ep 60

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**SPEAKERS**

Noah Guiberson, Jaida Elcock, Em Costa, Rob Frawley, emily costa

**Em Costa** 00:33

Hey folks! I'm Em Costa and I'm here alongside my co hosts, Rob--

**Rob Frawley** 00:38

Hey-o!

**Em Costa** 00:38

 and Noah--

**Noah Guiberson** 00:39

Hello!

**Em Costa** 00:40

(laughs)

**Noah Guiberson** 00:42

What? That's how I talk! Alright let's do it again. We'll do it again.

**Em Costa** 00:49

I was waiting for like an operatic like note.

**Noah Guiberson** 00:53

Say my name again. Say my name again.

**Em Costa** 00:56

All right all right hang on. And Noah-- Hellooooooooooo! Give him an inch, he takes a mile...for another episode of Facts Machine, a podcast created by and for people who are curious about everything, but especially the things that make them laugh. I am also here, to my indescribable delight, alongside today's fantastic guest host, who you might know as a shark scientist and PhD student studying shark movement ecology at MIT Woods Hole, co-founder of the organization Minorities in Shark Sciences, or MISS, an organization dedicated to encouraging women of color to pursue careers in the shark sciences, and organizer of #BlackinMarineScienceWeek on Twitter. But even with all of that, you must probably know her as illustrious TikTok-er @sofishtication, whose peppy, hilarious rapid fire and super informational animal facts videos take all the tenants of exemplary science communication, and just knock them out of the park and into the stratosphere. Anyways, please join us in welcoming Jaida Elcock!

**Jaida Elcock** 02:10

Wow, what an incredible introduction. I feel so honored. Thank you!

**Em Costa** 02:16

You know, an incredible guest merits an incredible introduction. What can I say? Thanks much for joining us.

**Jaida Elcock** 02:21

Yeah, thanks for having me! I'm excited to be here!

**Em Costa** 02:23

We're excited to have you!

**Rob Frawley** 02:25

You should get the transcript of what Em said and then whenever you give a talk, just hand it to them and say "I want you to read this."

**Jaida Elcock** 02:33

"Introduce me, otherwise I'm not coming."

**emily costa** 02:36

Contract stipulations.

**Noah Guiberson** 02:40

I've definitely imagining you know how like, boxers walk out with their like whole group of people. And they're like wearing like a shiny robe. But I'm just imagining Em doing this sort of like Don King-like microphone coming down from the ceiling, like "IN THIS CORNER...!"

**Jaida Elcock** 02:56

Everyone screaming in the stands is just a different group chat.

**Em Costa** 03:03

Amazing. Ah man, I might request some of those mics next time we're at Caveat.

**Noah Guiberson** 03:10

We can definitely make that happen.

**emily costa** 03:13

So Jaida! MISS, I was looking at your website earlier today, looks super, super cool. And I was wondering if you wouldn't mind telling us a little bit more about what you guys do?

03:24

Yes. So MISS, Minorities in Shark Sciences, is an organization as you so eloquently explained, that is dedicated to helping women of color get kind of like a community and get some good experiences in the field of shark science, because it is a very white male dominated field, as a lot of fields are. And I guess the founders were just kind of tired of realizing that we're the only woman in the room or the only person of color in the room, or especially the only woman of color in the room and kind of feeling a little bit isolated by that. So we started this whole organization, June of 2020. Coming up on our anniversary really fast, which is really exciting. And so it's just this thing that we wanted to make sure that other women of color felt like they had a community. And we can try to help inspire other young girls of color who are potentially interested in shark science as well so that they can see people that look like them in the field and they're like, "Hey, this is a job that I could do! That sounds so cool. I now have a community!" because we're here for everyone. So yeah, it's been so much fun so far, because I've met so many amazing women of color that are also obsessed with sharks, so you get to nerd out with like-minded people and have a good time. So yeah, it's been a really good time so far.

**Noah Guiberson** 04:44

So y'all I saw recently did like something in Florida like first was it a field school or something?

**Jaida Elcock** 04:50

Yeah!

**Noah Guiberson** 04:50

Tell us about that. It looked amazing. I was just looking at all these pictures of people like holding sharks with glee in their hearts. Just looking so happy.

**Jaida Elcock** 05:02

Oh my gosh, this was so exciting. So this was a field experience for people who probably don't have a lot of experience yet. So we took out some participants. We're partnered with field school. So we took some participants from all over the country out to Florida. And this was a fully-funded expedition, like they didn't have to pay for anything. We brought them out on the boat. We lived on the boat for like two days. And then we went out shark tagging, and we taught them how to drumline. We taught them how to longline. And the craziest part to me is we taught them how to longline in the dark because it was a dawn set. So the sun had not come up. It was like five in the morning. Everyone's exhausted. And they got it so quickly and were so good at it. I was like "you guys are literally amazing scientists!", never done longlining, and it's the middle of like, it's so dark outside, they just they picked up on everything so quickly. And so we got to catch some sharks, do a workup, you know like take blood samples, tag them, take a fin clip, take a biopsy sample, so we can get tissues and stuff like that. And I mean, for a lot of them, it was their first time ever seeing a shark in the wild, so they were just so excited. But even with all that excitement, they didn't just freak out and forget everything that we had taught them. They were like, "Okay, I know exactly what to do. I have this, this fin clip. I'm gonna take it and put it in the vial and what--" like, they knew exactly what to do. And they did it with excitement and enthusiasm. And they did it so well. And oh my gosh, it was just the most amazing thing ever. And I can't wait for next year's.

**Noah Guiberson** 06:35

So cool!

**Em Costa** 06:36

Oh, my gosh, that is, that is so awesome.

**Jaida Elcock** 06:39

It was so much fun.

**Em Costa** 06:41

Yeah. And to our listeners if you'd like to support this, sort of like this training experience and community building, and just shark-induced glee, you can do so at misselasmo.org/donate. So do that, make this happen, it's so cool. So Jaida will join Rob and Noah in our usual exchange of three facts, followed by a pub-style trivia quiz, loosely-inspired by this episode's theme, and that theme is teeth!

**Noah Guiberson** 07:17

Hard to imagine how our, how our guest who is a shark expert got us to the theme of teeth.

**Jaida Elcock** 07:25

It's funny because I'm not even like, as you said earlier, I do shark movement ecology is like where my specialties lie. So I'm not necessarily like an expert in shark teeth. But like, there's a lot of really cool shark teeth facts out there. So I had I had to, I had to go for it. So I'm super excited.

**Rob Frawley** 07:41

Shark teeth ooh-haha!

**Em Costa** 07:46

But rather than spew a mouthful of more or less canine to 10 not incisive dental puns, I'll exercise some wisdom and instead not bite off more than I can chew and pry this already wobbly intro from my chattering jaws and hand the mic over to Rob, whose fact will undoubtedly give us something worth gnawing on.

**Jaida Elcock** 08:06

Oh my god. That was so many puns all at once. It was hard for me to like keep up.

**Noah Guiberson** 08:14

Just keep swimming!

**Em Costa** 08:16

There we go.

08:19

All right. This week, I learned the hardest thing you can do is enamel. Yeah.

**Noah Guiberson** 08:26

I get it. Nice.

**Rob Frawley** 08:29

Assuming you're, when your body makes something, it does that. So that's that's the conceit there. Yeah. But so enamel is the hardest substance in the human body, which I think is really cool, because I, as has been brought up, like bones. I enjoy the field of osteology and orthopedics and you know, bone stuff. And I think a lot of people consider bones pretty, they're pretty hard. Like they're they're a tough substance in a mechanical sense. And like, so you know, I have a predisposition to really like bones. And I really want to drive the point home that teeth are not bones. And that is a very important distinction for me to make. Yeah, and I will fight you.

**Noah Guiberson** 09:17

Teeth are harder than bones.

09:19

I think that's an important point to make, especially because then it just amplifies the fact that sharks don't have bones.

**Noah Guiberson** 09:27

Yeah, perfect. Yeah.

**Rob Frawley** 09:29

Because, and so many students and I work with young kids. And I also have a shark jaw that is like a really great prop for classes. But like, but so we're like, oh, yeah, like we talk about invertebrates all the time. So we're like, "oh, name an animal that doesn't have bones" and kids are like "sharks!" So they're invertebrates but they have teeth and I'm like, oh, there's so much to so much to react to.

**Noah Guiberson** 10:00

"Which thing that my students said should I shame first?"

**Em Costa** 10:05

Science educator, Rob Frawley.

**Rob Frawley** 10:08

And then I'm like, "well, actually, sharks are chordates and that's quite important." But no. So I want to definitely draw the distinction between bones and teeth. And there's actually like, so the way that I think about it, the way that I've explained it in the past is, bones have this incredible ability to regenerate, which teeth do not. And for most species, teeth have this incredible ability to just fall out which bones do not. And that's kind of like, those are the two sides of it for me. And I think that really neatly summarizes it in most ways. So if you chip a tooth, you don't just wait for it to grow back. That's over, you put some put some tooth cement on it. What I think like I've always known but never really thought about until researching for this fact, is that teeth can demineralize and remineralize to a degree. And so that's something that I want to really sink my teeth into in this fact.

**Noah Guiberson** 11:07

So, so before you get started, when you said demineralize and remineralize, is that special?Like, what is it? Like, what is that--? Are you contrasting them with bones? Like what does that mean? Sort of like you were like, "I didn't realize before that they do this that makes them more like bones. Or this is an additional property that makes them even less like bones."

**Rob Frawley** 11:33

Yeah, it's I would say it's something that makes them more like bones in that they are a living, mineralized tissue. And so I think we're all familiar with, if you break a bone, it sets, a callus forms, and then these amazing cells, osteoblasts, go and they lay down new bone, osteoclasts roll in, and they kind of resurface it. And at the end, you have essentially the bone you started with, but just all new mineral kind of in the fracture space. If this happens at a juncture of your life where you're growing, you may actually have like, it slows down the growth or it stunts the growth. And so you may, you know, if you do this in adolescence, you may have a shorter long limb on one side because of a fracture. But otherwise, there's really no, there's no functional difference to the new bone than to the previous bone. You can kind of see, like historical remnants. So in fossils, we can tell if someone broke a bone and it healed because it leaves a slightly different mineral pattern in the places it integrates. But this is something bones do and like we said teeth don't. But teeth do get mineral back. And I think there's this idea that you can, you know, if you have bad dental hygiene or weak teeth, you can change your diet and you know fluoridate and do all these things and actually make your teeth stronger, which I've always kind of never thought about it, yes, but it's actually really true. And so I want to just I want to walk you through the magical world of tooth formation, and how we get enamel. And so so there's a few proteins that make up teeth, like any mineralized tissue is proteins and what we call matrix or the crystal the hard part. Bones have a kind of nice, but there's a lot of collagen in bones, a lot of empty space in bones. And then there's a lot of matrix mineral that makes it hard. Teeth are 4% protein, and one of the big proteins is enamel and there's another one called tuftelin. I bring it up because I think it's a funny name. It's so fun to say. It's, it's not nearly as important or consequential to this story, but I thought it was worth including and that's, that's it. And then there's like--

**Noah Guiberson** 13:44

So it's for, it's, what is it 4% protein? But like so does that like among the macromolecules it's like what are the-- so it's very little protein.

