Video Transcript - How Bones Reveal Environmental Health

Maggy Benson: Our bones have stories to tell. Some are obvious, but others are hidden deep within. How can scientists studying bones tell the story of how environmental [00:00:30] toxins impact humans? We'll find out today, when we talk with Physical Anthropologist, Sabrina Sholts. Fascinating stuff. No bones about it.

Maggy Benson: [00:01:00] Wow.

Maggy Benson: Hi every one. Thank you for joining us for another episode of, Live from Q?rius, Smithsonian Science How? We have a great show today and a great audience, thanks for all of you for tuning in, especially Canyon Ridge Middle School, we see you out there. Today with us is Physical Anthropologist, Dr. Sabrina Sholts.

Maggy Benson: Thanks for joining us, Sabrina.

Sabrina Sholts: Thank you for having me. I'm so excited to be here.

Maggy Benson: Sabrina, here at the Smithsonian [00:01:30] you're a physical anthropologist.

Sabrina Sholts: I am.

Maggy Benson: But I've also heard you refer to yourself as a Bioarchaeologist,

Sabrina Sholts: Yes.

Maggy Benson: Can you tell us what that means.

Sabrina Sholts: Of course, I can. Physical anthropology, that's the study of people, from a biological perspective, and there're a lot of ways to do that, a lot of questions to ask and things to focus on. So I'm particularly interested, in general, on human variation. The ways that we physically differ, and why? I don't just do this, you know, I'm not just interested [00:02:00] in these questions in living people, but people who lived hundreds or thousands of years ago. So, in that sense, that can be called bioarchaeology because I'm using the archaeological record to study biological evidence of humans in the past.

Maggy Benson: Sounds like a really fascinating job.

Sabrina Sholts: It's a great job. Yeah.

Maggy Benson: If you're studying the differences between human, I mean, what's your baseline? Is there any such thing as a normal person?

Sabrina Sholts: Yeah, well, that is a great question because normal is a relative term. So usually we are [00:02:30] using it in the context of, how old you are or whether you're a boy or a girl, or even where your families from. My stature, for example, my height, okay, that is ... well it's normal for an adult but not for a newborn. It's actually average for a woman in Sweden but not for one in Taiwan. So, these differences in the size and shape of our bodies, we can sometimes see in our bones, and that's great [00:03:00] if you want to study people in the past because bones are pretty much what you get. They are more typically going to preserve longer than anything else, like hair or skin.

Maggy Benson: So, as an anthropologist, one of the main things you must need to know is, how bones are formed.

Sabrina Sholts: Yes, absolutely. Very important.

Maggy Benson: I think that's a great question to actually ask our viewers. What do you think?

Sabrina Sholts: I think that's a fantastic question.

Maggy Benson: All right.

Sabrina Sholts: Yeah.

Maggy Benson: Viewers, here's an opportunity to participate in a live poll. Tell us, our bones are shaped by ...

Maggy Benson: The genes with inherit? [00:03:30] The environments we live in? Both? Or neither?

Maggy Benson: Take a moment to think about it, and put your answer in the window that appears to the right of your video. Remember that this is the same place that you can post questions for Dr. Sabrina Sholts to answer during our live program today, and her graduate student Cecilia Wallen is responding too in the chat.

Maggy Benson: [00:04:00] We're both watching the results come in.

Sabrina Sholts: Yeah, Yeah.

Maggy Benson: We see a lot of people are saying the genes we inherit, but more, 59 percent are at both, both genes and the environment. What do you say?

Sabrina Sholts: Yeah, I mean, it is both. Definitely there is [00:04:30] a genetic basis for a lot of the differences we see. I mean, these are differences encoded in our DNA and we inherit them from our parents, so that's why people who are related tend to look similar. Even people who are genetically identical twins will look essentially the same, but people from families, in distant places, might look more different. However, we're constantly interacting with the environment and those interactions within a population, or even within the family, can influence how these genes are expressed, [00:05:00] in ways that we can see in bones.

Maggy Benson: What do you mean about the environment? Does that mean where I work, where I went to school when I was a kid?

Sabrina Sholts: Yeah. I mean, it's all of that and more. It's, you know, the food and water and air, and everything that surrounds us and that we are coming in contact with. The environment today, it's changing. It's changing so dramatically and our interactions with it are changing too.

Maggy Benson: We saw a lot of images there.

Sabrina Sholts: Yeah.

Maggy Benson: Of pollution and a lot of negative environments.

Sabrina Sholts: Yeah.

Maggy Benson: Do you have any examples [00:05:30] here today about how our bones have been impacted by the environment?

Sabrina Sholts: I absolutely do, I have an extreme example.

Sabrina Sholts: What we have here is the biggest bone in the body, it's a femur. It's a leg bone. Okay. It's from an adult male, it's fully formed, it's a normal size for this individual. It's a normal shape for a human, and so it allows him to have an upright posture, and move on two feet, and doing everything it needs to do in the body. But this femur, from the same population, [00:06:00] is fully formed.

Maggy Benson: I'm not a physical anthropologist but that does not look right.

Sabrina Sholts: Didn't form normally, okay.

Maggy Benson: It's very bent.

Sabrina Sholts: Both males, both adults. What we call this, is a condition called rickets. It's a result, typically, of a vitamin D deficiency during childhood, resulting in not getting enough calcium in the bones. So if you zoom in on bone tissue you see that it's composed of proteins and [00:06:30] minerals. You zoom in on those minerals, look at the molecules, and you see that mostly what's making our bones hard are calcium and phosphorus. These are a few of the elements that compose bone. It wouldn't be so unusual to see other elements in bone, in much smaller quantities, because there are others that we need as essential nutrients. Things like iron, but then there could be other elements in the Periodic Table that have no business being [00:07:00] in bone, but you might find there, like lead, because lead can replace calcium and be very harmful.

