for those sci scientists that are listening in, I apologize because it is speculation. It's not supported by fact, but the fact that white sharks can traverse the Atlantic in a summer, they can go all the way across from the, you know, uh from North America or, you know, halfway across the Atlantic Ridge and back again in just a summer and they live 70 years suggests that a white shark could go all the way around the world 10 times over. But they don't, they stick in these genetically distinct populations and they don't move from the Atlantic down into the Indian Ocean or from the Atlantic across, into the Pacific. But they could. So, why don't they? Well, we're speculating, we don't know if this is true, but maybe they don't treat each other very nicely. Maybe they're not so friendly, just like dolphin pods or killer whale pods, they're genetically distinct. And when they interact with other um animals that are from a different population, maybe they, they don't play nicely. Now, that's very speculative. We, we do see that a lot of white sharks have some pretty nasty bite injuries on them from, they can only be from other white sharks. Um It's highly speculative and, and may not be the case, but it is something that we have been entertaining. And so the idea that there could be these pods or genetically distinct groups that um have a structure that is unique and distinct from other uh similar groups is something that uh hasn't been fully explored but might be what's going on.

JVN: it's a long story short. We don't need to be so afraid of sharks. They're like gorgeous interesting creatures. So let's get into that more now that all of my fear that I've ingested from the internet has been assuaged. Um So you said earlier 535 130 sharks are a species of sharks. Is there a way that we could categorize them or like-

DR. GAVIN NAYLOR: It’s a great question. So all of the world's living diversity, the different kinds of organisms and plants all arise through this evolutionary process. So it's like a tree that branches and splits through time and we can use the sequence of branching and

splitting through time to categorize these sharks. So most of the sharks of the uh that are coastal in the northeast of Florida are all in genus. They're the genus coins or the requiem sharks. So things like bull sharks, black tips, spinners, black nose, uh sandbars, these are all very closely related. They're all large bodied sharks that are coastal and they're quite closely related. But a white shark is about as different from a bull shark as a kangaroo is from a dog. They're completely different evolutionarily. And so we uh my graduate students and I study evolution. So we're really fascinated with all the different kinds of sharks and how they came to be, especially because they've been around for 400 million years and humans have been around a sort of bipedal, you know, sophisticated monkeys hitting each other over the head with a stick for about 2 million years. So sharks are like 400 million years. So, you know, 100 200 times older and they haven't changed that much. They must be doing something pretty sophisticated to last that long when they went through the permian extinction. They've been through the Cretaceous extinction, the one that knocked the dinosaurs out. So, they're fascinating animals. They persisted in this form for a long time, but there's not that many of them. There's only like 1200 sharks and rays. So, how do they do that? If you look at the rest of vertebrates, like 70,000 vertebrates, birds and frogs and lizards and bony fishes, 70,000 different kinds, but only 1200 different kinds of sharks and rays. And they don't have many babies. They live a long time, they don't reproduce. So they're older. All of these things would suggest. My goodness, you'd think they go extinct. They haven't. So why is it that these animals have all these traits, which you'd think would make them susceptible to extinction? And they've been around for 200 times the amount of time that humans have. This is what makes them so fascinating to study. And we think it's because they're really versatile. So, you know, when you go to the Turks and Caicos, you put on your bathing suit, when you go up to New England, you put on a park or if you're in, in the winter. And so humans adapt their equipment to the environment. They find themselves in. Most organisms can't do this. They may have genetic mutations and those with AAA mutation that's advantageous will survive. And the others won't. But we think sharks are essentially can epigenetic regulate. It's just a fancy word for saying switch on different genes at different times in different environments so that they can handle a new situation and survive it. And if they can do that, we think they're probably less intensely affected by natural selection because they can just adjust and bend and fold to the environmental conditions. So we think that is what allows them to be so successful. And one of my students, Joe Migas is actually studying how some of these stingrays can change the genes that they express when they move, wait for it from salt water into fresh water and back. That is an incredible trick.

JVN: Does any other animal do that?

