

# Selachimorphology (SHARKS) with Chris Lowe

## Ologies Podcast

### July 24, 2018

Oh... Haaaaay it's your too-talkative pedicab driver who eerily guessed your astrological sign, Alie Ward, back with another fresh as hell episode of Ologies. This is the quickest turnaround ever in the history of the show ever and, I guess given its oceanic vibe, I like to think of it as some treasure that washed up on the beach, delivered to your senses while it's still shimmering with sea froth, before it starts to stink.

I have been tracking this Ologist for months and he was always off on expeditions in remote corners of the Earth being awesome and we had an appointment to talk SHAAAARKS last Friday, and then I realized, boy howdy! This week is Shark Week, this is perfect timing! I don't mean Shark Week like anything uterine, it's actually shark Week on Discovery, and Nat Geo has a shark week. And then... he had to cancel, because of work stuff. Fair enough. But then he said he could record just hours before I got on a plane. So I drove my ass giddily down to Long Beach and I hung out in his lab, and I'm now back home I'm turning around asides, I'm having the amazing Steven Ray Morris edit this in probably a Redbull-induced mania. Honestly, we couldn't be happier about it. It's very exciting. But before we get to the episode, some thanks and some please, and some thanks again.

First off, thanks to the Patrons for making this whole show happen, pretty much. At [Patreon.com/Ologies](https://Patreon.com/Ologies) you can be a member of the club that knows what episodes are coming up next, and submits questions to the Ologists, and sees behind-the-scenes photos from their labs, and also you help keep the pod free and available to all. You can also support by putting Ologies on your human body, you can go to [OlogiesMerch.com](https://OlogiesMerch.com), and you still have a few more days to cash in on the July sale, I was like, "Let's have a summer sale!" 10% off everything, your whole dang order with the code `CampOlogies`. Backpacks, bikinis.. You can put Ologies stuff on your butt! You can also support with no coin at all just by subscribing. You can review, or rate. You can tweet about it. Tell your dentists, whatever. Also, as you know, I creepily read your reviews and then I prove it each week by reading you one.

This week, `fantasy_football_gal` says:

*Help! Now I have an Ologies addiction! Guys, I can't stop with this podcast, send help. Or don't... Actually please don't, and leave me to keep bathing my mind in Ologies.*

So nice. She said she "...got hooked after listening to the two-parter on Fearology, which resulted in a four-hour long post episode discussion on the topic" with her Mom, herself a psychologist. And she says, "because this Pod normally drops on Monday, I now look forward to everyone's least favourite day of the week."

Technically, it drops Monday, 9PM Pacific Time, depending on where in the world you are. Thank you to everyone who left reviews this week, I read every single one of them, sometimes they make me cry because I feel so appreciated. Thank you for that.

Now, back to Selachimorphology. I know it sounds like your drunk cousin had a bunch of Scrabble letters and is doing her best to convince everyone it's a triple word score, but really it's a term. A rare one, but it exists. It comes from the Ancient Greek for "having the appearance of cartilaginous

fish." And, what does it mean? It means we've got a Sharkspert in the house, and what a shark expert he is! He's been studying sharks for decades. He's appeared on SO MANY TV shows about sharks, it's absurd. And has been a marine biology professor at Cal State University Long Beach for 20 years! Tall, slim and with close cropped hair and what I imagine is a perennial tan. He greeted me this past Sunday, and showed me around the Shark Lab, a facility of gurgling seawater tanks, high-tech telemetry devices, and cameras, and suspended in the rafters as a nod to the past, a vintage shark-shaped submersible! It was amazing!

We sat down in his tidy office and I asked him all kinds of stupid shit and he answered with affable wisdom. So, get ready to dive deep into a world of ancient badasses, eye lasers, behind-the-scenes movie trivia, inside-out butts, cannibal twins, seeming immortality, sea kink, surfer intuition, lottery odds, and your aquatic, many-toothed, new role models during this, their week, Shark Week, with Selachimorphologist Dr Chris Lowe.

[Intro Music]

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**Dr Chris Lowe:** It's actually the worst week. It's great, in that we celebrate sharks. Just the way we celebrate them is sometimes not great.

**Alie Ward:** Thank you for doing this, this week of all weeks. Is this your week your nightmare, is shark week your nightmare?

**Dr Lowe:** So I was quoted in an article recently saying shark week is like my Christmas. Actually it's more like my Halloween. *[spooky witch laughing]*  
So it's great in one way, in that people are celebrating sharks, and they're very excited about sharks, and that's something that I find great. However, the Halloween part comes from the horror that's also partly created in that same kind of tone. So, it makes it really difficult to educate people about sharks and to help dispel some of the myths about them when we still do a lot of fear mongering in some of the media. It's really challenging.

I'll give you an example. So here I am on a Discovery Channel show talking about why shark conservation is so important, and sharks are vital to the ecosystem and why people need to protect them. And in the background you hear it, dun dun... *[dun dun, dun dun, dun dun, 'Jaws' film theme music plays in the background, deep wind instruments, tension builds]*. It just doesn't match, right? *[record scratch, music ends]* It becomes very frustrating and a little conflicting for the public to understand, wait a minute, is it about conservation? Or are we supposed to be scared?

**Alie:** What made you love sharks so much? What was the moment where you're like, "Sharks, I'm on your team"?

**Dr Lowe:** As a person who grew up fishing and loving to fish, and I caught thousands of fish, the first shark I caught, I was like this is different, there is something about this that is very different from all the other fish I catch. It actually forced me to go to the library. I was not a good student, I hated school.

**Alie:** Really? How old were you, when you started looking into it?

**Dr Lowe:** Probably about 9 or 10. Then I went to the library and I remember finding a book about sharks and trying to figure out what kind of shark this was, and then I was looking through this book and, I'm like, "Oh my God there's all these cool things about these animals. They're like fish but they're a different type of fish." And there was just something about that, that just sucked me in.

**Alie:** Is it crazy to you that you get to do this for a living? You're one of the leading shark experts in the world. If your name gets dropped, people are like, Dr Chris, he's legit! Is it crazy to you that you're that dude now?

**Dr Lowe:** Yes, I have to pinch myself every day. But, part of it is I'm so lucky to have the job that I have. I really am. I absolutely love what I do. And it's not just about the sharks. It's about teaching other people about sharks and teaching other people about science and why we do it.

**Aside:** So, Dr Lowe grew up off the coast in New England, in a family of working class, honest, cool, fisherman. He told me his favorite day was Wednesday because it was hamburger night, all other nights were seafood nights, because that's what his family did. And that's what they expected him to do, be a commercial fisherman, or a carpenter. But he really wanted to study marine biology, and he became the first person in his family to graduate college getting a Bachelor's in marine bio in Rhode Island, a Master's in Biology in Long Beach and then his PhD in studying hammerhead sharks in Hawaii, which sounds like something only the guy in those Dos Equis commercials would do, but it's a real life and he lived it. Hammerhead sharks in Hawaii! Okay!

**Alie:** So when it comes to shark outreach, what do you think is the most important thing that you do? Because that is one thing I feel like humanity can get behind. It's like if there was a villain, we can all be scared of, and pissed at, it's going to be sharks. We can't even be mad at bees anymore. We're like, oh, save the bees, but no one's like SAVE THE SHARKS. Everyone's like, let's kill all of them.

**Dr Lowe:** Well, I think it's getting better. That's the exciting part. I think things are starting to change. It's just taken longer than I think many of us would have liked to see happen. My best example are whales. So, 150 years ago if we walked down like San Pedro, or we walked down New Bedford, and you ask people what kind of animal they thought a whale was, they would say horrible things. Whales were... they were demons!

**Alie:** What?!

**Dr Lowe:** Oh, they were horrible animals! They killed people... *Moby Dick*. Right? Think of the image portrayed in *Moby Dick*.

**Aside:** If, like me, you have not yet gotten around to reading Herman Melville's classic, *Moby Dick*, it's about this whale who was a real angry... just a son of a bitch, and it was based on a real, actual albino whale by the name of Mocha Dick, who despite sounding like your friends barista ex-boyfriend, was in fact a sperm whale, and is said to have been a renown monster who evaded pursuers, was white as wool, and just cruised the seas with 19 harpoons hanging off of him like grass clippings on a sticky thigh. Didn't even notice! For a long time people were like, "Get bent, whales!" and their populations declined.