**Rob Frawley** 13:52

Yeah.

**Noah Guiberson** 13:53

So what are the other macromolecules in teeth?

13:55

It is mostly a matrix. It's mostly hydroxyapatite, which is basically basically a form of calcium phosphate. And like it's really just calcium phosphate. And the way you arrange your calcium phosphate is very important for the product you get. So you can get calcium phosphate arranged like bone, you can get it arranged more like enamel. You can get it arranged more like other elements of teeth that are not enamel. You can get it to be, I mean pretty similar to things like eggshell or clamshell or like a lot of those things have calcium phosphate in them. So the arrangement is super important on a mineral level. What's kind of crazy is the way that your your enamel forms. So there are these cells called ameloblasts, I'm not sure how it's pronounced. And that's the "amel" is from enamel. And so that's an Old English root and I really tried to find--

**Noah Guiberson** 14:53

(laughs) To get an Old English root canal?

**Jaida Elcock** 14:55

Literally, oh my gosh, I'm just proud of myself for being on the same wavelength as you 'cause I had that and I was like "nice, okay, cool, oh great."

**Rob Frawley** 15:07

Excellent. But yeah, I was hoping to find like a cool word origin story, but it literally is just like the Old English word for the enamel of the tooth. So yeah, I guess pretty, pretty functional and important word. But the ameloblast, one ameloblast cell sort of acts like one osteoblast. And the osteoblast is the cell on the bone that lays down new mineral. But the way am ameloblast works is it essentially builds a column from the from the base up of densely-packed matrix material. And then next to it, another ameloblast will lay another column. And there are these tightly spaced columns that have a little bit of space in between them, which actually gives them a little bit of flexibility, not really any great amount, but a statistically important amount, I guess. And then somewhere there's some dentists listening being like "that's so wrong" like this is I'm afraid, very simplified and not quite, quite perfect.

**Noah Guiberson** 16:02

I just want to interject that there's a type of column called the Tuscan, which is a tusk is a type of tooth.

**Rob Frawley** 16:12

There's also a type of column that's called Ionic. And there are definitely calcium and phosphate in here.

**Em Costa** 16:19

There you go.

**Rob Frawley** 16:21

All these rods are laid like parallel to one another, and they kind of create the macrostructure. And then what's really cool about the way that any mineralized tissue forms is that the mineral like works its way into the form. But so there's like, usually the protein makes the scaffold. And this is what I think is the cool part is you can lose a lot of the mineral that make up these columns that are between the proteins, and then you can get it back. Like if you have like dietary insufficiencies, you lose a lot of those minerals that actually be leached out, potentially to go to other places in your body that need calcium at the moment. But then if you if you keep good dental hygiene, and then kind of restore your body's calcium levels, like potentially it could fully remineralize, and really the tipping point is when you start to lose the matrix when you start to break down the scaffold. And the thing that does that is bacteria that live on your teeth that will eat away at everything indiscriminately and cause a cavity.

**Em Costa** 17:16

Also the idea of your teeth as sort of like mineral reservoirs is kind of crazy to me. That's just kind of like as a last resort, you can just dip into your teeth and harvest some calcium.

**Rob Frawley** 17:28

So it's it's your I mean, your bones go first and your bones are just much more accessible on a biochemical level. They're like sort of, you know, inside, so they're a little bit easier.

**Em Costa** 17:39

Very scientific, yeah.

**Noah Guiberson** 17:41

And as you'll probably agree they're dispensable because they're not all that important, right? Yes.

**Rob Frawley** 17:44

Stupid useless bones.

**Jaida Elcock** 17:47

Who needs 'em?

**Noah Guiberson** 17:49

Yeah sharks don't, that's who!

**Rob Frawley** 17:54

But so something that I do think is really interesting is a lot of energy goes into making all of these things right, like making a mineral is really hard. And we talked a few episodes ago now with our friend Anthony about narwhal teeth, which take an insane amount of energy to make this huge tooth. And it's like, it's crazy to make something that's just gonna fall out like, like the the energy expense. And I think Jaida will talk more about this later--for an animal that loses teeth a lot? Like if you're going through, you know more than your 16 teeth. Like that's crazy. Like, for humans to have two sets of teeth is like a significant energy expenditure.

**Jaida Elcock** 18:32

Yeah, sharks. We'll get into that. But good Lord, their tooth replacement is just ungodly. Like, why? I mean, like, oh my lord, it's yeah, no, it's a lot. We'll, we'll get into that.

**Rob Frawley** 18:47

Yeah, and so I think this is kind of the most PSA thing I've ever said, but it's super important to floss. It's super important to remove bacteria from between your teeth that will eat away at the enamel because enamel itself once you lose that matrix really doesn't come back and you can get, there are all kinds of treatments now that can do that lay down like kind of fake enamel or new like synthetic enamel you can top your teeth and get hydroxyapatite coatings and like a lot of things that can actually extend your tooth life really nicely. But at the end of the day, it really is up to you to maintain your teeth. And for anyone considering taking care of teeth, I'd like to say if your destiny is dentistry, then don't lose that that density!

**Noah Guiberson** 19:36

I love how like you messed up a little bit of the way through that but it didn't put a dent in your confidence.

**Jaida Elcock** 19:42

Oh my god...I'm gonna scream that was...

**Noah Guiberson** 19:51

I don't think there's ever going to be a better time for me to say this but, how do you got...? This is so stupid. Sorry, how do you calculate the concentration of teeth in your mouth? ...Molars per eater.

**Rob Frawley** 20:12

Oh, I'm trying to think of a response and I can't even like categorize to like, be like... So do I do a stoichiometry pun? Like where do I go from there?

**Noah Guiberson** 20:26

Oh, boy. All right.

**Em Costa** 20:27

Alright. Put a cap on that!

**Noah Guiberson** 20:33

Sometimes I just need to get those out. Rob, are you done?

**Rob Frawley** 20:37

Yes!

**Noah Guiberson** 20:46

This week, I learned that archeologists named the remains of a 9,000-year old Bulgarian woman, Julia Roberts, due to what they described as her quote, "perfect set of teeth."

**Jaida Elcock** 20:58

I feel like it's creepy. But okay. Yeah.

**Noah Guiberson** 21:03

It's weird. And let me tell you, because I'll explain to you a bit more, but this is not an uncommon thing to say about people's remains, as I've discovered. So, basically, so just to tell you a little bit about Julia Roberts. These remains, her remains...

**Em Costa** 21:17

Which one?

**Noah Guiberson** 21:18

Yeah. Julia Roberts, Julia Roberts is a 9,000-year old Bulgarian woman as we all know. And her remains were found in the Vratsa district of northwest Bulgaria, which has been apparently like a hotspot for ancient like superlative skeletons, including several 3,000-year old skeletons of people who are over six foot six, which is an extraordinary height for the time. Yeah, it's an extraordinary...

**Em Costa** 21:43

Or in general!

**Jaida Elcock** 21:45

It's not super common today either.

**Noah Guiberson** 21:48

Right, so it's like incredible, this is 3,000 years ago,

**Em Costa** 21:52

When giants walked the earth!

**Noah Guiberson** 21:54

Alongside... they had to be that tall ride dinosaurs. Just somewhere, somewhere Dustin Growick like is just screaming.

**Em Costa** 22:06

Doesn't even know why. Like something's just very wrong.

**Rob Frawley** 22:10

They were in that Bible story too of David and Julia Roberts, I think.

**Noah Guiberson** 22:14

But so yeah, so I mean, this region has been somewhat of a, as I said, a hot, hot bed of like these ancient human remains that have been found. This is sort of like, sort of north of Greece, kind of in an area that we would have in ancient times associated with Thrace than Thracians were mentioned in like, the Iliad being like incredible horse tamers and they weren't involved according to the Iliad in the battle at Troy. So it's kind of, people are kind of interested because it's, it's cool historically, but also because it sort of ties into some, you know, cool classical literature that they can learn more about the people who were even at that time considered to be quite ancient. So, I mean, we're, you know, Homer, we're talking like 800 BCE, but like, yes, 6,200 years before that would get roughly to like 9,000 years old. So at like 9,000 years ago, Julia Roberts, and by this of course, I mean, the the remains of Julia Roberts, just to clear up any distant, you know, issues with understanding who I'm talking about the remains of Julia Roberts are thought to belong to like the first agricultural civilization in that region. So like, an incredibly ancient, important time point in the study of Mediterranean civilization and the time course of how people moved into different areas of the world. But for like all the interesting features of this discovery, such as Julia Roberts being, and I mean Julia Roberts by the way, the remains obviously not that not the actress, just in case you're unclear at any point, Julia Roberts was found alongside charred wheat grains, cattle bones and flip tools and just to clarify, do mean the actress...

**Rob Frawley** 24:09

You said that there's a heap of stuff next to the remains?

**Noah Guiberson** 24:12

Yeah.

**Rob Frawley** 24:12

 Do you know what they call that? It's the Mona Lisa pile.

**Noah Guiberson** 24:18

Yeah, that's true. That's true.

**Em Costa** 24:29

Alright, this is gonna be bad, but it just needs to be like exorcised from me at this point: less pretty woman, more gritty woman.

**Jaida Elcock** 24:35

Oh my god...

**Em Costa** 24:36

It didn't work, but we're gonna go with it alright!

**Jaida Elcock** 24:38

You guys are really good at these.