DR. GAVIN NAYLOR: There's a few that do that. Some kelly fishes can do that but there's not many but sharks have got a urea based physiology. So they're more salty than salt water normally. So, normally, uh an animal in saltwater loses um uh uh uh sorry, it, it draws in fresh water into its tissue. But these sharks or these rays are saltier than the saltwater. So they actually lose water when they're in salt water a little bit. Not much. But when they go into freshwater, you'd think they'd be like a sponge. They just blow up like a blue. What they done? They adjust the gene expression to deal with the freshwater environment and switch all these pumps off and other pumps on so they can deal with the environment. That's a very clever trick and it's a clever trick that we don't know how they do it. And Joe is actually studying that. So he goes and gets freshwater stingrays and looks at the genes that they use in freshwater and then the same species and looks at the genes that they use in saltwater.

JVN: Um, ok. Wait, just because I'm a baby and I don't get it. So when you say sharks and rays, we said 530 species of sharks and then you said 1200 something of sharks and rays, right?

DR. GAVIN NAYLOR: So there's about 650 species of rays. Yes, that's right.

JVN: What are rays? Is that just stingrays? And is there other rays?

DR. GAVIN NAYLOR: Stingrays and skates. So uh there's mobili rays, things like an eagle ray or a manta ray. And then there's skates that tend to be deep water animals and there's uh about 300 different species of skates. And so they sort of look like little diamonds, they're flattened, but skates essentially. And rays are a branch from the evolutionary lineage from the trunk of the tree that split off about 100 and 80 million years ago. So the, the 400 million year old sharks look, you know, like modern sharks, they're long and tubular. They've got, you know, fins placed like modern uh sharks. But we believe that the rays and the skates branched off about 100 and 80 million years ago. And what happened is that the petrol fins sort of moved forwards and joined together at the head and they became flattened. So they become sort of like a, a sort of road kill sharks. They do eventually flattened and many of them moved to, to live on the bottom of the ocean. But some of them fly through the water, they actually fly and they generate thrust through by moving their fins up and down.

JVN: 650 ray species, 530 shark species. So you got like more like coastal sharks and then you got like, what are the other categories of sharks?

DR. GAVIN NAYLOR: Oh yeah, so there's a whole bunch of sharks that people have never seen except scientists from the deep water and these are things like squall and wolf sharks, which is just a long scientific name but that the jet black, they're just, they look like Darth Vader, they've got green eyes, some of them glow in the dark. There's one shark that I think you'll particularly like Jonathan because you have such good uh readership. I'm going to use the opportunity to tell you about it. It's called a taillight shark. Your proton micros. It lives, it's only been five or six specimens ever recorded. It's about six inches long and it's jet blank and when it's pursued, it produces a cloud of luminous fluid from it's a gland near its cloaca. So it's like an inverse octopus. So an octopus, if you're chasing it, it can produce a cloud of black ink and then the predator can't see it because it's confused. Well, at 5000 ft down, it's inky black, you can't see anything. And so if you can smell a little shark and you want to eat it, then and then you see this bright cloud of luminous fluid, it's gonna distract you probably blind you because the intensity of the brightness is different and the shark can swim away. Isn't that cool?

JVN: So cool. How do you study a gene? Do you just like, take some skin sample or like some blood and like we sequence it or something.

DR. GAVIN NAYLOR: We take some blood and uh we put it in a tube and then we squish it all up and break down all the cells and the DNA sort of it is released and then we spin it like put a bucket of sand around your head, spin it really fast and the DNA is dense and it goes to the end of the tube and then the DNA is right at the end and then we tip off all of the, what's called a super naten, all the stuff we don't want. And now we've just got a little blob of DNA in the bottom and then we, we don't know what that DNA means. So we have to then get the sequence and then there's all sorts of technologies which have been designed to, you know, uh a little molecule, sit down on one piece of DNA and start making copies and move all the way along it. And then we can put markers that actually record which different

brick is laid down and we can reconstruct the whole sequence of, of one fraction of DNA. And then it's like a jigsaw puzzle. We've got a string of DNA that's 10,000 bricks long, a string of DNA that's 20,000 bricks long, a string, that's 500 bricks long. And then we just overlap that strands and then we can put together the entire genome of the overlapping strands that are identical. That's how we get the entire genome and, and a genome of a shark is between maybe four and 6 billion bases long.