**Dr Lowe:** Okay, so around the seventies when whale populations were really in the tank, they got the perfect PR makeover. Whales went from being these demon, evil animals to, “oh my God, they’re like humans, they have babies, they nurse them, they have little eyelashes, they’re intelligent, social animals!” And I thought, if we can do it for whales, why can’t we do that for sharks? So, I think that we’re in that motion. We’re heading in that direction, but it’s really difficult when a lot of the programming still pushes the fear factor.

**Aside:** Discovery’s Shark Week (who is in no way sponsoring this show) has been this cable mainstay for, like, thirty years. They have shows like *Bloodline: The Spawn of Jaws*, and even a few years ago ran some docu-fiction, aka ‘fake news,’ about the extinct Megalodon shark resurfacing, and later they were like, “Oh yeah sorry that was, like, not real. We thought you knew.” Nat Geo has joined the blood fun with two weeks of Sharkfest. They have shows like *Shark Kill Zone*, and my personal favourite, *Sharktraz*, about the sharks near Alcatraz. The point is, whales are cute and smart, sharks are scary, steely-eyed murderers. They’re branded as, like, the sociopaths of the sea.

**Alie:** Do you think that if sharks had eyelids, their whole story would be better?

**Dr Lowe:** Well, they do have eyelids.

**Alie:** They do!?

**Dr Lowe:** Of course, some do. They’re called little nictitating membranes and they’ll fold them up to protect their eyes. They just fold the wrong way, so maybe that’s it. Maybe they look too alien to us. But I think that’s only part of it. Dolphins have the cute little smile. If we could only get some sharks with cute little upturned [*Alie squeaks at the cuteness*], jaws, maybe that would help.

**Alie:** Don’t say Jaws. [*creepy voice saying “JAWS”*]

**Dr Lowe:** Don’t say Jaws, yes. But I think part of it is being slowly demystified. People are starting to see sharks as being, you know, just like any other fish in the ocean, although they have a very different role than many other fish.

**Aside:** Quick question: is a shark a fish? It is! But about 400 million years ago they split off from bony fish, and sharks, instead of bone, have a skeleton made of lightweight and springy cartilage. They also don’t have swim bladders for buoyancy but they use their fins kinda like airplane wings and have these real fatty, oily livers to keep them afloat. And they range in size, from great white sharks (more on that name later), which are, like, 20 feet in length, to these itty bitty 8 or 9-inch dwarf lantern sharks, and Panama ghost cat sharks... which kinda both sound like D&D characters. The point is, they’re not all the stuff of cinematic nightmares.

**Dr Lowe:** So, it’s getting people to think along those lines.

**Alie:** Do you think this all started with the *Jaws* franchise or have people been kind of demonizing sharks since before the ‘70s?

**Dr Lowe:** I think our perception of sharks and that fear goes way back. It goes back to the way humans portray all predators. Imagine back in the early cave days, and the men would

go out and hunt some wild animals and they would come back and tell these stories about these crazy vicious animals they saw. And of course the families that are sitting around listening to these stories are going, 'wow, that's so scary,' and they're describing this animal... And, the reality of it is people listen when people talk about that because your brain gives you a little squirt of happy juice when you're scared.

**Aside:** 'Happy juice,' aka adrenaline, aka norepinephrine, is a hormone that's gleeed out from your adrenal glands during fight or flight. For more on this and why fear is a very lucrative business, listen to the two-part Fearlogy episode with Mary Poffenroth, who is a life changer. Okay, back to adrenaline.

**Dr Lowe:** It tells you to pay attention to characters that may be important for your survival. So now what happens is, if people don't encounter that animal they can embellish the stories, right? Because the chances of that person ever seeing the animal themselves may be very low, and now the storytellers are getting rewarded because people are listening to them. So now they can embellish the stories. They can go on and on about the gnashing jaws. Think about whalers and fishermen that were out at sea for years, and they would come back and they would be telling these stories to their families, and their families are like, oh my God these sharks sound horrible.

But now as people began to see those animals more, as they begin to encounter them more, those things don't match. You know, television's played off that. *Jaws* played off that. When you think about the book and the movie, they're describing something that people were envisioning in their head, right? And you only had to show a few pictures to help seal that deal.

The problem was, we knew very little about sharks at the time *Jaws* was written, and we've learned a lot more about sharks since then. So now it's getting a little harder to embellish the stories. Nonetheless, our brain is programmed to get a little squirt of happy juice [*squirt noise*] when we're scared. So I think that's what makes it so hard to move away from sharks being these scary animals and convincing people that they're important and they're actually not as dangerous as they're made out to be.

**Alie:** Hit me with some stats. We always hear that vending machines kill, like, 385 people a year and sharks kill five?

**Dr Lowe:** Those stats, there's tons of them out there. You're more likely to die in a car accident driving on the 405 going to the beach, obviously. In the parking lot you're more likely to be run over by another driver than you ever would by encountering a shark. So it's an irrational fear, right? Because the stats clearly tell us that the probability is crazy, crazy low. You have a better chance of winning the lottery than you do of being bitten by a shark.

**Aside:** Your odds of getting struck by lightning are just 1 in 3,000. Getting injured by a toilet? About 1 in 10,000. Death by sharks: 1 in 3.7 million! And, while 1 in 15 lottery tickets will win something, the odds for winning the good stuff like the Mega Millions jackpots, you ready for this? 1 in 302 million. Way less likely than a shark attack, because winning *actual* money in the lottery, is pretty much... naaaah... kinda never.

**Dr Lowe:** And that's with millions of people going the beach and shark populations coming back in some places. So, it's kind of frustrating sometimes to put out those stats and then still have people go, "I'm afraid to go in my pool."

**Alie:** Really!?!?

**Dr Lowe:** Really. I get that!

**Alie:** Are people are afraid to go in their pool!?

**Dr Lowe:** Absolutely.

**Alie:** Do they know there's no sharks in their pool?? Or are those people who *have* sharks in their pool??

**Dr Lowe:** No, I don't think they have sharks in their pool. It's that fear of water. It's the fear of being in water. And that adds another layer; we're a terrestrial animal, right? So when we go in the ocean, we're in a foreign place, for many of us. It's interesting because many of the people, water people I call them, these are surfers, divers, swimmers, they spend huge amounts of time in the ocean and they feel very comfortable in the ocean. Very few of them ever tell me they're afraid of sharks.

**Alie:** Do you think that the people who feel innately afraid of sharks just are like scuba diving? Not for me. Miniature Golf? Sure. Do you know what I mean? Do they self select?

**Dr Lowe:** I think so, but I think we can change that. Those are aspects of our behaviour that we, kind of, put on ourselves.

**Alie:** So is part of your role as a sharkspert, if you will, to give out enough facts so it counterbalances the fear?

**Dr Lowe:** I think that's an important part of it. The more we learn about sharks and the more people begin to see them in a different way, like they would see any other animal, maybe a dog, or a cat, or a mountain lion, or anything like that, the more they know, the less they're going to fear. And we see that; I see it particularly in kids. I talk to thousands of kids every year because they're actually the best. They quite often haven't developed that fear yet, and sharks are the new dinosaurs, so kids are *really* into sharks.

**Alie:** REALLY?

**Dr Lowe:** Oh yeah.

**Alie:** I didn't know that! Sharks are the new dinosaurs! That's so exciting.

**Dr Lowe:** Sharks are the new dinosaurs, and they're still here, which is really exciting [*DJ airhorn with underwater bubbles*]. 20 years ago I was really worried at the track we were taking that there would be a generation of Americans that would enter our coastal ocean and never get to see a shark. And now I'm kind of excited that things are changing. There's a really good chance that this generation will be able to go in the ocean and actually see a shark in the wild.

**Alie:** I love that for you, that's like, Amazing Good News! That's exciting.

**Dr Lowe:** It really is. Because imagine coming to LA and going down to Hollywood and seeing a movie star, that's what it will be like. People will be like, "I was in the ocean. I saw a dolphin, ho hum. But I also saw a white shark! That was freaking awesome!!"

**Alie:** I love that because if you go on Hollywood Boulevard, chances are you are not going to see your favorite celebrity. You're going to see a lot of other shit, but you're not going to see anyone famous.

**Dr Lowe:** Very true.

**Alie:** But when *you* think of sharks, what kind of place do they hold in your heart? When you think of a shark, what key words come to your mind?