**Noah Guiberson** 24:41

And also Julia Roberts, the remains, okay, were found alongside this, this what was referred to as a "domicile" which contained both above ground and like a subterranean living area, like sort of like a cellar that, that somehow they were able to in the in the cool way that archaeaologists can determine that the group that lived in this home split time between like living sort of at a first floor and living in an underground way and trying to figure out like, "why would they have done that?" It's not like there were some, I mean, were there some ridiculous like tornadoes tearing through, you know, like Macedonian Thrace so we don't we don't know really, they're the all these little things that archaeologists do, you know, the cool ways that they've established in their field to uncover information about ancient diet and rituals and social organization and technological capability. And all anybody wants to talk about in the articles about this is how nice Julia Roberts teeth are. Because, like, according to Dr. Georgi Ganetsovski, Director of the Prehistory Department of the Vraca District Museum, quote: "She was a rare beauty and could have competed with today's Hollywood stars for her perfect set of teeth. She is a stone age Julia Roberts, she would have had a perfect smile. It really is a puzzle."

**Em Costa** 25:58

...creep.

**Jaida Elcock** 25:58

That was super...all of that was really creepy, for sure.

**Noah Guiberson** 26:04

Because the thing is, though, I did a little digging, you know? There are there are so many examples of ancient humans being described as having perfect teeth. Like let me I'm just just to run through some examples. A study of 30 bodies exhumed from the ash and Pompeii using like and studied using CAT scans were described by the researchers and in every subsequent news article as having perfect teeth. A Russian farmer found a 2,000-year old skeleton that was described as having quote, "perfect teeth," and also in Russia, a similarly ancient skeleton belonging to a woman who apparently had quote, "unusually pristine teeth." Another one, a Bronze Age woman in Bahrain was discovered to have quote "nearly perfect teeth with just one cavity." And then one of my favorites like, and definitely the most effusive, a report of a Bronze Age man found in the UK that according to University of Derby forensic scientist Sanita Nezirovic had a quote, "perfect smile", was a quote, "catch for the ladies" and quote, "his teeth seem absolutely beautiful," and also quote, "he has better teeth than most people nowadays." But perhaps surprisingly, the fact is that among the remains of ancient people, perfect teeth are actually not all that rare. So, Janet Monge, who is the curator of the Physical Anthropology section at the Penn Museum, has been studying this and observed that it's another quote, "it's like the upper jaw, the maxilla, and the lower jaw, the mandible, are actually kind of perfectly in unity with each other." And the interesting thing is that was everybody in human history. Another quote about this is evolutionary biologist Daniel Lieberman notes this pattern in his book, The Story of the Human Body, when he says "the museum I work in has thousands of ancient skulls from all over the world. Most of the skulls in the last few 100 years are a dentist's nightmare. They are filled with cavities and infections, the teeth are crowded into the jaw, and about one quarter of them have impacted teeth. In contrast, most of the hunter gatherers had nearly perfect dental health." So the question is like, what went wrong? Why are the teeth of people who live today so much more likely to be crooked say, than those of ancient people, with a study in 1998, finding that a fifth of the US population has significant malocclusion, which is the sciency name for like misaligned teeth literally translating to bad bite?

**Jaida Elcock** 28:20

I'm just processing all of this because I want to know what happened because all these people that way back then had like perfect teeth, but I had to go through three and a half years of braces and now I have to wear a retainer for the rest of my life?

**Noah Guiberson** 28:37

 Same!

**Jaida Elcock** 28:37

You gotta be kidding me. I'm not--I'm angry about it!

**Noah Guiberson** 28:40

I know. Me too!

**Em Costa** 28:42

Yeah, it's trash.

**Noah Guiberson** 28:47

Send it back.

**Em Costa** 28:48

I am short four adult teeth because they couldn't all fit in my mouth. Like this, like this math is just not working out. You just gotta go.

**Jaida Elcock** 28:57

Oh my gosh.

**Em Costa** 28:58

So yeah, when I was like in high school, I had four of them, I think were like, hemi- or semimolars, like the molars towards the front, like one from each corner of my jaw just like removed. And for a solid like year or two I just had like a hole in the back of my mouth so that when I smiled like really wide you could just see through my mouth from one side out the other and like, that was the only reason it was worth it.

**Noah Guiberson** 29:20

Did you ever have a friend like hide really far away so that they could like see their face in the hole?

**Em Costa** 29:26

As in like look through it?!

**Noah Guiberson** 29:29

Just saying like it would be a picture in profile with you smiling really big... It would be like you know how like they sometimes they do those pictures with like

**Em Costa** 29:34

Ohhhhh!!!

**Rob Frawley** 29:40

...they're holding up Epcot...

**Noah Guiberson** 29:40

...they're holding their hand, yeah or like, or like the leaning tower of Pisa.

**Em Costa** 29:44

Dammit, now I gotta lose four more teeth just to do that!

**Noah Guiberson** 29:48

That's the kind of commitment that I love about you.

**Jaida Elcock** 29:52

I have holes in in my face too because my canines were growing in wrong, my adult canines growing at the top, so I had to go get my canines pulled root and all, not even close to wanting to come out. And then I just had like gigantic holes in my face for a year and a half. So I think two years of my yearbook photos in like, not even like early middle school I'm pretty sure this was like eighth grade or something, where I just looked like a crazy person because I just had very prominent front teeth missing.

**Em Costa** 30:23

Anti-fangs?

**Noah Guiberson** 30:29

That's the only reason we know you're not a vampire.

**Jaida Elcock** 30:32

They just weren't there for a very long time.

**Noah Guiberson** 30:37

In one of the many things I have in common with Sheryl Crow, Sheryl Crow had her front teeth, like knocked out by a waitress with a beer mug. Now, I didn't have my front teeth knocked out by a waitress with the beer mug, but I did have one of my front teeth chipped by a friend who was throwing a glass of water in my face in a water fight. And she didn't realize that I had snuck up on her with a glass of water. And she just turned around and like uppercut me in the tooth...

**Jaida Elcock** 31:12

Oh noooo...

**Rob Frawley** 31:14

That, that's bad.

**Noah Guiberson** 31:18

So anyway, Sheryl Crow, and I have a support group.

**Jaida Elcock** 31:20

Can my dad join because he also knocked out both of his two top front teeth? One with I think, maybe these are wrong, but one with a golf ball and the other with a skateboard.

**Rob Frawley** 31:33

Yikes.

**Em Costa** 31:34

Wait so two separate incidents for each tooth?!

**Jaida Elcock** 31:37

 Yes!

**Em Costa** 31:38

That's so sad!

**Noah Guiberson** 31:40

There's two, there's two phases of life where you knock your front teeth out with a skateboard and then when you're old and a sellout and you knock 'em out with a golfball.

**Rob Frawley** 31:49

I am super, knock wood, have not had any, besides losing all my wisdom teeth, like which has to happen sometimes, no big problems. But this is my tooth losing story. A friend of mine, I won't identify, was in the weight room for college athletics one time, and someone was like, "You ready?" And this is the most meathead thing I've ever been around. But one guy's like, "you ready to do these weights?" And he's like, "I eat weights like this for breakfast" and then pretended...

**Noah Guiberson** 32:15

That was real?!

**Rob Frawley** 32:16

...for real that was a real exchange between two humans. And then as a joke, like pretended to bite a 45 pound plate and chipped his tooth.

**Jaida Elcock** 32:27

This may be controversial, but he deserved to chip a tooth for that interaction.

**Noah Guiberson** 32:31

Yeah.

**Rob Frawley** 32:32

He agreed instantly. Because like they're both putting it on because neither one of them are like, really that dumb, but they acted a little too...

**Noah Guiberson** 32:42

They were just pretending.

**Rob Frawley** 32:44

Yeah.

**Jaida Elcock** 32:44

That's great, that's really funny.

**Rob Frawley** 32:47

Yeah. It was a good learning moment for everyone.

**Noah Guiberson** 32:50

So if, if they...hmmmm oh boy. So if they were making fun of people, they imagined it would be like that? And then he broke his tooth...is that a chip off the old mock?

**Jaida Elcock** 33:00

Oof!

**Rob Frawley** 33:03

I think so?

**Noah Guiberson** 33:06

Okay. All right. So, but just getting back to this like issue of like, why is it that modern humans have so much more issue with like teeth crowding and like sort of orientation of their teeth in their mouth, than it seems like we were ever supposed to. So a few possibilities have been proposed, ranging from like our modern diet, which is full of softer foods, and possibly the onset of the Industrial Revolution, you know, eventually resulting in shorter breastfeeding times, there's a whole lot of suggestions. But whatever the cause or causes, the result has been a smaller human mouth with the same number of teeth, which results in crowding. And it would be great if that was just a cosmetic thing that we could write off. But as it turns out, crowded teeth can be hard to brush, which means that like certain parts of your teeth get cleaned less and that can provide a home for bacteria, which in addition to causing tooth decay, have a pretty clear relationship with cardiovascular health. And so it turns out that we would do well to be a lot more like Julia Roberts and here I mean, both the actress and the remains of the 9,000-year old human, in taking care of our smile.

**Jaida Elcock** 34:18

I like that we came full circle. I have decided that sharks are a dentist's nightmare, but a scientist's dream.

**Em Costa** 34:41

Nice.

**Jaida Elcock** 34:42

I say dentist's nightmare because I mean, maybe it's their dream as well depending on if you don't like the work, definitely not your thing, but you might be able to get a profit off of them, you know. So, like sharks have, first of all, so many teeth like in their mouths, so many teeth. So we talked a little bit about tooth replacement earlier--shark's tooth replacement rate varies by species, we're pretty sure, but they can go through between 20 to 40,000 teeth in a lifetime.

**Noah Guiberson** 35:16

Wow.

**Em Costa** 35:16

I was not expecting the thousand!

**Jaida Elcock** 35:20

It's just their, their teeth are on like, we've all kind of heard about this before, on a conveyor belt where they just kind of like form, they pop up, they move forward, they fall out. And it just continues doing that throughout their entire lives. And teeth can fall out just because they've reached the end of the line and they fall out, or they can break off into a prey item or whatever else, so they lose their teeth constantly nonstop. And that's why there's so many teeth in the fossil record, which is, I mean, we talked also about how sharks don't have bones. Their skeleton is made of cartilage, which doesn't fossilize well. So a ton of what we know about sharks is based on their teeth, because that's what we find most often in the fossil record. I have some teeth over here as well on the side. And I no one can see this. But this is my favorite. This one's fossilized. I have no idea what it's from, but it's huge and I love it. And then I've got a bunch of other smaller ones from the white ones from the aquarium that I was at.