JVN: So it is the thing that makes sharks so unique in the animal kingdom. The fact that they've been around for, you said, 40 million years, right? OK. OK. And then we've been two, so you said 400 million and we've been two. So that's basically the same as comparing a 40 year old to a two day old. And is there any shark that was like around 400 million years ago that's still around now?

DR. GAVIN NAYLOR: That's a great question. Um No. Um But it's, it's quite interesting because the only reason we say things are the same as is because they look the same. So, you know, So, if I tell you, you know, if we compare ourselves to, you know, uh uh a bacterium, a bacterium is alive now, we're alive now. And if we trace all the way back through time, uh you know, there's been rapid change from in the lineage to us uh relative to a bacterium. But the fact that that uh things look similar in the fossil record makes us say, oh, this is, hasn't changed in millions of years. Well, it hasn't changed from our point of view from what we're looking at, but it could have changed intrinsically. And there are some that's how we know sharks have been around for a long time. We go back in the fossil record and say, does it have the same paired fin structure? Yes, it does. Does it have the same prismatic cartilage that modern ones? Yes, it does. Does it have the same kind of teeth as the modern one? Yes, it does. Does it have the same spines as modern one? Yes, it does. And so eventually it's got enough check box as we say, hey, guys, guess what? It's a shark, you know, even though it may look a little bit different, it's a collection of these traits that we see in the fossil forms and there are some that look similar. So modern forms. Um.

JVN: Ok. Ok. So what does your research look like? You know, how like Dr Giles like sometimes she's like, oh, I can't come talk because like the whales need me and like, I'm gonna go like I got because like when the whale comes to, to poop and you got to get the poop, the whales poop waits for nobody. So like, what does your work look like? Are you like out with these? Are you scuba diving and stuff?

DR. GAVIN NAYLOR: Joe, one of our PHD studenst, he goes out and collects the stingrays himself and then he samples the blood and different tissues and he gets the DNA and the RN A. Um But we, we spend a lot of our time um in the lab collecting DNA sequences. We spend a lot of time much more than people think um behind computers, analyzing stuff, looking at the patterns, trying to make sense of it, learning statistics. And so we, we, a lot of the work is fairly uh analytical. So we spend a lot of time with maths and with computers analyzing patterns that we see. Um uh we do do field work. Um but not as much as some scientists. Most of the work is actually in the lab and on a

JVN: How do sharks have kids? Like? Is it usually like always one? And they don't lay eggs, like, don't they have like live baby sharks or do they have there?

DR. GAVIN NAYLOR: There's different kinds, there's some that lay eggs and they lay them external on the, on the, the uh the sea floor. Some are live bearing. In fact, there's just pretty much every way of growing babies in sharks. Some of them lay eggs internally and they sort

of hatch internally and then they are fed by other eggs. The little shark lets will eat other eggs. Some will actually, that's called intra uterine cannibalism in sand tiger sharks. So what happens is all the fertilized eggs. The first thing they do is since they get big enough they, they to swim around the uterus, they'll go and kill all of their brothers and sisters. And so they have two uterine. And so you just have uh one pup that survives in its uterus because the first thing it does is kill all of its siblings and then eat all of the eggs.

JVN: Does any shark only have one baby at a time?

DR. GAVIN NAYLOR: That's a good question. Yes. Mantis mantis tend to have just one pup at a time. Yeah. So a manta feeds its pup with what's called inter uterine milk. So it secretes this um uh lipid rich fluid in the uterus and the baby manta will lap it up and grow to about 150 pounds before it drops. And then a single, this little baby is all wrapped up like a pretzel and it falls down through the water column and then opens up its wings and starts swimming away and then it starts filter feeding.

JVN: And so that's like a manta ray.

DR. GAVIN NAYLOR: Exactly. Yeah.