**Dr Lowe:** They're just amazing! They've been around for 400 million years as a group, right? They've seen the gnarliest shit on the planet, right? Asteroids hitting the planet, they've been through all these mass extinctions and they come out the other end of the pipe and they're still around. That's amazing. When you look at all the other life in the ocean, during some of those mass extinctions we lost over 90 percent of the marine life. It was gone. Huge, huge, huge extinction.

**Aside:** Sharks are like, "Yeah I'm still here, how you like me now biiiiitch!?"

**Dr Lowe:** So the question that I love to ponder is what is it about them that makes them so resilient? What makes them so adaptable? Those are the things... they have these characteristics, either part of their physiology or their morphology that just seem amazing, and they're different from many of the other animals on the planet. So, I think that's one of the things that just puts me in awe.

**Alie:** What are some of those characteristics?

**Dr Lowe:** Sharks have an amazing immune system. It's very different from all other vertebrates. They have all these unique characteristics to their immune system, and I think that's one of their keys to their success. Their ability to heal, their ability to deal with pathogens in the ocean, is just simply amazing.

**Alie:** How does that work? Do they just have better T-cells? What's happening in there?

**Dr Lowe:** Well, their innate immune system and other aspects in their immune system are very different. There's still a lot of work being done right now, and... just the way they heal. So when sharks mate, males have to bite females to get them in a position to copulate, right?

**Alie:** Well, didn't know that!

**Aside:** *[bubbling underwater sounds, Alie sounds surprised]* What the fuck, dude?!

**Dr Lowe:** Now we're talking about teeth, a lot of biting. Females, yes, aren't always willing to, you know, comply, and that's probably part of the sexual selection. Females get a choice; if the male can't hang on then you're not going to get to mate with me. But there's a lot of

teeth involved and therefore there's gonna be a lot of tearing, and tissue damage, and things like that. So female skin is twice as thick as males.

**Alie:** Is it seriously? Damn.

**Dr Lowe:** Oh yeah. Of course you would need that, right? If you're going to mate and a lot of females will mate with more than one male, because we now know from litters that there's sperm from more than one male. So there's this polyandry going on, right? So there's multiple paternities.

**Aside:** Heeeeeeeey!

**Dr Lowe:** The other part is how fast they heal from those things. Females get completely torn up, [*sad clown horn, whaap whaap whaaaaaap*] and then the question is how do they heal so quickly? So there's been some really cool research being done by some colleagues in Florida.

**Aside:** Evidently, sharks can recover from incisions super quickly because of the antiviral and antimicrobial properties of their skin's slimy protective film. It is a substance that rhymes with 'fucus,' and it's bleeped it for decency [*ding*]. Every time you hear it, feel free to do a tiny, imperceptible butt dance, or take a swig of your beverage.

**Dr Lowe:** So what happens is, literally within minutes of that injury, that [*ding*] begins to pour into the wound and it acts like an antibiotic Band-Aid, and then the wound begins to heal outward. You can literally cut the shark into its body cavity, sea water will get into its body cavity. It's not a sterile environment, but they have pores that lead into their body cavity, so their body cavity is not sterile.

**Alie:** So wait, they're just getting sea water coming in and out and their body cavity's are like, "It's all good. Don't worry about it."?!

**Dr Lowe:** Yep.

**Alie:** [*gasps*] Also, that makes me think of a sharkskin suit, and if you actually had a sharkskin suit that was just covered in a layer of [*ding*] that would be... not good for formal wear, but..

**Dr Lowe:** But man you'd heal fast, right!?

**Alie:** You can tear it on a fence and be like "It's cool. Give it a couple minutes."

**Aside:** Dr Chris Lowe, right now, singlehandedly making sharks lovable and math cool. He is a thought magician.

**Dr Lowe:** I just get so excited, even about math because there's math in sharks. They're covered in math. Their teeth, you know, they're a math problem, right? Because they have never-ending rows of teeth and the teeth keep falling out. And of course, how old do sharks live? Well, we don't know, but now we're coming up with new techniques to figure out how long sharks live, like sleeper sharks, like Greenland sharks that have been aged to 470 years old.

**Alie:** How do they find out that that's how old they are?!

**Dr Lowe:** Really cool. From the dead ones, you can take their eye lens, and then you can run a laser through that, and you can measure when radioactive carbon was in the atmosphere from when we did bomb tests back in the fifties.

**Alie:** Oh my God!

**Dr Lowe:** So it becomes a little chronometer, little old time keeper, and then you can count these bands, the amount of radioactive carbon to non-radioactive carbon and use that as a chronometer to go back.

**Alie:** Oh my God.

**Dr Lowe:** So, 470 years old. That's the oldest vertebrae on the planet.

**Alie:** That's Super Bananas! Are they doing this on deceased sharks?

**Dr Lowe:** Yeah.

**Alie:** Okay, so if they find a dead one, they're like "Okay, let's check it out."

**Dr Lowe:** The other thing is some of these sharks are caught in fisheries, right? So they're being caught, they're being used, they're already dead. We may as well take their eyes out and look at their lenses, and when researchers started do that, they were like "Whoa, how can this animal live to be that old?" Well, sleeper sharks, there are some found in the Atlantic, some found in the Pacific, some found off Antarctica, they live in very cold, deep water.

What we know about things that live in cold, deep water, is: really cold, really dark, really old, because everything slows down. Metabolism slows down, everything slows down, and when you do that, you have the ability to live a very long time.

**Alie:** Because you're just like [*speaking super slowly*] sloooow moootion. They take fooreeeever to return emails. [*laughs*]

**Dr Lowe:** Exactly. And there's even some evidence that they may not even reach maturity until they're 120 years old.

**Aside:** Can you imagine having a teenage son for 120 years of your life? Like, picking up someone's socks and dirty dishes *for over a century*? Or, from the shark's perspective, can you imagine having zits until you're 120, and mystery boners that you can't do anything about because you have a curfew? Not getting a driver's license until you're older than any human on the planet? No wonder sharks are pissed! Maybe some of them are just cranky, and horny, and they're too young to get a job but also old as shit!

**Dr Lowe:** But again, 400 million years of evolution, right? So they've got something wired and they've passed that on through those lineages. I think those are the things that, the more I learned about them, the more I just go "wow these are amazing animals." I understand

why people are so interested in them. And then, what new thing can we figure out about them? And more importantly, how can they help us?

**Alie:** Yeah, how can sharks help us?

**Dr Lowe:** Well, you know, that that's the thing, the more we learn about their immune system and their physiology, the more we learn that they've got some cool tricks that other animals don't.

**Aside:** Yeah, like a million revolving knife teeth that are punk as a mother.

**Dr Lowe:** As we begin to understand those tricks, there's ways that we can use those tricks ourselves for developing new treatments for infections, and cancers, and all sorts of things.

**Alie:** Now, a few patrons asked us, and I had this question as well. Sharks. Cancer. Does it happen?

**Dr Lowe:** It does. Sharks do get cancer. There's this big thing out there; Sharks don't get cancer at all. That's not true. They do get cancers. They do get them at lower frequencies than many other types of vertebrates. And of course they have this amazing physiology that enables them to do that. There's a lot of research being focused in that area right now and a lot of it may come back to slow metabolisms. It may come back to their ability to deal with antioxidants. I can't wait to see what the next 20 years is going to show.

**Alie:** Talk to me about their electric faces. Do they have magnets? What's going on?

**Dr Lowe:** Well, it's not that they have magnets, they have the ability to detect electric fields. They have little volt meters in their face.

**Alie:** How does that even happen?! Do other animals have that?

**Dr Lowe:** There are some other critters that have it. Duck-billed platypus have these things.

**Aside:** God's up there in a bathrobe like, *[spectral, deep, echoing voice of God]* "Duck-billed platypus. Okay let's see, otter fur, bird beak, titties, but also eggs... hmmm still not weird enough... Give it a machine in its face."

**Dr Lowe:** So the bottom line is, the ability to detect electric fields in water is easier, right? Because the fields conduct better in that media than they do in air. In seawater they conduct even better. So, the idea there is you can have a fish and that fish is full of ions, positive ions and negative ions, and they create basically a biological battery. So every time the fish breathes *[makes a pulsating like electricity sound; whaaw, whaaw]* the field expands. And of course sharks as they swim through the water can detect that electric field when they're close. They have to be maybe a meter or two away to be able to detect that.