**Noah Guiberson** 36:14

Very cool. And listen, if you're listening to this on the podcast, and you're really jealous, because you should be those were very, very cool, you can go over to Twitter or TikTok @sofishtication. And you can see pictures Jaida has posted or really cool videos about it. But in the meantime, you'll just have to be jealous of our experience.

**Em Costa** 36:40

So, par for the course.

**Jaida Elcock** 36:41

Yeah so, these, these shark teeth they are replacing and constantly but also the shape of them, if you've ever seen, you know, different shark teeth, you can tell they differ by species, and it can tell you a lot about what they eat. So that's what I mean by like a scientist's dream. Like we know so much about sharks based on their teeth. So if you see a shark tooth with a lot of serrations on the sides, that's probably for like shredding and tearing flesh. So like the great white shark eats marine mammals, at least when they're older, they eat marine mammals, you probably need kind of like a steak knife to get through some of that blubber. So that's a really good thing to have is the serrations. Also, the tiger shark is pretty known for eating sea turtles from time to time, it's gonna take a lot to get through that shell. So you need those serrations. But then you have sharks like the horn shark that have like kind of more rounded teeth, at least on the sides. There they have different teeth shapes throughout their mouth, and some species have this but the horn shark eats like shelled invertebrates, so like crabs and urchins and stuff, so it's teeth are more made for crushing and things like that. So there's piercing, there's shredding, there's crushing, all kinds of different teams. So depending on...

**Noah Guiberson** 37:54

Is there like a, you know, like the whatever the Galapagos like finches for, for Darwin, is there like that in shark species?

**Jaida Elcock** 38:01

Yeah! I guess that's a really weird way to think about it, but I would kind of think of those is pretty similar. Like depending on what it eats, it's gonna have like a different shape. That's really cool. Wow, what a connection! I like that!

**Noah Guiberson** 38:12

Yeah! Facts Machine!

**Jaida Elcock** 38:20

That was really cool. I love that.

**Rob Frawley** 38:21

I can't help now picturing a shark with a really long nose that would eat a flower, like I know that's not what it is...

**Em Costa** 38:28

Awwwww! Like a hummingbird!

**Jaida Elcock** 38:31

Like the goblin shark and its nose just like goes into a flower

**Em Costa** 38:37

Ugh if someone could draw this, I would be enamored.

**Noah Guiberson** 38:40

I'm just imagining like, I'm just imagining a great white stork. I don't know why.

**Jaida Elcock** 38:44

Oh my god...I don't like that image at all! Someone needs to draw this, that would be the best thing ever.

**Noah Guiberson** 38:53

I actually would. I mean, can you imagine like it'd be incredible if there was like a society where they're sort of like the thing they told kids about where babies came from was that like it was delivered by a great white shark?

**Jaida Elcock** 39:05

Oh my god. Wow. I can't even imagine how that would work. But I need to think of how that would work so that I can start using that.

**Noah Guiberson** 39:14

Yes.

**Em Costa** 39:14

Pop out of the water and like spit it out, go back down.

**Jaida Elcock** 39:18

Oh my gosh, I love this, this...I'm gonna, I'm gonna make that shift just so I can make fun of Dustin and like, yes. Make the shift from dinosaurs to sharks because sharks are obviously better.

**Noah Guiberson** 39:30

They deliver babies everyone knows.

**Jaida Elcock** 39:32

Exactly!

**Noah Guiberson** 39:34

Just two different kinds of breech.

**Jaida Elcock** 39:40

...that was really good. I'm so angry at that joke, it was so good.

**Rob Frawley** 39:46

Sharks, what they prefer for birth though is a "sea"-section.

**Jaida Elcock** 39:50

I liked it. It was good. It was good.

**Noah Guiberson** 39:56

Well, that's, you know, that's how we get "baby shark do-do-do-do-do-do"

**Jaida Elcock** 40:03

Oh my god! My nephew's three, he knows all the dance moves to that song and he has for like the last year. It's incredible.

**Rob Frawley** 40:11

Are the dance moves anatomically accurate? In terms of...

**Jaida Elcock** 40:15

NO!! Hold on--the thing that gets me the most..

**Noah Guiberson** 40:27

Wow, I can't believe you just asked her that. Obviously, very upsetting.

**Jaida Elcock** 40:32

The thing that gets me the most is like, it's mommy shark. And then daddy shark is the big one. But for most shark species, the female is larger than the male. So...

**Em Costa** 40:43

\*claps\* YES.

40:44

One thing people like "oh, mommy shark, daddy shark" and I'm like, "NO that's wrong! I don't like it!"

**Noah Guiberson** 40:50

You go gill!

**Jaida Elcock** 40:55

Yeah, I know that that question wasn't as serious as I just took it, but like, wow...

**Rob Frawley** 40:59

That's totally what I wanted though.

**Em Costa** 41:01

That's great, ah man...

**Jaida Elcock** 41:04

That was such an aggressive like reaction that I didn't even think was gonna come out of me. So yeah, we know a lot about sharks based on their teeth, but also based on their skin teeth, which sounds... So, shark skin is made out of what's called dermal denticles, which are basically teeth scales. They're so wild to look at. There are scanning electron microscope images of dermal denticles all over the place on the internet. So 10 out of 10 recommend looking those up because it looks really, really cool. So basically, these dermal denticles help to reduce drag when the shark is swimming. And so the Olympics have started using that concept to make more efficient swimsuits for Olympic swimmers.

**Noah Guiberson** 41:52

Wow!

**Jaida Elcock** 41:53

How cool is that? Right?

**Em Costa** 41:56

Yeah, that's awesome.

**Jaida Elcock** 41:57

I want to sharkskin swimsuit.

41:59

Michael Phelps is in a 2006 issue of National Geographic wearing such a swimsuit. You're like, "what are you doing here?"

**Noah Guiberson** 42:07

Didn't Michael Phelps, wasn't Michael Phelps supposed to like race a great white shark?

**Jaida Elcock** 42:12

Yeah. I remember that episode of whatever it was.

**Rob Frawley** 42:19

Vs. Wild, I think, right? It was like Justin Gatlin races a zebra or something, like it was like ridiculous man versus animal like...

**Jaida Elcock** 42:28

Yeah. And like, I remember going to school the next day after seeing that, and everyone was like, "they didn't actually put Michael Phelps in the water with a shark" and I was like, "why...on God's green Earth would they do that?!"

**Em Costa** 42:43

But that's the whole reason they watched, though!

**Jaida Elcock** 42:45

"But he's the most powerful swimmer." No!

**Rob Frawley** 42:48

People were really disappointed. So it was an hour long special, too. And like it ended with essentially a CGI race. And you're like, okay.

**Noah Guiberson** 42:58

The other thing was like, when I did, like, I was like, "okay, this is not going to happen," but I did watch it, just to make sure. But like, but also, you know, when I was thinking about it after, like, if you were to do that, like what would be the shark's motivation to swim in a straight line as fast as possible in the way that Michael Phelps would? And it makes me think that like, they should do different events, like based on what each like sort of, you know, species, human versus great white shark, it can be motivated to do?So maybe like, you know, Michael Phelps could, you know, let's just say swim real fast to get a time in a way that a shark can appreciate. But then for the shark event, Michael Phelps would have to eat a seal really fast?

**Jaida Elcock** 43:35

I don't like that at all!

**Em Costa** 43:41

Fair's fair, you know?

**Jaida Elcock** 43:43

No, no he just has to eat like a Subway sandwich, that's the equivalent of a seal, as fast as he can?

43:50

They both probably eat 8,000 calories in a sitting, so like...

**Jaida Elcock** 43:56

So these dermal denticles--well, first of all, I just have to share this quick little fact that apparently, whale sharks, this is a discovery as of last year, whale sharks have dermal denticles on their eyeballs. And they're a little different than the dermal denticles that are on the rest of their body, but they have them and because this is such a recent discovery, we're still trying to figure out like, what exactly is the deal with that, but it makes me wildly uncomfortable, and I absolutely love it. So that's my fun, my, my gross fun fact about dermal denticles.

**Rob Frawley** 44:32

On the sclera, though? Like on what they see through is a denticle?

**Jaida Elcock** 44:36

It's on like, like the peripheral part of the eyeball. So like, not where like the pupil would be, you know, but like, oh my god, it's so weird. I don't know. Look at pictures of that as well.

**Noah Guiberson** 44:46

That's so interesting.

**Jaida Elcock** 44:47

Yeah, I'm excited to see like, what comes of that research.

**Noah Guiberson** 44:51

I hope you'll keep us updated.

**Jaida Elcock** 44:53

Yeah!

**emily costa** 44:54

Yes, please come back in.

**Jaida Elcock** 44:55

Dermal denticles can apparently also be used to reconstruct community structures of sharks in the past and now, which is something that I learned recently. So there's this paper that I was reading Dylan et al. 2017, called "Dermal denticles as a tool to reconstruct shark communities". And basically, they explain how like dermal denticles vary among an individual shark like along different parts of their body, but they also like in like shape and size vary based on species, and different shark families can be identified based on dermal denticles that you see. And typically, it's harder to find, like, more fine resolution than families, like it's harder to go more specifically and be like, this is a great white shark. But knowing the family can give you a lot of information about like what's going on in the environment anyway. So basically, they found dermal denticles in like the fossil record, or just like in the reef environment, and they kind of can go back through and look at that, and determine, like, what kind of sharks were in the area during certain times. And even now, some forms of, like reporting sharks in an area or determining shark, like community structures in an area aren't 100% accurate, because there are a lot of places where maybe shark sightings are rare. But that doesn't mean that they're not there, you know. So, using this, like dermal denticles as a way to determine like, what the population abundance is or what the community structure is, like in sharks in a specific area, I think can be super useful. And this is just like the coolest thing to me that like not only do sharks have teeth for skin, but you can use their teeth skin to determine who is where and when they were there. And what friends were they hanging out with and whatnot. I just like this is the coolest, weirdest thing. And like sharks are so weird and have such weird adaptations that we can use to figure out what the heck is so weird about you guys.

**Em Costa** 46:54

And that sounds like it really applies to what you're interested in, too, in terms of like using that to kind of maybe track their migration, like as you were just saying, like, where they were, when, and with whom.