JVN: Yeah. Now we just had um, we just did an episode about climate change um a couple weeks ago last week, my sense of time, but how is climate change affecting sharks? And I know that you're in Florida. I've been also seeing a lot of stories about like these little, these like little fish that are like spinning and spinning and spinning and then they just like die. And then I also read this thing about the spinner sharks which then when you said spinner sharks, I was like, oh yeah, that I think there's like some spinner sharks that are like dying around there. Like there was like some shark that was like getting that spinning thing. I don't know if I'm getting it messed up. But what's going on with this climate change?

DR. GAVIN NAYLOR: Climate change is absolutely happening. But um sharks have been through the permanent extinction. They've been through the Cretaceous extinction. So a little bit of climate change that we're seeing is not really gonna adversely affect the sharks, it's gonna affect their food. So if there's less food for them to eat, they'll go somewhere else, they're big, they can move. So climate change isn't gonna impact the sharks directly in terms of, you know, their direct survival, but it can have indirect effects, right? So what you're talking about is these uh these fishes uh including saw fishes incidentally in South Florida that have been showing these sort of moving behaviors where they spin around. They seem discombobulated. People who have examined many of the animals. They're not quite sure exactly what it is, but they think it might be the result of some algal bloom and the algal bloom could be the consequence of warmer water or polluted water going into these uh coastal regions. We don't know that yet, but that seems to be what's going on. Now, the spinner sharks uh naturally spin black tips and spinners. Well, they're percival animals so they target schooling fishes and they will swim up through a column of schooling fishes and they will launch themselves like a ballistic missile is spectacular and they can come out of the water by 20 ft spinning like crazy. This is normal behavior for them. So this is not something that's induced by the the toxins that we think are affecting the saw fishes in South Florida. So yeah, so, so they both spin, one is spinning because it shouldn't and the other is spinning because it should.

JVN: And then also back to the, so the four main sharks that'll fuck with you. White sharks, tiger sharks, bull sharks, oceanic white tips. Now, where are these oceanic white tips? I don't feel like I hear about these very much.

DR. GAVIN NAYLOR: We don't hear about them very much. They're in open ocean so they usually you don't see them unless you go 20 miles offshore. So it shouldn't be a problem. But there's one part of the world where the deep ocean comes really close to the land and that is the Gulf of Aqaba in the Red Sea. And so it's an extension of the Rift Valley and the Rift Valley has got very steep sides. And so what we find is that the water goes from, you know, about uh 5 ft deep to about 3000 ft deep in about 100 yards. So basically the deep ocean is right there next to the shore. And the Gulf of Akiba also has spectacular diving some of the best in the world. A place called Ras Mohammed. The face of Mohammed. Mohammed is supposed to be so beautiful that that no animal could or person could uh could uh could could suffer the beauty of Muhammad. And so this is called the face of Muhammad. It's so beautiful um in the Red Sea and that brings lots and lots of tourists. So tourists go diving in Ras Mohammed and occasionally places like Hurghada. Um and Sharm El Sheikh, you've probably heard of them. Uh uh People are bitten by these oceanic sharks and that's because they are minding their own business in deep water, but they're very, very close to where people are. And normally, you know, you don't find that the Oceanic White Tip Sharks where there are people

JVN: and what country is that off of again?

DR. GAVIN NAYLOR: Egypt. It's in the Sinai Peninsula,

JVN: Egypt. I think I remember years ago someone getting a shark attack there like it was like off a tourist thing that I feel like I've also seen on my algorithm. So that, that makes sense. Where are you from again?

DR. GAVIN NAYLOR: I'm from England. I'm born in Tanzania, but my parents are

JVN: British. So, but you were minding your own business in England. And you were like, I want to become a marine biologist, doctor of genetics for sharks.

DR. GAVIN NAYLOR: And wasn't really, I was born in East Africa. I was born in Tanzania. I spent my first few years in a tent, my dad's an exploration geologist. And so I was really interested in nature. So we were surrounded by elephants and gazelles and giraffe and buffalo and rhino and hippopotamus. So as a child, I was mostly interested in nature.

JVN: So you were giving like, basically like the wild Thornberry when you were like little, you were like talking to the animals and like running around and like your dad's a scientist. And so then, and then at some point you realize that your passion was in like marine biology?