Remember those eyelids you're talking about? Right before a shark goes in to bite something, it closes its eyes. It rolls back its nictitating membrane to protect its eye. So how does it find a prey that's trying to escape it with its eyes closed? Well its using these electro receptors to track its prey. It's kind of like being in a cave, and animals in a cave

have either poor vision or no eyes at all, and yet they're able to survive and enhance their other senses. In this case, they have an extra sense and that's that electro sense.

**Aside:** Sharks feeding with their eyes closed, come on, so cute. It's like rummaging in a cupboard with the lights off. Like, "Shoot, I know I shouldn't snack." But the bag of marshmallows is emitting electricity that helps you find it.

**Alie:** I've heard of surfers wearing shark bands that have electro-magnetic fields coming off of them. Is that hocus-pocus or no?

**Dr Lowe:** No, some of it does work, but the bottom line is we found... There's been some research done that shows that sharks can habituate to it. Imagine... it's like being in a building and then you go to a concert. You walk through these soundproof doors and suddenly you're just nailed with the sound, so you're going to kind of be a little irritated by it, maybe disoriented by it. That's how we think those fields are working in those cases. But if you have a shark that's highly motivated, it will tolerate that.

Will it keep you safe some of the time? Sure. But here's the danger in shark repellents; quite often when people feel like they have a superman's cloak, something that makes them invincible, they do riskier things than they would do if they had nothing at all. So this is where I have kind of a problem with shark repellents. I think most cases if people just use good common sense they'll be just as fine than if they use one of these devices.

**Alie:** Is there a good common-sense tactic? If you had a friend who was like, "I've started Boogie boarding and surfing in cold waters where there may be sharks," is there something that you can do that's smarter?

**Dr Lowe:** I think first of all, knowing that there are sharks in the water, right? Your brain is taking in information. You may look at the beach, you may look at the situation and go, "You know what? It just feels a little too creepy. I'm not going to go in today." Hey, you know what? You just made a decision.

However you may do that every single day. You know there are sharks there and you go "I know they're here, I'm in the water, I'm trying not to do anything that would piss them off and as long as I do that it's worth the risk." And I think that's how most of those water people feel.

**Alie:** Oh, they use an intuition?

**Dr Lowe:** I think so. I know I've been in the water a couple times, in the evening in particular, by myself, and those little hairs on the back of my neck start going up and I'm going, "Okay, this could be a *Jaws* flashback, right?" [*quiet, foreboding orchestral drums in the background*] I can hear the music in my head. Or my hindbrain is telling me something. And then I think, "I think I'm going to get out of the water." But that's a decision I make, right? Now, coming back to that concept of what should you do to be safer? What we know based on statistics, is that your chances of being bitten at a crowded beach are very low.

**Alie:** Oh, why is that?

**Dr Lowe:** Well, we think that sharks don't like people.

**Alie:** [laughs] They're just like misanthropes. They'd rather be like, "You know what, I'm more of an indoor kid."

**Dr Lowe:** Well, there's all that suntan lotion pouring off people, and we're smelly, and loud. If you're a shark and you're cruising by you might go, "I'm going to swing wide of this group," Right?

**Alie:** They hate parties! They're like, [angstfully] "I'm not into it."

**Dr Lowe:** Exactly. But the bottom line is that statistics tell us that on crowded beaches it's really rare. If you're worried about it, surf with a friend, swim with a buddy, swim with 10. The more the merrier, right? Most sharks, especially the predatory type that tend to target large prey, tend to isolate things. They're looking for something off by itself because it might be more vulnerable, might be easier to capture. Whereas if they're in a group it becomes a little harder. So these are some things that people can do and it should help keep them a little safer.

**Aside:** I had to ask this and so did Patron Ashley Perez:

**Alie:** Should you ever become snacked on by a shark, should you try to administer a well-timed boop to the nose? [toy horn honk]

**Dr Lowe:** Absolutely. I don't think you have to tell most people to do that when...

**Alie:** It's going to be reflex. [laughs]

**Dr Lowe:** Yes. When something grabs you, your response is to hammer on it, and that's the best thing to do. And of course if you're going to beat on that shark that's biting down on you, the best place to hit it is around its senses. Around the eyes, the nose, those are all very sensitive areas. And what has been shown over and over again from people that have encountered these sorts of situations is that the sharks tend to release. So that's generally the rule of thumb. If a shark comes at you, gets really close, bumps you, or bites you.

**Alie:** Have you ever had an encounter in the wild that was like [heavenly angels singing]? Either in a shark cage or watching something? What's been the craziest memory you've had?

**Dr Lowe:** I would say when my wife, who is also a biologist, and I discovered that sharks sun tan.

**Alie:** What? What!

**Dr Lowe:** Yes. That was an accident.

**Alie:** What, how do you know that they do? Are they just out there with a *Marie Claire* magazine and some jojoba oil?

**Dr Lowe:** Well, I was studying hammerhead sharks, and I was studying how they swim. I would go catch them - these are baby hammerheads - and I would put them in the shallow coral pond. The water is very clear and the sand is very white. You know, it's coral sand. And I would collect a bunch of hammerheads, and I'd put them in this pond, and then I would

film them swimming so I could measure how fast their tails beat and things like that. And then I told my wife, "Look, I need to go get more sharks so I can increase my sample size." She said, "Let's go fishing." So we go out, we catch new sharks, we bring them, we put them in the pond, and we're standing there together looking at sharks going, "Oh my God, they're like different animals!"

So kind of jokingly, we're like, "Oh, maybe they're suntanning." It just so happens that that summer, the group of probably the world's experts on the effects of UV in the marine environment were at this marine lab we were working at. So we started bringing them out to this pond and saying, "Hey, you know, we think these sharks are suntanning." And they are like, "What are you talking about?" The only animals known to suntan are humans and a couple of weird, like, naked guinea pigs.

**Aside:** So, alongside fellow marine biologist Dr Gwen Goodmanlowe, who is also his wife, (P.S. Adorable!) he designed an experiment where they affixed little pieces of plastic onto the pectoral fins of hammerheads. Some of them blocked just UV, some pieces of plastic blocked all the light, and then some that were clear. And then they kept the sharkies there for one to three months, kinda like summer camp.

**Dr Lowe:** After that time we'd take the sharks out, remove the filters, and they had tan lines.

**Alie:** Oh my God, that's so tacky and amazing!!! That must have boggled your mind!

**Dr Lowe:** Well, yeah. We actually got on the cover of *Nature* with that paper.

**Alie:** Oh my God, I'm looking above me.

**Aside:** Directly over my head on the wall was a framed magazine cover showing two sharks next to each other: one looking like my legs in winter, and the other looking like wet asphalt. The headline read: Suntanned Hammerheads.

**Alie:** That sounds like a band that's going to headline Coachella one year.

**Dr Lowe:** It should be. That's a great name.

**Alie:** Now, you got your PhD in Zoology in Hawaii working with hammerhead sharks. Did you pick them because they are the weirdest things on the planet?

**Dr Lowe:** Sort of, but also they're like a high-performance athlete. They really are. As sharks go, they're highly tuned. They can turn on a dime. They've got this big canard wing in the front that generates lift.

**Aside:** So in case you ever black out and come to on the glossy stage of a game show and need to know what that broad head-flap on a hammerhead shark is? I gotcha covered! It's a sphyrnid cephalofoil, from the Greek for 'hammer' and 'head wing.' And, not to *hammer* too many facts into your head, but it may act like a canard wing, which is a little forewing on a fighter jet that comes in front of the main wings to help it float and get lift. So... now you know that information.

**Dr Lowe:** They're incredibly powerful. But they're a shark, like some of the groups, that can never stop swimming. If they stop swimming they suffocate. From the time they're born to the

time they die, they're constantly swimming in order to breathe. So, I was really interested in, what does that cost the shark?

**Alie:** God, that sounds like workaholism. [*fast robot-like voice*] Never stop never stop never stop.

**Dr Lowe:** I figured, how am I going to measure this? I thought, what I'll do is I'll build a big water treadmill for these sharks, and then I'll put them in this water treadmill, and I'll make them swim at different speeds, and I'll measure how much oxygen they take out of the water. If we know how much oxygen an animal consumes, you know how many calories they're burning.

Now I need to make a Fitbit for them, so I built my own acoustic transmitter that measured every single tail beat. Every time their tails wag back and forth it would produce an underwater ping, and then I follow the sharks around for 48 hours and count how many times their tails were beating per minute. By doing that, I could calculate how many calories they burn per day.