**Jaida Elcock** 47:04

Yeah! Honestly, I didn't really think about that, but that's definitely something that could be used for, like ecology and movement ecology and stuff like that, where like, maybe we didn't think a shark was in a certain area, but we're finding denticles of like that family. So maybe they go there more often than we think or maybe they were there in the past, but they're not there now. So what's going on with that? Wow, there's a possibility.

**Noah Guiberson** 47:28

Actually, we'll delay this episode until you get the chance to publish on that.

**Jaida Elcock** 47:33

Yeah sure, it'll be delayed for quite a long time.

**Rob Frawley** 47:36

Also, I want to point out that the title, even though you did an excellent job explaining it, the title really makes it sound, "reconstructing shark communities", sounds like a group of sharks that was like ravaged by orcas, and like, has come together over a common denticle. And they like, they kind of see themselves in each other and now they have this support network of like...

**Jaida Elcock** 48:00

They're a support group for each other. Oh that's so precious.

**Em Costa** 48:04

Sharks doing therapy. I love it.

**Noah Guiberson** 48:08

Shark group therapy is what happens in Finding Nemo for their...

**Rob Frawley** 48:10

That's true!

**Noah Guiberson** 48:10

For whatever, whatever the opposite of pescatarianism is.

**Jaida Elcock** 48:12

Fish are friends, not food. So what would they eat in...like, what would they eat? Invertebrates, then?

**Rob Frawley** 48:26

Kelp?

**Jaida Elcock** 48:28

 Those are not the-- Ooh fun fact! There is actually an omnivorous shark.

**Noah Guiberson** 48:32

Whoa, really?

**Jaida Elcock** 48:33

Yeah, the Bonnethead shark regularly like eats and digests and gets nutrients from sea grasses as well as animal ladder but like, this is the only shark that we know of that does this. And like why? What are you? Who are you? Why are you like this?

**Noah Guiberson** 48:50

What's your story? I always like the fact about cookie cutter sharks that they like take bites out of submarines and like undersea cables and stuff. So, I don't know what if that qualifies for like vegetarian...

**Em Costa** 49:09

Do they leave them, like their bites in like very like festive little shapes? Are the cookie cutter sharks...

**Noah Guiberson** 49:14

Yeah, exactly.

**Em Costa** 49:15

Because like, I mean, they make like this perfect circle shape. And if you've ever seen like a cookie cutter shark bite on like whales or dolphins, seals,...

**Noah Guiberson** 49:24

Or like swordfish, you have...

49:25

It's like this perfect circle. And a few people have been bitten by them as well and have like this chunk taken out of like their leg because they're deep sea organisms. So like most deep sea organisms, they come up to the surface at night, but some people like to go try to do their distance swimming at night in the ocean. I wouldn't recommend it. But I mean to each their own. I've seen these pictures of them on people and I'm like, that looks so painful. But I mean it's also really interesting just like the way that they do it. They have like these big fleshy lips that just like suction onto an animal and then their jaw just like scoops And that's how they eat.

**Jaida Elcock** 50:02

So it's like a melon baller? Like, that's what I picture...

50:04

Yeah! Oh my god, a melon baller! Wow, that's so cute. It's a living melon baller. It's so funny because like, I've talked to people that didn't know that that was even like a real shark. And I'm like, yeah, it's the cookie cutter. There's so cute though. And like so little. Wow. Oh my god, I can't get over them. They're so funny. And then there's like, you've got like the basking shark and the whale shark who are filter feeders, so their teeth are obviously super different. They're like way smaller, it's like super reduced. Because they don't really need them.

**Noah Guiberson** 50:43

I was reading recently about how in like the sort of transition from toothed whales to like baleen whales, at some point, the baleen whales lost sort of what we think of as teeth. But they're even some I don't want to say like transition whales, but they're like some whales that in development have teeth, but they don't have enamel. And it's like they lose, they're baleen whales, but they sort of like in development they have teeth but not like full teeth sort of along the way. They hadn't got around to like kicking up the teeth genes yet, but they had gotten rid of whatever the enamel genes are. Which is kind of cool.

**Em Costa** 51:18

I don't know why but the image of a tooth without enamel is like terrifying because I--this isn't right I know that the the image in my head is wrong, like straight up incorrect, but just like, this like throbbing entity that should be a tooth but like isn't? I don't know why but it's in my head. And now in mine! Thanks!

**Noah Guiberson** 51:41

I don't know why you introduced the concept of throbbing?

**Jaida Elcock** 51:45

Maybe like blood flows? I don't know.

**Em Costa** 51:48

Pulsating...

**Jaida Elcock** 51:49

 I mean, it doesn't make sense. I'm, I'm aware that it's wrong.

**Noah Guiberson** 51:52

I don't know if the enamel holds in blood. I don't...

51:56

No that's inside of the tooth. It's fighting to get out and the enamel just keeps it in place.

**Jaida Elcock** 52:01

I don't think I know enough about teeth. That's fine.

**Noah Guiberson** 52:05

That's why we're here.

**Jaida Elcock** 52:06

I've learned a lot from this episode already, just like listening to Rob talking about teeth. And then listening to Noah talk about how...

**Noah Guiberson** 52:13

 Julia Roberts.

**Jaida Elcock** 52:14

 Yeah, and all the other dead humans have like weirdly perfect teeth. Like, I've learned so much.

**Noah Guiberson** 52:21

Yet another reason to be jealous of dead humans. Um...I'm sorry.

**Rob Frawley** 52:31

...'cause global warming's not their problem!

**Em Costa** 52:31

What the hell?!

**Jaida Elcock** 52:31

That's so pathetically sad!

**Noah Guiberson** 52:40

Oh my god. I'm so sorry!

**Jaida Elcock** 52:42

They don't have to live through the Trump presidency!

**Noah Guiberson** 52:44

Yeah, no kidding.

**Em Costa** 52:45

Yeah. And a piece of space junk, like just landing somewhere on the planet!

**Jaida Elcock** 52:52

So excited to get more updates.

**Em Costa** 52:54

I haven't checked on it in a little bit, actually. But it should be soon.

**Jaida Elcock** 52:57

It's supposed to happen somewhere between like 11:30pm Eastern Time, give or take a few hours.

**Em Costa** 53:03

Ok, I'm staying up!

**Rob Frawley** 53:05

Two, two hours...

53:07

It has no chance of hitting me. So I'm, I'm just...

**Rob Frawley** 53:11

Right on the cusp.

**Noah Guiberson** 53:12

What's like the entry window?

**Rob Frawley** 53:13

 42 to 42, right?

**Jaida Elcock** 53:15

Getting more narrow, more narrow, because it gets closer and so they keep evaluating it and looking at like, crash times or whatever.

**Noah Guiberson** 53:26

Honestly, I don't think any of us have anything to-- \*make explosion noises\*

**Em Costa** 53:34

Noah nooooo!! Just over here like four blocks away like yeah....it's a very small piece of debris.

**Noah Guiberson** 53:42

It was a very small piece of debris. It went right through my window, just headshot.

**Rob Frawley** 53:51

Oh, this is so neither here nor there. There's a podcast that I just listened to about a woman who got hit by a piece of like a space shuttle. And it was like, it was an inch big and it like bruised her badly in the leg. And she like brought it to the government. She went to like a nearby military base. And they're like, "we don't know what that is."

**Em Costa** 54:09

"Excuse me!!"

**Rob Frawley** 54:14

Really, yeah. But so like some professor got wind of it and tested it. And he was like, "yeah, this is like the stuff that they put in the insulation of of the spaceship" and so they got in contact with NASA and they're like, "yep, that's what it is."

**Em Costa** 54:27

Oh that's where it went!

**Jaida Elcock** 54:27

I mean like, that sucks, but at the same time because you didn't die or get seriously injured--like how cool is it that you got hit with part of a spaceship? Like come on.

**Em Costa** 54:39

If you have like a little scar after it, you'd be like, "you wanna how I got this scar?" and actually have like an interesting answer to that question. I mean, come on.

54:46

Yeah, rather than just like "I was shaving my leg and then I dropped my razor."

**Noah Guiberson** 54:51

"I got hit by the Scarship Enterprise."

**Jaida Elcock** 54:58

Oh, I love it.

**Em Costa** 54:59

That's great.

**Jaida Elcock** 55:01

Yeah, so sharks are really cool and we shouldn't let our fear of them get in the way of the respect that we should have for them in their environment, because they're really important, as we're learning through shark denticles and more information. So, it's okay to be afraid of sharks if you are afraid of them, but they're not out to get you. And they're super cool. So let's just share the love that we have for the ocean and extend it to sharks as well.

**Noah Guiberson** 55:28

Absolutely.

**Em Costa** 55:29

Nice. Also, I want to make one joke, it's not going to go anywhere, but I just been, I've sitting on it.

**Rob Frawley** 55:35

We should always end on these trips.

**Em Costa** 55:39

So, I didn't see the race with Michael Phelps and the great white shark. But, if I had to place a bet, it would be the shark would win by the skin of its teeth.

**Jaida Elcock** 55:47

Oh I love that! Wow, that was wonderful. That made my day. So good.

**Em Costa** 56:06

All right, so we have reached our quiz! So, today's quiz is going to be loosely based around a cultural history of teeth, so focusing on how we as humans have taken care of, celebrated, feared, obsessed over, and just generally considered our teeth, over the years, across civilizations, etc. So, on a side note, in researching facts for this quiz, I found my Google searches just thoroughly inundated by dentists' offices, and dental associations, and even like toothpaste companies, because they were just all absolute treasure troves of tooth facts. Like that is apparently just a feature on every dentist website or just like "here is a history of teeth!"

**Noah Guiberson** 56:55

So true. I had exactly the same problem. I had exactly the same problem. We like, Rob, you know, he's a bone scientist and he knew he was going to do his like tooth bone beef. You know, going in, you know, Jaida had her sharp teeth really the fact that we built this theme around, but I was just sitting out here like trying to find a tooth fact and it is so hard because they're like all the Google results are just completely saturated with like random dentists' blogs.

**Em Costa** 57:27

Yeah, I have never in all my fact searching years seen anything like it! Just for dentistry.

**Jaida Elcock** 57:34

Can I just say, maybe this won't hit the way I think it will, but like, Rob's bone to beef can it be considered as bone wars part two?

**Noah Guiberson** 57:50

Oh, part tooth!

57:51

Part tooth!! Thank you for helping me, yes.