DR. GAVIN NAYLOR: Well, so my, my passion really is actually in evolution. I think it's just mysterious that there's so many different kinds of life forms on earth from, you know, tiny little ants and bacteria to bumblebee bats and wh I mean, a bat and a whale are mammals. How do you, how do you have a common ancestor that on the one branch, it, it sort of moves and changes and gives rise to a flying little bat on the other hand, 100 ton blue whale. So how, you know, it's magical how these different kinds of life forms arise. And you know, they start out as a single cell, they divide, they start consuming things. And when we build machines, we build them for the final product, you know, a paper cutter or a laser printer. But living things are machines that grow. They change over time on the fly. A baby is operating

as a toddler, is operating as an elementary school kid is operating all the time. The architecture is changing all the way through time until it becomes an adult. And when it becomes an adult, what does it do? Splits its genome in two, makes sperm or eggs and starts a thing over again? Ridiculous. So this is what I'm fascinated with. Why is there so much life on the planet? If you go to another planet? It probably has life but it would be maybe just like a bunch of different bacteria. But on our planet, things are ridiculous. We've got redwood trees and slime molds and ferns and beetles.

JVN: Those fucking frogs that hatch their frog babies out of their backs.

DR. GAVIN NAYLOR: Exactly.

JVN: It's crazy. So when did you, when did you know that you wanted to study evolution? And like, how did you go about studying that?

DR. GAVIN NAYLOR: That's a great question. So, um as an undergrad, I was interested in neurobiology and I came to the U SI went to the University of Maryland and I met this, this man who was fascinating. He was a professor. His name is Lin Chow, Chinese Brazilian guy with a ponytail, probably the most uh influential person that I've ever experienced. And he was amazing. He said, well, why do you want to study how these brains are organized? Why do you want to study the wiring diagram? He said you should study how any piece of architecture actually becomes self organized and becomes a thing. Evolution is much more interesting than just studying the equipment of any one particular organism. And he I took his class, he was very clear thinking and a fascinating person. And from that point onwards, I became super interested in how structures arise in innovation and how the different elements of living systems come together to make machinery. And so that's why I became interested in evolution. And then at University of Maryland, I worked with a lady who studied sharks, uh Eugenie Clark and she's since uh died. But uh um she, I was interested in studying a group of animals that had a really good fossil record. But um but and also fairly good representation of the, the living forms. So snails would have been good. And I talked to a paleontologist who was actually blind, uh get up Vermeil, who was a co avior of mine. And he said, study uh gastropods because you studied the evolution of gastropods. Well, somebody was already studying them and then he said, well, what about mammals? Mammals have got a good fossil record and somebody was already studying them and he said, well, what about sharks? I know he was studying sharks so that the, the evolution of sharks was a place where people who weren't studying it. So, I thought, ah, this is what I was studying. So I'd love to be able to tell you that I've liked sharks since I've been six years old. But in fact, I just liked evolution since I've been six years old. And sharks are a vehicle to study this process. And they're really cool because they sort of, they're the exception that proves the rule. There's only 1200 of them. So, why aren't there more, especially given, as you pointed out the se, you know, acceptability to extinction. They don't have many offspring, they mature light. So they're sort of breaking all the rules. We can learn a lot about processes when we learn about systems that break the rules of those processes to see how they do things differently.

JVN: Oh, my God. That's so fucking cool. So, what do you want? Like, what do you want to like, prove next?

DR. GAVIN NAYLOR: I would like to find all my students or somebody in the world. It doesn't matter who finds it. But the, um, how these genes are expressed on cells that actually makes

them into useful uh, objects. So, we tend to think, you know, everybody thinks that Darwin has told us how natural selection shapes organisms into useful products. But there is some architectural mystery. There, not everything, all possible combinations exist. There are Proclivities that cells grow divide and are shaped in peculiar ways that generates raw material that is workable that natural selection can act upon. I would and Alan Turing um

JVN: Great imitation game!