What I found out was these baby hammerheads were burning so many calories that they only had about a three-week period to learn how to feed proficiently on their own or they would starve to death.

**Alie:** What is it about some sharks where they have to stay moving all the time? Is that so that water continues to pass their gills? That seems like it would be an evolutionary disadvantage to the max.

**Aside:** [*clip from the film Speed: There's a bomb on the bus!*]

**Alie:** Why is that still in place?

**Dr Lowe:** I think a lot of that has to do with, historically, many places in the ocean, there's a lot of oxygen in the ocean and it's only recently that we're starting to see that change.

**Aside:** So to keep water passing over their gills, sharks have to swim around with their mouths open, though some species just chill out and gulp in water. In more oxygen-rich regions of the ocean, sharks can take more pit stops. They can boogie around a little less.

**Dr Lowe:** Their metabolic rates are much lower than that of us, animals that constantly pay a price to keep our body warm. So their costs are lower. and that means that even though they're constantly moving, their costs are still substantially lower than ours.

**Alie:** Does that mean that they're not sleeping or that they're moving while sleeping?

**Dr Lowe:** That's the big question! There's good evidence that some of these sharks actually do go quiescent even though they're moving. Think of those people that are restless sleepers, even while they're sleeping, they're rolling all over - I'm one of those people. I probably get more exercise sleeping than I do during the day sometimes. It's not that animals aren't moving. They are moving, it's just that they have to do that to breathe. What we think is their brains are, kind of, slowing down, and everything is slowing down. And we recently did a really cool experiment with these baby white sharks that we're studying.

We built a custom Fitbit for them that clamps on their dorsal fin and that Fitbit measures every tail beat they make and also measures every motion they make. What we found was really cool. Two of the sharks that we tracked were doing these 30-foot circles, and they were swimming in a bank. So they'd bank, swim a 30-foot circle, and that circle was almost a perfect circle. And they would do that for 20 minutes and then all of a sudden they would stop and reverse and go back the other way. And they do that for 20 minutes and they'd stop, reverse, and go back the other way. And they would do that for four hours.

So we're scratching our heads going, "What in the hell is that?" My students started looking through the literature and it turns out that migratory birds that fly will actually turn off half their brain, and when they do that they'll fly in a circle in one direction, and then they'll turn off the other half of their brain and fly and circle in the opposite direction.

**Alie:** Oh... my... word...

**Dr Lowe:** So, physiologists believed that that's the way that these migratory birds, which are warm-bodied, so they're spending a lot of energy keeping their bodies warm, are basically resting their brain, and they kind of go on autopilot like that.

**Alie:** Are sharks doing the same thing then?

**Dr Lowe:** It could be, could be.

**Alie:** And now when you say white sharks, is that a new term for great white sharks, or are white sharks 'little great white sharks'?

**Dr Lowe:** Really good question. We've gotten rid of the 'great' part. The common name now is white shark, a.k.a. the great white.

**Alie:** Because great white has such a cachet for like [*gritty, scary voice*] "Watch out. It's a killer." Right?

**Dr Lowe:** It's given them such a big head.

**Alie:** [*laughs*] They're such dicks now!

**Dr Lowe:** We're trying to bring them back to reality. They're such a prima donna! They're just going to be white sharks from now on.

**Alie:** [*pretend whining*] Such complicated coffee orders! And so we just call them white sharks now?

**Dr Lowe:** Yep.

**Alie:** That's good to know! I wasn't sure if they were just, like, little ones. What is the biggest flim-flam that you would like to debunk about sharks? If you could bust a myth, what would it be?

**Dr Lowe:** There's actually a lot. Probably the biggest one is, if you're in the water and you see a shark, it's going to attack you. That just simply is bullshit. That's just not true. We have millions of people in the water in southern California year round, in and among sharks every single day, and nothing happens. Now, they may not see the shark, but those sharks are there. So this myth that if you're in the water, the sharks are going to bite you.

The other one is if you're in the water and you're bleeding.... Great example, and I get this every spring: If a woman is menstruating, is it safe for her to swim in the ocean?

**Alie:** Yes. I got this question from Patron and Mars expert Jennifer Buz, who was a guest on a previous episode. She said, can a shark smell my period in the water or what?

**Dr Lowe:** Probably, if it's very close, but the reality of it is there are little kids out there on the beach that are all skinned up, right? They're bleeding. So, every little kid that goes to the beach that skins his or her knee on something is bleeding in the water. It's not like sharks are pickin' 'em off every day. It's just not true. So people have this vision that a drop of blood sends sharks into this craze. It's just not true.

The other example I use is, I can't tell you how many hours I've spent putting hundreds of pounds of ground-up fish and blood in the water to try to attract sharks and get absolutely nothing!

**Alie:** Right. You must be the real chum master out there. How much of your work involves hauling buckets of chum?

**Dr Lowe:** [laughs] I used to do it a lot. I try to do it less now, mainly because we're putting a lot of nutrients in the ocean that we don't need to use. There are better ways to attract sharks. The bottom line is, here's a situation where we're trying to attract them using the same things, and we can't. So, this whole thing is a fallacy, "Oh my God, if I'm bleeding in the water. The sharks are going to form a frenzy." It's just not true.

**Alie:** Now, where were you? Do you remember the moment you heard about *Sharknado*? Do you remember the actual moment and what your reaction was?

**Dr Lowe:** Actually, after the first one came out... I never saw any of them, but after the first one came out, I got a call from a reporter who actually asked me, could that really happen?

**Alie:** I mean, the answer is yes... happens all the time... Very frequent.

**Dr Lowe:** [sarcastically] Suurree... I was shocked, and I was trying to determine if they were serious. I think they were! And I was like, "Well, you know, there are cases during hurricanes and things like that that sharks do end up inland..." They actually get carried in by storm surge and things like that. But I don't think I've ever heard of a swirling tornado of sharks swirling around off the ocean from a water spout. That just doesn't happen. So, I think those are the sorts of crazy things that, every once in a while, happen and you shake your head, like "uuhh... what, really?"

**Alie:** Even though the world can seem like a dystopian simulation right now, like politically, *Sharknado's* not gonna happen.

**Dr Lowe:** No, it's not going to happen. As crazy as it may be. The bottom line is, actually I think some of those movies are fun. I get it. They're fun. They're kind of a cool twist, and they're so unrealistic that it actually helps. It helps get people over the fear of sharks because they think that's just utterly ridiculous. In a way the campy ones like that actually help sharks, I think.

**Alie:** Do you have a favorite shark movie? I'm sure you have several UNfavorite shark movies.

**Dr Lowe:** Oh my God. People give me DVDs all the time. I had a stack there. I try to give them away. Actually, *Jaws* is one of my favorites.

**Alie:** Is it really?!

**Dr Lowe:** It really is. For me, I was there. I grew up on Martha's Vineyard, so I was there when they were filming it. Half the kids I went to school with are in the movie.

**Alie:** Holy shit! That's crazy.

**Dr Lowe:** So for me, watching *Jaws* is like a family reunion.

**Alie:** Do you think that influenced, at all, your work with sharks? Or how do you grapple with the fact that that movie is part of your childhood and it's part of so many people's fear of sharks? How do you merge the two?

**Dr Lowe:** Maybe being there and seeing how it was made... you know, watching the sausage being made gives you a different impression of what you're eating, right? So the idea there is, we saw all the things, a lot of my school friends were in the movie. They were extras and things like that, and you know, they saw the mechanical shark, and sometimes it didn't work...

So when you see all those things then you realize it's just a movie. I think being there when that was happening made it easier. But of course when you watched the movie, this is the brilliance of Steven Spielberg. None of the things he wanted to actually shoot...like that real underwater footage, they had a hard time getting. Then the mechanical shark rarely worked. So, he made that movie where you actually only see the shark in only minutes of the movie.

**Alie:** Oh really? I didn't realize that.

**Dr Lowe:** Watch it again. See how many times you *actually* see a shark, whether it be a mechanical one or a real one. It's your brain that's doing that. Your brain is building the monster. And that was the brilliant part. That, and the soundtrack is just amazing, right? John Williams is amazing. It creates that whole scene in your head.

**Alie:** This feels kind of like a shark-based 'stop hitting yourself' kind of a situation, you know what I mean? Like, the movies doing it, but also we're doing it to ourselves.