58:04

I think I think the only reason it will never reach that level is because the only people on the other side are literally like elementary school kids. Like, there's no scientist who's like "bones or teeth are the same", it's just children.

**Em Costa** 58:22

Come on Rob, you can take 'em.

**Noah Guiberson** 58:23

The perfect adversary! ...we should probably do the quiz.

**Jaida Elcock** 58:31

I am ready for this quiz. I don't think I'm gonna do well because as we established earlier, like I really don't know enough about like...

**Rob Frawley** 58:37

Oh we're, we're a team.

**Noah Guiberson** 58:38

This is a, we are a collective team.

**Em Costa** 58:42

Totally. Also, on a side note to whomever the copywriters--or honestly, my hypothesis is that it's just one copywriter with a very specific niche, but to all the potential copywriters who just fill in all of this dentistry trivia on websites...

**Noah Guiberson** 58:58

Filling?

**Em Costa** 58:59

...filling, yes, there we go. We see you. We appreciate you. Call us up because I'm very curious about who you are, there's a story there. All right. On to the quiz. Question one. What type of human remains are often disproportionately present at archaeological sites and can tell you about the diets, migration patterns, and health of their former owners?

**Noah Guiberson** 59:29

I am very scared of this question.

**Em Costa** 59:34

Why?

**Rob Frawley** 59:34

I think I know why. So, I think that it's not just teeth. I think it's baby teeth. I mean, I was looking for just teeth.

**Jaida Elcock** 59:44

I was gonna say just teeth too but I was like, I'm assuming this is a trick of some sort. There's gonna be a twist in there. Okay.

**Noah Guiberson** 59:52

I really, I really thought this is gonna be a big trick. We were gonna be like, "well, I mean, it's teeth, right?" Because we've all learned a lot about teeth tonight. Yeah. So...

**Rob Frawley** 1:00:00

And then it's like (\* imitation of incorrect answer buzzer noise\*)

**Noah Guiberson** 1:00:02

Psych!

**Em Costa** 1:00:03

So I feel like, so in my mind this was going to be the kind of like orienting us to the theme like question, where it's like "duh, of course it's teeth!" But then your fact was like...basically, Noah like went into most of what I have for the spiel for this. So now I think like, we talked so much about this topic that it became suspicious.

**Noah Guiberson** 1:00:24

Well, tell us tell us.

**Em Costa** 1:00:25

Sure. So I learned a little bit about this in a great article by Lorraine Bassano over at Smithsonian mag, summarizing how teeth are used in archaeological discovery, and also the vast array of information that we can glean from them. So Noah, you know, talked a lot about this, and actually Rob did as well, to some extent, but teeth last a long time compared to other tissues in our bodies. And I didn't say bones, I had to stop myself from saying compared to other bones, so I'm internalizing this knowledge, progress is being made. But that's because of their high mineral content and their strength as a consequence of that. So it's not uncommon to find like way more teeth than what you'd expect based on like the number of skulls present at a dig site. Like there are just teeth everywhere. And what's more, studying ancient teeth can yield a really cool wealth of information. So, for example, analysis of the teeth from Lucy, hominin fossil of bipedal fame, revealed a change in diet in her generation of hominins. from fruits and tree buds to crunchier fare, like seeds and nuts, due to her thicker enamel, comparatively, on her teeth. Scientists have even been able to glean migration events from sequencing and, this was crazy to me, sequencing bacterial DNA in fossilized plaque.

**Noah Guiberson** 1:01:46

Yeah, they did that in Pompeii, I think, like Vesuvius, they like people, they had very nice teeth. That's like something I mentioned in the string of different dead people who had nice teeth...

**Em Costa** 1:02:01

But with lots of plaque? Hmmm...

**Noah Guiberson** 1:02:03

Yeah, so basically, they so they had the right, the arrangement of their teeth is really nice. But they did have they had plaque. And they use like, sort of the chemical makeup of the plaque basically, to deduce certain things about what they ate, or like whether or not gingivitis was a problem in their community. And like all those things give you really interesting little vignettes into what life was like at that time.

**Em Costa** 1:02:27

Yeah, yeah, absolutely.

**Jaida Elcock** 1:02:28

That's the weirdest thing I've ever heard. Like, that makes perfect sense, but like never in a million years, would my mind have ever thought to make that connection.

**Noah Guiberson** 1:02:38

I mean, it's very cool.

**Em Costa** 1:02:39

The Norse Good luck tradition of wearing baby teeth into battle is thought to be the root of what modern day childhood mascot?

**Jaida Elcock** 1:02:49

Tooth Fairy?

**Em Costa** 1:02:50

 Yeah!

**Jaida Elcock** 1:02:51

That's so gross. I'm so sorry. No disrespect, that makes me so uncomfortable.

**Em Costa** 1:03:00

That's fair. That's fair.

**Rob Frawley** 1:03:01

The truth fairy.

**Noah Guiberson** 1:03:03

Yeah. So the, so I know a little bit about this from like, trying to like look up facts and then like choosing different ones. And that the, so I don't I didn't know about the wearing them into battle thing, but I did read that in like, sort of like among Vikings like they would pay, they would give money to children in order to like to buy their baby teeth off, off of them was one of the potential sort of influences for the tooth fairy? But I also read about how the amount of money that kids in the U.S. get from the to the quote, unquote, tooth fairy has dramatically increased. Well above inflation. Yeah. And so I read, I read up like a Planet Money article, and I guess, like a bunch of different like, people who interviewed like, former Fed, you know, it's like vice chairman about like, what it means. Basically, it was sort of a, there's a narrative history of a, like a Fed meeting, where one of the people had a child who had just had, like a tooth fall out. And they were talking about the inflation relationship between the amount of money they were supposed to get, and came up with some like really interesting ideas about like, even though the amount of money children get for a lost baby tooth is greater than the amount like wages has gone up, some of the hypotheses are that like if wages go up, but like food doesn't go up, the amount of money you spend on like essentials, like food doesn't say the same. But if you have more disposable income, your like, amount you're willing to spend on like, a child having like a really fun childhood could go up with basically no sort of limit. And so there I read a bunch of articles by economists trying to rationalize like the amount of money that people were giving to their kids from like the quote unquote, tooth fairy going up, I think it was like 10 times above inflation. And I wanted to point out that the average amount of money left by the Tooth Fairy 1900 was 12 cents and 1950 25 cents in 1988. It was $1. And according to Delta Dentals "Tooth Fairy poll", which is a long term, like nationally representative poll of the amount of money parents are giving kids in these situations, in 2013 that the amount was $3.51. And now it is much closer to $5. Oh, although, over the last, I think like 2019 to 2020, was the first time it's ever gone down and then went down again. So two years in a row. So it may be decreasing.

**Rob Frawley** 1:03:14

I feel like it's a quality of life like metric, that basically...

**Noah Guiberson** 1:05:14

It so, it very, very strongly correlates with the S&P 500. Isn't that interesting? But I also find it ridiculous that right, like roughly now, the average sort of amount you get per tooth is like, on average is $5.

**Jaida Elcock** 1:05:57

That's ridiculous.

**Noah Guiberson** 1:05:58

That's that is ludicrous. I got, I got a quarter.

**Rob Frawley** 1:06:03

Yeah, I was on the 1950 pay scale.

**Jaida Elcock** 1:06:05

I never got more than $1, and I also lost my last tooth when I was like 14 or 15. So like, very quickly, I think I got money for like my first like five or six teeth. And then after that my parents were like, "you know, this is bullshit, right? Like, we're not giving you money for this anymore. Like you lost a tooth. Wow, that's happened six times already. Like it's not special anymore. Let's move on."

**Noah Guiberson** 1:06:28

So it honestly it makes me think of like how, so my grandparents, this is, I've never said this out loud to anyone, but my grandparents used to give me a quarter for every friend that I made on the first day of school. And honestly, like I didn't, I thought of that immediately. We were talking about like, what I was reading about the tooth fairy earlier. And I was thinking about that, like, "oh, this fun thing that only my grandparents did, because they were like trying to--" And it was like, "wait a minute, did they do that because I didn't have any friends?" Like...

**Jaida Elcock** 1:07:01

That is simultaneously the purest and saddest thing I've ever heard.

**Noah Guiberson** 1:07:08

Hey, you know, joke all you want but Jaida, that's another 25 cents for me for having you on the podcast. Money, money money!

**Rob Frawley** 1:07:17

Weirdly, the amount of money grandparents pay kids per friend has stayed very static for the last hundred years.

**Em Costa** 1:07:25

Geez. I mean, I've heard of relationships being transactional, but like that is another level.

**Noah Guiberson** 1:07:31

My mom, my mom did have to pay my grandparents to hang out with me. So, it was they were getting it all back.

**Em Costa** 1:07:37

Okay, so a little bit about sort of like yeah, the history and like the sort of the mythology of the tooth fairy. So yes, Noah, you were talking about kind of like what was called the "tan fae" or like "tooth fee". which, yeah, which was given to kids, like, you know, in Norse culture when they lost their first tooth. And then all this is also written about like in the Eddas, which is like the collection of Icelandic literature that gives us most of what we know about Norse culture. Warriors also believed that children's teeth brought good luck on the battlefield, so they would hang their children's teeth as a necklace around their necks when they went into battle. But another root of tooth fairy traditions, which exists across multiple cultures, by the way, has to do with a superstition that was prevalent during the Middle Ages that basically sort of like improper disposal of baby teeth would result in the children like as adults, presumably, hopefully, spending their afterlives, so after they die, looking for those baby teeth. Why? Who knows! You would think there, they had better things to do, but I guess if they weren't disposed of then they'd be like, "I guess I gotta find these teeth forever now. Thanks. Thanks, Mom and Dad." Or being susceptible to cursing by witches if the witches got a hold of those teeth. So, baby teeth are actually collected and burned or swallowed by moms, ew, or left out, yeah, as a snack for rats. And it's that last one, that again, I was trying to like muddle my way through a bunch of dentist office sources, which I don't really regard as the most credible, apologies. But, I suspect at least that last part might contribute to European versions of the tooth fairy because they're notably very rodent centric. So, Spanish and Hispanic cultures have Ratoncito Perez, who collects teeth that have been put under a pillow and replaces those teeth of the gift. Like same thing as the tooth fairy, except it's a giant rat. So, notable difference. The Italians have Topolino, which in that case at least is a small mouse, so like a little bit cuter and not freaky. And in France, they have Le Bonne Petit Souris? Maybe it's how you say that? I don't know. But again, same idea. Just a little mouse...