DR. GAVIN NAYLOR: Oh, absolutely. And Alan Turing was interested in the evolution too. Alan Turing was, he was just too damn smart for his own time period. He was brilliant. He, he came up with a reaction diffusion equations that actually accounted for the genesis of form due to is it out of uh completely random uh mixtures? You could have elements that would diffuse through a medium and elements that would inhibit that diffusion and they would generate these beautiful rhythmic patterns, many of which we see in nature. So we now everybody thought that Turing was full of it. Just a mathematician. He doesn't really know. But now we're seeing in developmental biology that a lot of what Turing suggested is actually found to be empirically the case, these reaction diffusion equations are shaping the form of life.

JVN: Excuse my French, but fuck me hard. That is just so cool. Two more things and then I'll let you go. OK. So I feel like I read these like other random articles about how like these scientists are studying like sharks because they like don't get cancer or something or like they just like, like, is that true?

DR. GAVIN NAYLOR: So um it's interesting. So sharks don't get cancers that are really terrible, but they do get cancers up to a certain size. And it turns out that um cartilage produces this inhibitor for, for this angiogenesis factor. If you're a tumor and you're growing, you need food and what they do, the tumors basically encourage blood vessels to go in to provide the food so that the tumor can get bigger and bigger and bigger. But cartilage produces this inhibition factor that prevents tumors from actually vascular. So sharks do get tumors. But they've got this inhibitor produced by the cartilage. And it means that the tumor only gets as big as the diffusion distance and it can't get any bigger. So they do get cancer but they don't get cancers that are too terrible because they're restricted in their size.

JVN: And then I just, just for my husband because I feel like we got in a fight about this and I didn't believe him. But then you said that we didn't, it was in a literal fight, but it was just like we were hypothesizing about like sharks. Mark told me this one time that if you, if a swim shark, like if you like if you took your hand on a shark and went like this, like went against the grain of the shark that it would just like leave you cut and bloody. And I was like, no, it wouldn't, that shit's like soft and water and stuff would be right. I have to tell him that I was so wrong. How come they look so fucking smooth and watery. But then they're actually like,

DR. GAVIN NAYLOR: But in the other direction you get road rash and in fact, one of the four people that was injured in that Padre Island uh incident got basically road rash cos the shark swam past them and it grazed them so badly. It can just shred you like a hamburger. He's right. It's like a cheese grater.

JVN: Doctor Gavin Naylor. Uh Last thing, what was the most amazing thing that's happened to you throughout your career?

DR. GAVIN NAYLOR: So uh that's biology related. Um a colleague of mine, a professor at Florida State University. Dean Grubbs had an expedition uh to go off the Bahamas in a submarine. And I got to, and what Dean was trying to do was he studies sixgill sharks. And the way, the best way to study them is in their own habitat rather than drag them all the way up to the surface and they get compromised. So they wanted to tag them at depth. And I asked him if I could tag along and he said, well, yeah, sure, no guarantees. Um But sure we can, you can come along. So we went on this very nice boat with some, you know, very uh distinguished people and I got to go in the submarine and uh I got to see a six skill shot, which was bigger than the submarine. It must have been about 1670 ft long and it was so beautiful. And uh uh yeah, just in the sub when pitch dark around it, uh when we'd start the propellers and switch all the lights off, all the bioluminescence around, I felt like I was eight years old again. It was the most magical thing.

JVN: How did you see the shark? Did it glow in the lights or something?

DR. GAVIN NAYLOR: The shark didn't but we, we put uh uh red lights on so the shark couldn't see it, but we could see the shark and I took a bunch of pictures with my little apple, you know, uh iphone of this animal and-

JVN: Can we see, send us those pics we want to see and put them on social?

DR. GAVIN NAYLOR: Well, they are, they were on Twitter and -

JVN: I know but we want to do it for ours just that when we make our little thing so that we can like that is so cool. So when you put a red light on, in the submarine, like it just like it's like it like shows you what's out there,

DR. GAVIN NAYLOR: but the animals can't see it because they can't pick up that frequency. Where

JVN: can people follow you if they're obsessed with you? Are you like big on tiktok or Instagram? Like do you like to use anything?