**Dr Lowe:** It's more we're doing it. [*laughs*]

**Alie:** Now, have you ever said - be honest - in the field, "We're going to need a bigger boat"?

**Dr Lowe:** Yes.

**Alie:** Has that happened?

**Dr Lowe:** Yes, it has. It's happened a couple times. Not because of the size of the sharks, but usually because the ocean that we're in. Last summer my students were out tracking those baby white sharks that I was telling you about. We're doing this out of a small 17-foot Boston Whaler. Well, the third shark we did, at one o'clock in the afternoon, my students call me up and they go, [*clip from Jaws, "We're gonna need a bigger boat"*].

So I go, okay. I told my other students take out a bigger boat and we'll switch boats. So they switch out boats, and then I get another phone call at one o'clock in the morning, and they're like, "We're now off Newport beach." That's like 22 miles away. And they go, [*Jaws clip repeats, "We're gonna need a bigger boat"*].

**Alie:** They're going man!

**Dr Lowe:** When they're ready to leave a spot, it seems like they know exactly where to go and they make a bee line.

**Alie:** They're just like, "We out!" They're gone.

**Dr Lowe:** "I'm done with Long Beach. I'm going to Dana Point and I'm going to hang out there for month."

**Alie:** Reminds me of people I used to know, like in club days, that would go to a club at 10:30, they'd arrive. 11:15 they're at the next club. You're like, [*urgent voice*] "Where are we going next? Aahh!"

**Dr Lowe:** Exactly. "This place is dead!"

**Alie:** Have you been in an underwater shark cage?

**Dr Lowe:** Yes.

**Alie:** Yeah, you've been in those, right? My thought on them is, like, they look scary, but also they look like they're not going to... They seem like they would be safer than other things, because they're not going to bite through the bars, right?

**Dr Lowe:** Yes, exactly.

**Alie:** Is it fun? Is it crazy?

**Dr Lowe:** It's kinda cool. You do feel somewhat restricted because you can't move as well. As a diver, I'm used to being in the open water. I feel more comfortable, being able to move a little bit more freely. The other thing that is always a little uncomfortable is when the cage is hanging in the water and you're hanging by a rope, or a cable, or something like that. You go, "Okay, wait a minute, I'm in a box, over 200 feet of water..." It sounds like a plot to movie, right? And you're going, "How quickly can I get out of here if I have to?"

But the biggest problem that has occurred with some of the cages is that the photographers want big windows. They have big cameras, and they want to get those big cameras out those windows so you don't get a beautiful shot of this awesome shark swimming by with bars in it, so they make the windows bigger. But what happens is the smaller sharks can swim through the windows, and occasionally when they get in the cage with you, they don't like that.

**Alie:** Yeah, I bet not.

**Dr Lowe:** And they start bouncing off the walls, and you're in the cage with the shark, and the shark's not happy about being in the cage and you're trying to get out of the cage. Those aren't good scenarios.

**Alie:** Yeah. That sounds like having a bee in your car.

**Dr Lowe:** It's kinda like that. So, for me, I prefer not to use cages. In good, clear water when you can see the sharks coming, and the sharks know you can see them coming, you feel a lot more comfortable.

**Alie:** Have you ever gotten a little love nibble from a shark?

**Dr Lowe:** The little ones, because they don't like being held. A lot of animals don't like being held. Those are the ones that...there's some forgiveness there, right? Little teeth, little wounds. I've been bumped a couple times. I've come close to getting bit, but there's one rule in my lab, one rule, really important rule. Do not get bitten. That's the number one rule. I always tell my students, if there's one thing you leave the lab with, rule number one:

**Aside:** [*spectral, deep, echoing voice*] DO NOT GET BITTEN.

**Dr Lowe:** I'm not taking anybody to the emergency room.

**Alie:** Oooh my God! And so they know their precautions?

**Dr Lowe:** Yes. We spend a lot of time training. We really do. We spend a lot of time on how to properly hold sharks. And it's not just for our safety, it's for theirs, because we want to make sure these animals are well taken care of. But the other part is, when you're in the water, what do you do when you see these sharks? And can we begin to interpret their behavior? And generally what you find, and most water people know this already, it's like having dogs. People that have dogs and are around dogs all the time, you can tell when a dog's upset. You can tell when a dog's afraid. You can tell when a dog's angry. And you know what to do in response to those recognitions. Sharks are no different. They really aren't. Once you start to interpret body language, you can start to go, "Okay, that shark is not in a good state. I'm just going to back up."

**Aside:** Also, I asked later, off mic, if sharks have individual personalities and Chris stopped and looked at me like I had asked the same question about his children. And rightfully so. He was like, "Oh, you dear woman, yes, *of course* they do." So my job in life is now to wear spiked shoes, to climb the nearest, tallest tree and scream to as many people in earshot that [*loud voice*] Each Shark Has A Unique Personality! They're like

dogs! Or people in the real world! Maybe some of them are really sweet and would help you move, and then others would not even RSVP for your birthday party.

**Dr Lowe:** ... Or, you know, it's coming really close, it's just checking me out, if I give it a good swat in the nose, you know, that'll be good enough. So these are the sorts of things that we're learning. We're trying to interpret their body language so that we can better give that information to the public so that if you see a shark, you can do the same thing, like you would if you're walking down the street and you encounter a dog.

**Alie:** So it's: back up, maybe a nose boop, maybe trust your intuition, and don't be a bucket of chum.

**Dr Lowe:** That's pretty much it. And being aware of your situations. I hear really funny stories from surfers who are like, "I love going out in the surf and communing with nature. It's great. You know, there are times I'm out there and there's this huge school of fish around me, and they're underneath my board, and I'm in the middle of it, and I'm thinking that's great."

I'm like, "Yeah, that's probably not the best place to be because you're in the middle of a bait ball." And what is it sharks do? They charge through those bait balls, and you don't want to have your foot mistaken as a piece of bait.

**Alie:** Oh, I've never heard of the term bait ball, but it's now my favorite ever.

**Dr Lowe:** Yep. The other one is, they're out there and it's a beautiful evening and a baby seal or sea lion climbs on their board and they're thinking, "Oh, what a touching moment. It's wanting to bond with me." Actually, it's trying to hide from what's in the water that's trying to get it. *[laughs]*

**Aside:** Oh man I just went so deep down a rabbit hole watching clips of seals on surfboards, and they also flop into fishing boats to take refuge from orcas like scared little aqua-dogs . And if you're grumpy or in a bad mood just consider, our species is SO LUCKY that the thing that kills us the most, especially as a nation, is eating too many appetizer platters at TGI Friday's. Other animals are constantly watching their backs because they might get eaten, and we likely have more ability than we're aware of to sense that, but we just probably chalk those perceptions up to spidey sense or whatever because we're just not used to using them.

Now, it's time to get to the Patreon questions and get to the rapid-fire round. There were so many good ones, I jammed in as many as I could. Let's start with Topher who asked this innocent, breezy, casual question that I love: Is it true that sharks eat each other in the womb?

**Dr Lowe:** The answer is yes. It's called adelphophagy, and it's common in sand tiger sharks. They should have been called the Highlander shark because there can only be one. One per uteri. So they eat all their lower, slower-growing siblings.

**Alie:** Okay. Man, that's one way to have the survival of the fittest. Start 'em off young. They're all 'only children.' They're like, "Really? Me too. That's so weird, I'm an only child too! We're all only children! Huh!"

Jamie Drew, wants to know: My nine-year-old, Chelsea, would like to know if sharks fart. Thanks.

**Dr Lowe:** Good question. A lot of other fishes do, but there are other reasons for that. They probably do because they probably build up a little methane gas in there.

**Aside:** For more on this topic, you may want to add to your library the reference book *Does It Fart?: The Definitive Field Guide to Animal Flatulence*, written by a zoologist alongside a salamander expert, and fun side note: Dr David Steen, of the herpetology episode is thanked in the foreword of this book for helping inspire it. Once again, it's called *Does it Fart?*

**Dr Lowe:** By and large sharks' digestive systems are amazing.

**Alie:** Are they SO efficient?

**Dr Lowe:** They're unbelievably efficient, considering what they eat. Sharks are unique in that they can evert their stomach. When we get sick, we have to have what's called reverse peristalsis. Suddenly muscles that normally go only in one direction from your mouth to your stomach go, "that's not good in our stomach," and they start moving in the other direction. That's why you vomit. Sharks actually don't do that. They actually turn their stomach inside out. So they evert it out their mouth. They can rinse it out and then pull it back in.