**Noah Guiberson** 1:10:00

Small mouse?

**Em Costa** 1:10:02

That'll do it. Yeah, but I will say I much prefer the tradition in Asian countries like China, Japan, India, and others, where rather than the whole like fairy and the pillow and the gifts, they actually toss baby teeth onto the roof of their house, or like onto the floor or ground based on which jaw the teeth came from, which just sounds like way more fun and does not require any, you know, any exchange of money, which I think is better for children.

**Jaida Elcock** 1:10:31

This is just, all of this talk about like, what different cultures do with baby teeth, is just making me think like, why do we have this obsession with our baby teeth? Like, where did that come from? We're typically, I don't know. I feel like it's, it would be pretty normal if we all were just like, "oh, this thing fell out of my face because the new ones growing in, alright, anyway, next, move on with my life." They're like, "no, no, we're gonna throw it on the roof or the ground or a giant rat is gonna come take it and it's gonna give me money." And I'm like, there's, it's just such a weird concept to me. Like, revolve so much of our childhood around what happens to our teeth after it falls out of our face. I don't know, maybe this is me just like having a mini existential crisis. But like, it's so weird to me.

**Rob Frawley** 1:10:33

I feel like the modern version is going to be like you take the baby tooth and you like imprint it, and you then like mine a Dogecoin. And like, and then that's it.

**Em Costa** 1:11:35

Maybe the baby teeth become non-fungible tokens.

**Jaida Elcock** 1:11:40

Oh my god. No, it's like a super special token that you can use it like Chuck E. Cheese.

**Em Costa** 1:11:45

 Oh that would be kinda sick.

**Jaida Elcock** 1:11:48

Congrats. You can pick any prize you want with your tooth token. Bam. Wow, that's such a great idea. I just became a millionaire. Anyway.

**Rob Frawley** 1:11:58

 Oh and Chuck E. Cheese is a rat!

**Jaida Elcock** 1:12:00

Oh my god!!

**Noah Guiberson** 1:12:01

Oh wow full circle! Wow.

**Em Costa** 1:12:07

Why isn't this already happening?!

**Rob Frawley** 1:12:09

Made it worse!

**Noah Guiberson** 1:12:10

And this is, just just to finish this out, just in case anyone didn't know this, this is Facts Machine. We are providing you all the trivia you can handle and more. Do you know what Chuck E Cheese's full name is?

**Jaida Elcock** 1:12:23

Charles Entertainment Cheese!

**Noah Guiberson** 1:12:25

That's right. Charles, the E stands for "Entertainment", Cheese.

**Jaida Elcock** 1:12:32

I hate it so much.

**Em Costa** 1:12:37

All right. Question three. Over the centuries, what archetypal dream theme has been associated with payment of debts, the impending death of a family member, or masturbation? Because why not?

**Noah Guiberson** 1:12:51

Well, I think I knew it but now I don't want to answer

**Em Costa** 1:12:56

Hits too close to home?

**Noah Guiberson** 1:13:00

Is it teeth falling out? Or like teeth? You know, sort of not being there?

**Em Costa** 1:13:03

Yeah, yeah, exactly. So teeth dreams are as they're abbreviated in psychology "TD", because they are that much of a common universal thing, includes sort of the scope of like dreams of teeth falling out...

**Noah Guiberson** 1:13:15

Scope, like the mouthwash.

**Em Costa** 1:13:18

Great, Oral B-plus. Teeth rotting or breaking are among the most universal dream themes, as they're called. Which is weird, because they generally don't reflect upon like current or past waking life experiences in that like, way more people dream of all their teeth falling out than people who actually have all their teeth fall out. So, in terms of like the origins of these dreams, psychologically, we don't really understand very well. But because of this mystery, and how frequently these dreams happen, over the ages there have been all sorts of hypotheses about where they come from. So for example, Artemadoris, the ancient Greek diviner, or interpreter of dreams, suggested an association between losing teeth in a dream and paying debts, which kind of makes sense, you know, you're like losing them and then maybe, I don't know, giving them to someone in exchange for toys from Chuck E. Cheese. The Jewish Talmud introduced the belief that these dreams were prophetic of someone in your family dying soon. That probably belief actually, like persisted beyond that. And then Freud...

**Noah Guiberson** 1:14:26

It's always eventually right.

**emily costa** 1:14:29

You just don't know when. And then Freud, of course, related teeth dreams to sexual stuff, because he's really got a one track mind in that way, like masturbation and castration. And like Jung posited that in women it relates to childbirth, so like all sorts of just crazy, crazy stuff. But yeah, so my advice is to just not read into it too much, because we don't know. Question four. Which Beatle who's solo career hits sound similar to "Gimme Some Tooth", "Mouther", and "Canine Dream", gifted a tooth to his former housekeeper's daughter? This is maybe my favorite trivia question ever.

**Noah Guiberson** 1:15:14

I know this one.

1:15:16

I don't know the names of all the Beatles.

**Noah Guiberson** 1:15:18

Well, look, we're not gonna make you feel bad about that because I know the answer.

**Jaida Elcock** 1:15:24

Okay.

**Noah Guiberson** 1:15:27

I think it's John Lennon Yes. And that John Lennon gifted a I think it was like a molar to a, to his housekeeper who then, you know down the line it was auctioned for I think about $30,000, which makes it the second most valuable tooth ever sold after Isaac Newton's tooth, which was set in a ring and auctioned.

**Em Costa** 1:15:50

Ewwww!!

**Noah Guiberson** 1:15:52

It was set in a ring and auctioned sometime the 1800s, I can't quite, late 1800s and for like, like 3,500 pounds, I guess? But with inflation adjusted and switched currency is actually more than John Lennon's tooth. So Isaac Newton's tooth, it remains the most valuable tool ever sold at auction.

**Jaida Elcock** 1:16:11

I am once again asking, what is up with our obsession with teeth? Was it like a baby tooth? Or was it like his grown adult molar?

**Noah Guiberson** 1:16:23

So I saw, I saw a picture of the ring which I also read has now been lost. Like we don't know where it is. But it looks like an adult tooth. I can't be sure.

**emily costa** 1:16:33

Nice. Yeah.

**Em Costa** 1:16:33

Oh for Newton. Yeah, yeah. And for John Lennon it was the same thing. So yeah, it was a molar that he had like extracted when he was like already in the Beatles, but like, you know, a fairly young man, and he gave it to his former housekeeper Dot Jarlett sometime between 1964 and 1968, suggesting to her that she hang on to it for her daughter who was a Beatles fan. I assume a really intense Beatles fan. And then yep, as Noah mentioned in 2011 It sold at auction for about $31,000 to a Canadian dentist who I'd imagine it must rank "Give Teeth a Chance" somewhere highly in his choice of dental catchphrases. Oh yeah speaking of the songs, yeah, the ones I referenced were "Give Me Some Truth", "Mother" and, "Number Nine Dream". Nicely done. Good beats. Question five. What feature associated with sexuality, lust, and a Chaucerian Wife of Bath, is medically called a "diastema"?

**Jaida Elcock** 1:17:30

What? I, no, I don't know, what thoughts...?

**Em Costa** 1:17:37

It has to do with teeth. Right.

**Noah Guiberson** 1:17:40

It's a teeth quiz...

**Rob Frawley** 1:17:42

It has to do with lust and the Wife of Bath in the Canterbury Tales.

**Em Costa** 1:17:45

Yes.

**Rob Frawley** 1:17:46

Is it gap tooth, the gap in the tooth?

**Em Costa** 1:17:49

Yeah. So yes, in Canterbury Tales, the Wife of Bath's Tale, the woman, the main, The Wife of Bath, was a gap-toothed old woman who like tricks a knight into marrying her and then turns beautiful because like, you know, whatever, whatever another man getting a thing he didn't deserve. But earlier in the story, it's mentioned that she has a gap tooth and that's meant to be a sort of cheeky, outward manifestation of her kind of like lustful sort of nature. And the association of gap teeth, particularly between the two front teeth, with sexuality, was a connotation like in medieval times, but interestingly, it had a much different connotation in Napoleonic France. So in French, gap teeth are called "dents de bonheur" or like lucky or happy teeth, because when soldiers were being selected and drafted to Napoleon's army, their incisors were checked and had to be perfect, because they needed to use them to open paper cartridges with gunpowder for their muskets. So if you had a gap in your teeth, you were lucky, you didn't get drafted. They're still called that in French to this day. Alright. Question six. Eddie Klein, who's past clients include Flavor Flav, Outkast, and Little John, is credited with popularizing what type of jewelry in the 80s in New York City?

**Jaida Elcock** 1:19:17

Well, I gotta say grill. That's the only type of tooth jewelry I can think of. And if there's something else out there, then I don't know what I'm missing. But...

**Rob Frawley** 1:19:26

There's also those Halloween vampire teeth that you put in, which is a very cheap form of tooth jewelry, I would say.

**Jaida Elcock** 1:19:31

I mean, for sure. I'm here for that one. Yeah. Yeah.

**Rob Frawley** 1:19:35

I've seen them with rhinestones on...

**Em Costa** 1:19:36

Can add in canines that way, get those canines back! Yeah, re: grills, so they are, of course, dental jewelry worn over the teeth. And they grew in popularity among NYC hip hop artists in the early 1980s and have since, of course, taken over the world. So Eddie Klein, the founder of Eddie's Gold Teeth, made gold caps and custom like crazy elaborate grills for all sorts of big name hip hop artists like the ones I mentioned, among others. Per Guinness World Records, the most valuable grill made thus far cost $1 million. It involves multiple diamonds and precious gemstones, and it was worn by Katy Perry in the music video for Dark Horse.

**Jaida Elcock** 1:20:24

No...

**Em Costa** 1:20:25

Question seven. Friend of the pod, Pliny the Elder, we go way back, in his infamous Natural History, recommends boiled dogfish brains, sting rays, and pickled frog juice, as cures for what?

**Noah Guiberson** 1:20:43

I just want to say first of all, I'm so sorry, Jaida. Those are a lot of shark and skate-related animals, and I'm very sorry that Emily would so callously suggest boiling them.

**Em Costa** 1:20:55

I'm a little bitter at the elasmobranch used for remedy-type... I mean, do what you gotta do I guess. I am unsure of the answer to this question. Would do you guys think?