DR. GAVIN NAYLOR: Don't have a TikTok account? So

JVN: it's OK, you're busy, you're learning about shark genetics,

DR. GAVIN NAYLOR: but we have a website. So the Florida program for shark research and, uh, I'm, you know, I do somewhat but, uh, there's a whole bunch of people much smarter than me that work with me, my phd students, they do all sorts of interesting things. And, uh,

JVN: well, if any of your phd students that you like are on like TikTok or talking about any of this cool stuff, send us over their account so we can put them on like a little like who to follow if because I'm sure that people are going to be like titillated with shark genealogy after shark. Uh my not genealogy genetics, shark genetics, but it's kind of genealogy. Yeah, it's kind of giving it. Um I gotta tell my husband that he was right and Dr. Gavin Naylor, thank you so much for coming on, getting curious. We appreciate you so much and thank you for your time and it's been one of my most favorite episodes in a long time. So thank you so much for coming on.

DR. GAVIN NAYLOR Thank you very much, Jonathan. It's been a pleasure.

JVN You guys, are we shark experts or are we shark experts slash I? Should we turn this into like an exclusively shark podcast? And also I fucking forgot to ask him about why fucking sharks can't swim upside down? Like why are they little punks for, for killer whales with all this evolutionary genius? How come? Ok. Well, let's just focus. Did we learn what's going on with sharks? Yeah, we did. It's, it's a seasonal perception thing. We're not actually experiencing more shark attacks. There are five fatal shark attacks on average per year. Last year, there was 10. So that was double. Uh, but a lot of that was in Australia. Not that, that matters. I mean, a death is a death. We hate that story. Um Also, so basically I learned that like, there's nothing like for sure going on with them as far as like, are they attacking us more? I just think, you know, the media loves a good story that scares the shit out of people because it gets more traffic to their site and the more traffic they get to their site, the more money they get. And so that's always gonna be a thing with media that you know, need to understand. Um oh, here's some of the most interesting things I thought honey, we're not seeing great white shark anymore. That is so yesteryear. That is so over. It's all about white sharks. Um The 3000 kilometers a month, they literally could circumvent the world a million times that they wanted to. Um I oh that sharks have been around for 400 million years compared to our 2 million years like and that they've lived through two extinctions. I think that's really fascinating also that there's 530 shark species, but there's 70,000 vertebrates. I thought it was really interesting the way that, um, Gavin was telling us about, like, when you think about the amount of species of like lizards, birds just different, like different types of animals, but there's only 530 sharks total. Like that is really interesting and how they don't have like a jillion babies. Um, but they're still here, like they, they seem to break every rule and I think I loved Gavin's passion and perspective on when we can find examples that operate against uh what would be considered successful or like when we can find things that are successful that operate like outside the norm, it's important for us to try to understand that because I think that that could glean so much knowledge, you know, like I just think that's just fascinating. Um Also just really curious about genetics and DNA now, like, I'd like to grasp that more. I was just more thinking sharks and I didn't, we, we got, I got so much more than I bargained for which I loved. But yeah, like genetics, DNA. Um What else am I curious about? Really sharks? Like I wanna know more about all the sharks and yeah, you guys, the animal kingdom. It's so big, so broad. Also, what are you guys curious? What, what animals are you guys curious about? Is there any animals that, that we haven't covered on the pod that you would really like us to let us know? Because we love your ideas. Um OK, I think that's all the time we have for getting curious like go July. Stay cool, avoid them fucking sharks um and stay safe out there. Y'all love you. See you next time on Getting Curious. Bye.

You've been listening to Getting Curious with me, Jonathan Van Ness. You can learn more about this week's guest and their area of expertise in the episode description and follow us on Instagram @CuriousWithJVN You can catch us here every Wednesday and make sure to tune in every Monday for episodes of Pretty Curious which we love. It's our pod pass on all things beauty. Get into it. Still can't get enough and you want to get a little spicy with us. You can subscribe to extra curious on Apple podcasts for commercial free listening and our subscription only show, Ask JVN where we're talking sex relationships are really just whatever is on my mind. That week, our theme music is Freak by Quinn. Thank you so much to her for letting us use it. Our editor and engineer is Nathaniel McClure. Getting Curious is produced by me, Chris McClure and Julia Melfi with production support from Julie Carrillo, Anne Currie and Chad Hall.