**Alie:** God, that's so handy.

**Dr Lowe:** It really is.

**Alie:** On their 21st birthday. They do live to be 400 and whatever, I don't know what the equivalent is of legal drinking age, but that would be handy.

**Dr Lowe:** When you're eating whole fish with spines, and scales, and things that are really hard to digest, why pass those through your sensitive inner bits? Why not just get rid of them, flush 'em out.

**Aside:** Like shaking crumbs and bobby pins out of your purse.

**Dr Lowe:** Once that meal passes it starts going through their intestines. Their intestine is this great space-saving device that's a spiral staircase where food kind of winds its way through... it looks like a football with a spiral staircase, and it's very efficient at pulling out all the good nutrients. Some sharks actually have a different kind of what's called a scrolling valve. So they can actually rinse out their intestine out their anus. Now, this is something you'll typically want to do in private.

**Aside:** No really, shake out your rectum in private, you'll see.

**Dr Lowe:** The way we know this works is, in public aquaria where they have some of these sharks, they will have their sharks out during the day and they look great, and the next morning they come in and the shark's dead on the bottom of the tank.

So the researchers at the aquaria's will take them out and they'll do a necropsy, and what they'll find is that the lower part of their intestine has perforations, and they internally haemorrhage. Nobody could figure out how this was happening. It turns out, at Waikiki Aquarium, one of the grad students who was in charge of sweeping up the foyer at night saw this happen. They saw this blacktip reef shark swimming around, flush this thing out its butt, and a jack [fish] came over and bit it.

**Alie:** [*horrified*] Oh my God! Rude!

**Dr Lowe:** So the great thing is, they have the ability to completely flush their body, their digestive tract, to get rid of all sorts of debris, and parasites, and all sorts of things. The bad thing is, you don't want to do that in the presence of other predators.

**Alie:** Oh my God, this is like triple lock on the bathroom here.

**Dr Lowe:** Exactly.

**Alie:** Oh my God. That's so tragic. But who knew that? Whoever was sweeping the lobby was like, "You just figured out a whole new thing about the bowels of a shark!"

**Dr Lowe:** Exactly.

**Alie:** Oh, that's amazing.

Both Hail Science and Justin So want to know, essentially: How aggressive are sharks really?

**Dr Lowe:** They're not any more aggressive than I would say most of the other animals that we're familiar with. Like all animals, they will protect themselves. Everybody has personal space and when something starts getting in your personal space, you will have a breaking point where you will protect yourself. Push somebody else away, thwart somebody, do whatever you have to do to protect that personal space. And we know sharks have that, and have a body language that they warn other animals that 'you're in my space.' And my predecessor, Don Nelson, did some really cool research on that too.

**Alie:** Do they flick their tails all sassy?

**Dr Lowe:** No, they arch their back. They drop their pectoral fins. You know like when you chase a cat down an alley and you corner them, and they arch their back, their fur stands up, and they bare their teeth. That process is known as an agonistic display.

**Alie:** Oh, it's like mad doggin' someone.

**Dr Lowe:** Yes it's like mad dogging. It's like "Back off, Jack!" We know that sharks exhibit that behavior, and that behavior is an agonistic display because my predecessor would chase them around in an underwater sub to piss them off, and then he would get them to the point where they would break out of it and they would attack the sub and take off. So, he could actually induce that behavior and get them to basically do what a cat would do. And then of course, when animals feed, that's not aggressive, that's just feeding right?

**Alie:** You gotta eat! You gotta eat, you're a shark!

Sarah Nichelle wants to know: I've seen a few videos recently of sharks enjoying scratches. Do sharks have a type of pleasure center in their brains? Do they like little scratchy-scratchies?

**Dr Lowe:** They do have a lot of itchies. I'll give 'em that. There are a lot of ectoparasites that get on sharks, and they have little claws, and they move around the body, and they probably itch. Quite often, it's not uncommon to see sharks rub on the sea floor or they'll rub on coral reefs. They'll rub on rocks trying to rub these things off. One of the reasons why we think some sharks jump is to try to dislodge those things.

**Alie:** They're like, literally, "Get off my back."

**Dr Lowe:** Exactly.

**Alie:** Neil Williams wants to know: What's with the fish that tags along with sharks, like an annoying little brother? Are those lampreys, what are they?

**Dr Lowe:** So those are remora. So there's remora and shark suckers, and basically they're hitchhikers, but they're hitchhikers with a purpose. Their goal is to not only to catch a ride, so sharks are like Uber, basically, for them, but also Uber Eats. As the shark's feeding, it's releasing little bits and pieces that they can actually snack on.

**Aside:** This sounds like the fish version of being a stowaway on a gelato truck and I am into it.

**Dr Lowe:** They're getting a ride and a meal at the same time.

**Alie:** Oh, that's so cute.

**Dr Lowe:** Not to mention, now you're with big brother, and big brother, nothing's going to come try to eat you because you're attached to a big shark.

**Alie:** But they might be like, [*annoyed whiny voice*] "Ugh get ooooff!"

**Dr Lowe:** They do that, and all the remora's do is switch to the other side.

**Alie:** What a professional pester. Akii wants to know: Do sharks communicate with each other? And if so, what do they talk about?

**Dr Lowe:** Well, probably the same things we do like, "Hey. How's your day going? Have you seen any seals lately?"

**Alie:** "Do I have remora on my butt right now?"

**Dr Lowe:** [*laughs*] "Does this remora make my butt look big?" Stuff like that. That's the part that I think is really interesting. That's the part we're trying to figure out. A lot of fish use chemicals as a means of communication. They use pheromones to communicate with individuals of the opposite sex to say, "Hey baby, are you looking for a mate?" Or maybe, "I just saw something really scary and there's a predator around here," and those chemicals alarm them. They're meant to scare other sharks.

We don't fully understand how that system works in addition to the body language parts, and some of the body language may be very subtle. Big ones tend to show the little ones, 'you're in my space.' They'll do things like jaw gaping. They flap their gums, basically. And that means, "You're pissing me off. You better back off."

**Alie:** Damn! So they DO communicate.

**Dr Lowe:** They do. Our job right now is to try to figure out what those messages mean.

**Alie:** When you say if there's a predator around for sharks, what would be a predator to sharks? What eats sharks? Aren't they an apex predator?

**Dr Lowe:** Well, sharks eat other sharks, so they'll eat other sharks no problem. But probably the king of the hill, the king of the ocean, is really orca. They're the true bad asses of the ocean because they're the only thing that's been known to take down adult white sharks.

**Alie:** Oh, I didn't know that! You know what? Now that you say it, they're kind of like an SUV cop car.

**Dr Lowe:** They really are. They're true badasses. And what makes them the true badasses, is that they're warm bodied, they're fast swimmers, super smart, and they're very social. They work as a team.

**Alie:** Oh, so they can surround one white shark.

**Dr Lowe:** They're basically like a gang, the worst gang of wolves you can imagine.

**Alie:** But it's so funny because no one's afraid of orcas like they are sharks.

**Dr Lowe:** Hmmm.... I wonder who did the PR for those whales.

**Alie:** Damn! SeaWorld!

A couple more questions, I know you gotta go. Here's Carl and Alicia Pruitt want to know: How do their teeth grow so quickly and what determines how many rows of teeth a shark has?

**Dr Lowe:** Some of that's genetic. The number of teeth they have per row is genetic. In fact, we can use that as a way of identifying certain species. The tooth shape actually changes, which is really cool. So if you're the type of person that hates going to a dentist, you should've been a shark. Absolutely, because the cool thing is when they're small, their teeth will be a different shape because they're designed for eating different things, usually the things they eat when they're small. But as they get bigger their teeth morphology can change so they can eat different things. The cool thing about that is their teeth change as they mature, which enables them to feed on different things.

**Alie:** And they just keep growing.

**Dr Lowe:** And just keep growing. Here you can see behind the gum would be another five or six rows of teeth that are developed. The entire front row is programmed... it's like, literally

a conveyor belt. The front row fall out about every 30 days and a new row of teeth is constantly rotating in.

**Alie:** And that's why sometimes people find shark teeth on the beach. They're just disposable.

**Dr Lowe:** Pretty much, yeah.

**Alie:** That's amazing. I have never seen a shark skull like this up close and to look and to see them all nested in there. It's crazy. It's almost like, if you were to take apart a rosebud and it's just layer after layer of teeth. Oh my God. Okay, last two questions...