**Rob Frawley** 1:21:08

Yeah, I mean, again, just on theme, the only the only tooth maladies that I can think of are generally a toothache?

**Jaida Elcock** 1:21:15

 I was gonna say a toothache or like a cavity.

**Rob Frawley** 1:21:18

Yeah. When you get to that time of day, you know, tooth-hurty.

**Jaida Elcock** 1:21:22

I was waiting for that joke to come up at some point during the episode.

**Noah Guiberson** 1:21:31

Like I feel like anytime Pliny the Elder or like Galen, or any sort of like ancient person interested in medicine comes up, they're basically just playing like a mad lib of like insane animals to say, like, "okay, we're gonna take the, okay give me a random animal, okay, pig, give me random part of the body, penis, okay, we're gonna take the penis of the pig and we're gonna...what's a weird thing to do with a pig's penis? Like throw it around our head really fast..."

**Jaida Elcock** 1:21:57

And that cures erectile dysfunction!

**Noah Guiberson** 1:21:59

Exactly. Erectile dysfunction would be unusually related thing for the penis.

**Rob Frawley** 1:22:08

That cures indigestion.

**Em Costa** 1:22:12

Exactly. Well, you guys were right on the money with toothache. So yeah, Pliny's dental advice has a consistent theme at least, which is basically like scraping your gums or teeth with bones and then swishing around some kind of like stinky, briny fish juice. So like, okay, it's like a topical treatment of sorts on the teeth. Admittedly, I only had a limited preview of Natural History, so I wasn't able to keep reading, but I'd imagine the next chapter is a cure for terrible breath. But, I will say he was really caught up on using frogs in particular for like loose or damaged teeth. So, to give a few examples of like his frog-based remedies that he recommended and heard about, boiling frogs in vinegar and rinsing with the juice, hanging several frogs by their hind legs, eating frogs with broth, tying frogs on people's jaws as an amulet, just like walking around with a frog tied to your face, and boiling the hearts of 46 frogs, don't get the number wrong, under a copper vessel in one sexteriues of old oil to be poured into the EAR on the side of the aching jaw. That one is direct quote. So...

**Jaida Elcock** 1:23:28

These poor frogs! Oh my god. 46?! For one messed up jaw? Like bro...that's a lot of frogs!

**Em Costa** 1:23:38

Is it, is it worth it? Is it worth it? But now this to me was even crazier. And Rob, please chime in if this rings any kind of bells for you. The whole like connection between frogs and toothache remedies is not exclusive to Pliny. It apparently, is also an Irish thing. So a study through Dublin City University looking at Irish folkloric remedies in the 19th and 20th centuries included various frog-related dental care techniques, namely putting a frog in the patient's mouth for a few minutes along with like various quasi-religious stipulations. So, one of the sort of like sources they included mentioned that frogs must screech, invariably, three or nine times or that its leg or back must be licked, or you have to use the frog to make the sign of the cross on the affected tooth. Or the idea like, in terms of the frog in the mouth, was that the pain will be transferred from the person to the animal. And from the paper, "this was explicitly stated by an informant the words 'frog, frog take the sting of the toothache' were uttered while the frog was put in the patient's mouth." It was not clarified whether the patient was meant to utter this while the frog was in their mouth. But I have to wonder... In fairness, this this paper also included some pretty regular cures for tooth issues, including like a salt and water rinse, cool, carrying a potato in one's pocket to ward off toothache... And I imagine that just carrying potatoes is like a normal good luck practice. I

**Rob Frawley** 1:25:12

Just a thing people did. Yeah. right.

**Em Costa** 1:25:13

Right? I thought so. Which to me spurred a mental image of the scenario of just someone passing by being like, "is that a potato in your pocket are you just happy to see me?"

**Jaida Elcock** 1:25:22

Oh God...

**Em Costa** 1:25:23

...but then a lack of response because there was a frog in the person's mouth and so they couldn't actually give an answer to that question.

**Jaida Elcock** 1:25:29

I would just assume that the patient is the one that has to utter that phrase, because it seems really on brand for dentistry just like making you talk while there's something in your mouth.

**Noah Guiberson** 1:25:40

Exactly.

**Jaida Elcock** 1:25:41

So how was your day today? I'm like, "I can't answer this because there's five feet of your arm down my mouth right now. Like I don't--what do you mean?"

**Noah Guiberson** 1:25:50

Are we sure that was a an accredited dentist?

**Jaida Elcock** 1:25:56

Look sometimes I exaggerate way too much.

**Em Costa** 1:25:58

Their hands are supposed to go in your mouth, not their feet. There's something wrong with that.

**Rob Frawley** 1:26:03

The dentist, to be fair, the dentist dropped the tooth and then had to go down to get it.

**Jaida Elcock** 1:26:07

Yeah that was one of my canines. That's how we got it back.

**Em Costa** 1:26:13

Sent a frog in after it.

**Noah Guiberson** 1:26:16

Went spelunking.

**Jaida Elcock** 1:26:17

Yep. Love that.

**Em Costa** 1:26:21

Well, honestly, even reading through the Pliny stuff I had kind of a flashback to last time we had Moya on where she was discussing how sort of like, magical rituals from folklore so complicated to make it impossible to ever get them completely right. So that if the spell doesn't work or produce results, you can be like, "oh, you must have like, dropped the stone into the pond like, when one sunbeam was on it instead of two!" Yeah. And I'm like, a lot of these are impossible. So, I wonder if it was just kind of like, "well, we just, you know, chomped on some frogs for no reason, but not in quite the right way, that's why your tooth still hurts, but still pay me for my very valuable medical advice." Question eight, what innate human behavior is thought to have evolved from the way our ancestors communicated social status and dominance?

**Noah Guiberson** 1:27:06

Laughing?

**Rob Frawley** 1:27:07

Oh, is it?

**Em Costa** 1:27:08

Close!

**Noah Guiberson** 1:27:08

I was thinking maybe baring your teeth?

**Rob Frawley** 1:27:10

Is it smiling?

**Em Costa** 1:27:11

Yeah!

**Noah Guiberson** 1:27:13

Wow!

**Jaida Elcock** 1:27:14

That makes sense. I don't know why that didn't come to mind.

**Em Costa** 1:27:16

Yeah, so this one, I had a difficult time. I mean, I think just, well, the consensus is that, of course, first of all, it's impossible to be like, "why did this behaviour evolve?" and actually have a conclusive answer.

**Noah Guiberson** 1:27:27

Right.

**Em Costa** 1:27:27

But also, yeah, there are some varying hypotheses. But generally, primates bare their teeth, like as a display of aggression, or when they're afraid or cornered, like basically, you know, they curl their lips back and tighten all the muscles in their face and go "rawr", but it's been noted...

**Rob Frawley** 1:27:42

Very "The Shining" energy, there.

**Em Costa** 1:27:47

But it's been noted over evolution that higher primates evolved to show their teeth to indicate submission to like a more dominant member of their species or their community. So the idea being like, "look, I'm showing you my teeth in this kind of chiller way, please don't hurt me." Like "we're cool, right?" And although like I said, it's impossible to ever know this with certainty, we think that the evolution of smiling and humans may have followed like a similar track. Though in us, of course, it's more complex because we have different kinds of smiles, and real smiles and fake smiles. So note on real smiles, these are referred to scientifically as "Duchenne smiles" after the French neurologist Guillaume Duchenne, who made various scientific observations regarding smiling as part of his experiments, applying electricity it people's faces and seeing what the muscles did, which is pretty fun.

**Noah Guiberson** 1:28:41

Which kind of makes me think he doesn't know what smiles look like.

**Em Costa** 1:28:47

"That's a smile, if I just poke right there."

**Noah Guiberson** 1:28:49

Ow!

**Em Costa** 1:28:54

So for a Duchenne smile, basically, by that metric, what makes a smile real is the smize. So basically, engaging the muscles at the corners of your eyes, or the, or the orbicularis oculi muscles as they're called. And admittedly, the kind of funny thing about this is for a long time, like sort of engaging your eyes along with your zygomatic or like jaw muscles and smiling was kind of the indicator of like a real, genuine smile versus a fake like, or as they were called, I've seen PanAm or Botox smile, which is kind of funny and makes a lot of sense. But I feel like over the pandemic, you know, we've, people have been honing their smizing skills. So I feel like we're gonna emerge from this just never knowing again if anyone is smiling genuinely, because we've gotten so used to smiling with our eyes as well. So, interesting, Brave New World. But, I will say real or fake, we do know that smiles are innately human, because even congenitally blind infants do it, so they're not learning it by example because they can't see any adults smiling around them, and in response to the same happy cues as sighted people. And I think that's something to smile about, with our nicely brushed and flossed teeth, which I honestly am immediately going to do as soon as we're done. It's all I've been thinking about for the past hour. I'm like "my precious enamel, oh no!" All right, so that's all we have for today. Thanks so much for joining us. And thank you so much to Jaida, our awesome shark-loving, tooth fact-sharing guest of honor. It's been such a pleasure.

**Jaida Elcock** 1:30:34

Yeah, thanks so much for having me! This was so much fun.

**Em Costa** 1:30:39

Is there anything that you'd like to direct our listeners to or turn folks attention to regarding all the awesome stuff you have going on?

**Jaida Elcock** 1:30:45

Yeah, so if you guys are interested in following my journey through science or looking at some of my science communication stuff, you can follow me @sofishtication on Twitter and TikTok and sofishtication\_ on Instagram because "sofishtication" was already taken on Instagram but it's fine. And then for MISS, if you'd like to keep following our mission and support us, you can take a look at our website, misselasmo.org, and you can follow us on Instagram and Twitter @miss\_elasmo. So yeah, that's what I got!

**Em Costa** 1:31:19

Fantastic! And if you'd like to peruse more content from Facts Machine, you can find us on Instagram and Twitter @factsmachinepod and on Facebook at Facts Machine Podcast, and also were individually on social media. I'm @\_emcosta, Rob--

**Rob Frawley** 1:31:37

@sweatervestsci

**Em Costa** 1:31:39

And Noah--

**Noah Guiberson** 1:31:40

@arksandsciences

**Em Costa** 1:31:42

Facts Machine is produced by Rob Frawley, Noah Guiberson, and Emily Costa, with editing by Noah Guiberson. The theme music is by A.C. Antonelli and our logo was designed by Mike Zolla. Thanks for tuning in. See you next time. Bye!

**Noah Guiberson** 1:31:55

Bye!