**Dr Lowe:** Fire away.

**Alie:** What is the worst thing about your job? Is it scraping tanks? Is it scheduling press? What's the shittiest thing about your job? What do you hate?

**Dr Lowe:** As a university professor, the worst thing about my job is grading. Oh my God do I hate grading. It's the worst!

**Alie:** I love that this is a person who has been suspended in a shark tank in the ocean, and the worst thing about your life is *grading*.

**Dr Lowe:** I would clean a tank before I would grade. Oh man, I hate grading.

**Alie:** So, grading sucks the most.

**Dr Lowe:** Grading sucks the most. I love being in the field. I love being out working with my students. I love working with sharks. But I have paperwork that I have to do and somebody's gotta do it, and it always falls on me. That's another really crappy job. Even dealing with the press, I don't mind doing that because I feel as though the more I do it, the more reporters I educate. We gotta change the dynamic. We gotta change the way people think about sharks. And to get a reporter to say that? That, to me, is a win.

**Alie:** Right? It's a chance to get people to love sharks as much as you do.

**Dr Lowe:** And I think it's working. I think we're slowly making progress.

**Alie:** Now, what's the best thing about what you do?

**Dr Lowe:** There's so much. I love working with students. I love talking to the public about sharks. People have so many interesting questions and observations. I love working with kids. Kids have no fear. None. They are just like, "That is the coolest thing *ever!*" I love technology.

**Alie:** Because you use a lot of it in your telemetry?

**Dr Lowe:** I'm a total tech junkie. If I had to go back to school, I'd do it for engineering.

**Alie:** Really?

**Dr Lowe:** Oh my God, I love it.

**Alie:** But we need you in the shark world!

**Dr Lowe:** No, no. We need engineer-computer scientist-shark biologists. That's what we need.

**Alie:** So calling all people who have interests in all those things, go do that.

**Dr Lowe:** Come see me please. It's changing the way we look at sharks. Technology is literally revolutionizing our understanding of the ocean. What held us back was the lack of tools.

**Alie:** You can do so much more now than you could 20 years ago in terms of collecting data, right?

**Dr Lowe:** Absolutely. It's because the technology has got us to that point. The great thing is it's getting like-minded engineers and like-minded computer scientists to say, "Okay, I can work with you. That's really cool idea. I can build that for you. I can work with you to build that." And then when that technology comes along, we're suddenly buried in data. Biologists who aren't used to having that much data are suddenly going, "Oh my God, what do I do with all this?" Now we're working with data scientists who go, "Hey, I know how to help you with that."

What it's doing is, it's showing people how we use the technology, how we're using it to understand sharks, how they can use that to use the beaches safer. And then it's motivating the next generation of student who is interested in science, or math, or technology, or sharks.

**Alie:** Do you think that there is a world, five, ten years down the line where we look at sharks with the same warmth and reverence that we do whales, and cougars, and other predators who are really astounding biologically?

**Dr Lowe:** I think a lot of people are getting there. The tough part is, if you look at predators in general, land predators, ocean predators, we got rid of them all. 50 to 100 years ago, we eliminated those things because we perceive them as a potential threat. What's happened since then is humans have now used the woods, and the mountains, and the ocean for all sorts of recreation, and we did so without those predators.

And about 25 years ago we recognized the importance of those predators and we started putting in place protections for them. Now that they're coming back, we don't know how to act around them. There's a big need to teach people how to be predator savvy again. As an example, seals and sea lions, they've come back tremendously. Since the marine mammal protection act in 1973, they went from being on the verge of extinction to being fully recovered. Now it's not uncommon to be at the beach and have a sea lion haul out. In some cases the poor animals are sick.

I've seen people go place their toddler next to them to take a picture of that. At what point did we think that was a good idea? That animal laying on the beach looks so cute, is actually an ocean wolf. It's got canines about three inches long. These are the sorts of things we have to fix. Like the family driving to Yellowstone and they see a bear eating out of garbage bags on the side of the road, and they pull over their car, and they roll down the window, and they give their kid a cracker to feed to the bear, and they take a

picture of that. When did we think that was okay? These are the things that we got to work on.

**Alie:** So don't be fearless, but be smart.

**Dr Lowe:** Be predator smart. It's so cool to be able to see these animals, but we have to give them their space - and we have to remember their job, they're a predator - so that we don't become part of the food chain. As long as we're smart we should be able to do that. We did it before in our ancient history. We can do it again.

**Aside:** But of course, being predator savvy isn't the same thing as being terrified of an extinct megalodon. Now, watching Shark Week, just take it with a big fat grain of salt.

**Dr Lowe:** Entertainment wise, enjoy the entertainment. Just be aware that the educational value may not quite be of the same caloric content.

**Alie:** Sure. Thank you so much for debunking so much flim-flam. You are amazing in your field. Thank you so much for doing this.

**Dr Lowe:** Thank you.

**Alie:** Yeah, this ruled.

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So remember: if you have a stupid question, ask smart people because seriously, they love talking about it. And that's how they got smart, and just asking the question is smart as it is.

Now, to learn more about Dr Lowe's work, you can Google Shark Lab Long Beach. It'll pop right up. He's also on [Twitter](#) and [Facebook](#) as CSULBSharkLab (that's Cal State University Long Beach Sharklab). You can watch the telemetry trackers of white sharks, shovelheaded guitarfish, sea turtles. It's kind of like Find My Friends. That's at [SCATTN.org](#), and I'll throw a link in the show notes.

Ologies is at [Patreon.com/ologies](#) if you want to join the question club. I include as many as time allows. And we're also at Ologies on [Instagram](#) and [Twitter](#). I'm @alieward on both. The [Ologies Podcast Facebook group](#) is popping off. Thank you Erin Talbert and Hannah Lipow for admining. You're both wonderful and I love you!

[OlogiesMerch.com](#) has your body actually covered, and again the code for 10% off sale through July is CampOlogies. Thank you Shannon Feltus and Boni Dutch for being such rock stars! Thank you Steven Ray Morris, who has been under the weather, and when I expressed that I was afraid that editing this on a tight turnaround would kill him, he texted me, "You're not gonna kill meeeeeeee." And I hope he's Ok. Steven, Please sleep! The music was written and performed by Nick Thorburn of the band Islands.

And you know, each episode I tell you a secret at the end. Usually it's one of my secrets, usually slightly shameful, but I'm going to tell you a cool happy secret that's not mine. If you watched the Superbowl performance a few years ago with Katy Perry dancing, two upholstered seven-foot tall sharks, one on either side of her - the left shark fucked up, could not dance, and became this mascot for doing your best and not nailing it. For years, the person inside the left shark costume would not speak publicly, and finally he did earlier this year.

His name is Brian Gaw, he was a dancer with Katy Perry for 5 years. Now he's a hair stylist in West Hollywood, and he said he knew what he was doing. He was like, "I'm a good dancer, but I just figured, you know what? I'm gonna mess this one up. It'll be more interesting." So he got up there, screwed up the choreography. He looked like an idiot, everyone's like, "Yes, left shark, you're giving me life! It is ok to be myself!"

In this episode about accepting sharks, I think the left shark will usher us into a new era of sharks are people too, they are individuals, they are imperfect, and that is what makes them loveable. We are each our own little shark with our own little personalities.

Okay, that's my secret.

Berbye!

[*Outro Music*]

*Transcribed by Rosie Thomas, Wolverhampton, UK, that lady whose face always seems really angry but inside she is happy thinking about sharks, dinosaurs, and cats.*

Some other links which may be helpful:

[Dr. Chris Lowe's SharkLab](#) at Cal State University Long Beach

Track sharks and fish and turtles at [Scattn.org](#)

Dr. Lowe's [Twitter](#) and [Facebook](#)

More links at [www.alieward.com/ologies](#)

[OlogiesMerch.com](#) has hats, pins, totes, shirts, etc.

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[SHARK WEEK is old enough to have a kid](#)

[A shark is a fish but not all fish are sharks](#)

[Teeny-tiny sharkies](#)

[Swim or drown, I guess](#)

[Shark attack odds](#)

[Lottery odds vs. other disasters?](#)

[Do obtain, "Does it Fart?"](#)

[Seal rests on surfboard, ummmm, yeah](#)

[Hammerhead head](#)

[We are all the Left Shark](#)

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