Sabrina Sholts: However, this condition was not the result of something being in the bone that didn't belong there or getting too much of something, it's actually a result of getting too little of calcium. That reflects the balance that we need in our bodies to grow and develop normally. So, that didn't happen in this case, and so not only did that result in misformed [00:07:30] femur but also it prevented him from reaching his genetic potential for height. He was shorter then he should've been.

Maggy Benson: And that person's life could've been impacted.

Sabrina Sholts: Absolutely. I mean, you look at the whole skeleton and you'll probably see, I mean, I'm seeing right now other evidence of problems that may have resulted from this condition or been a part of his life.

Maggy Benson: You showed us on that Period Table other elements you might find in bone that have no business being there, like lead

Sabrina Sholts: Yeah, yeah.

Maggy Benson: How to elements like that make it into our bones?

Sabrina Sholts: Well, so we saw up there, I think, mercury, arsenic, [00:08:00] cadmium, these are things that are in objects that we see and use every day and don't think about, light bulbs, batteries, things in our houses.

Maggy Benson: Is coming in contact with those, using those light bulbs, using those batteries, going to actually make those elements any ... Can I ingest those into my body? Can they hurt me?

Sabrina Sholts: They'll hurt you? Well, I mean ... Well, not like touching them normally, as you would through your skin, probably not, but if we don't dispose of them properly. If they get out into the environment and then they break [00:08:30] and they leak, these elements, they don't break down, they persist, they circulate, they get into the soil, they get taken up by plants. For example, tobacco, and then if someone smokes tobacco, they're actually inhaling those chemicals and it's getting back to their body. This is a particular concern for women who are pregnant because the mother's body, you know, when there's a baby inside of it, is the environment. So anything she's taking in or maybe when she's nursing, the milk is going back into the child that is growing so fast, [00:09:00] and potentially being so severely affected by these chemicals.

Maggy Benson: So, exposure to your environment, at different life stages, is another factor in considering overall skeletal development and health.

Sabrina Sholts: Absolutely. Yeah. I mean, you saw here. We think a lot about the physical environment and the cities, and the waters and rivers but the prenatal, early life environment, can also be a pathway to exposure of chemicals and plastics, and pesticides and cigarettes.

Maggy Benson: Wow. So, I [00:09:30] mean, exposure to different chemicals may be harmful at different life stages.

Sabrina Sholts: Yes.

Maggy Benson: I mean, is there any way to monitor that? I mean, is that why we get measured so often when we're kids?

Sabrina Sholts: It is, yeah. I mean, you need to monitor these things because we are growing so fast, and stature is actually a really good indicator of overall health. Had this individual been measured throughout life the condition might have been identified and, it possibly, he may have been able to [00:10:00] ... they might have been able to treat it.

Maggy Benson: You're looking at a leg bone to be able to determine what this person's environment was. In this case, lacking.

Sabrina Sholts: Yeah.

Maggy Benson: Which causes developmental defect.

Sabrina Sholts: Yeah.

Maggy Benson: But you're a physical anthropologist, you study the entire skeleton.

Sabrina Sholts: Yes.

Maggy Benson: Do you typically look at every bone within the body to be able to determine somebody's overall health?

Sabrina Sholts: Well, you do. I mean, you definitely have to take all the skeletal evidence available into account to get some sort of idea of everything that might have been going on. It's always complex. It's always [00:10:30] a big picture but you have to focus on something. I focus on the skull because it is so complicated. It is composed of so many bones ...

Maggy Benson: How many bones are in the skull? Wow.

Sabrina Sholts: You know ... Many, dozens, and it serves so many functions that can be informative about the environment.

Maggy Benson: Awesome. Let's take some student questions, they're rolling in.

Sabrina Sholts: I'd love too. Yeah.

Maggy Benson: All right. This one comes from Jason and Ashton, from Canyon Ridge.

Sabrina Sholts: Okay.

Maggy Benson: They want to know ...

Sabrina Sholts: Hello Canyon Ridge. Hey Jason.

Maggy Benson: What are the oldest bones that you study?

Sabrina Sholts: [00:11:00] Okay. Jason, great question. Yeah, so, the oldest bones that I study, because I work in North America, are about 12,000, 13,000 years old, as early as we get because that's when people actually entered the continent and started to settle.

Maggy Benson: Great. Great question.

Sabrina Sholts: Yeah.

Maggy Benson: This question comes in by video, so let's have a look.

Sabrina Sholts: All right.

Corey: Hi, I'm Corey, and I'm wondering what pollutants might be affecting my bones.

Sabrina Sholts: Okay, Corey. Well, [00:11:30] I hope you don't smoke because, as we just discussed, that can be one really harmful source of chemicals, but, you know, it could be really anything from, in the water or food or metals, organic pollutants.

Maggy Benson: All right, great questions. Several people have asked, in our comment stream.

Sabrina Sholts: Yeah.

Maggy Benson: If milk is actually good for your bones.

Sabrina Sholts: Oh. Great question every one. Well, I mean, the first question is, can you metabolize milk, because not every [00:12:00] one can. This is actually a genetic difference between a lot of people.

Maggy Benson: Actually processing it and getting energy from it.

Sabrina Sholts: Yeah, not everyone can actually drink a lot of milk but if you can, if your body, if you have a genetic disposition to metabolism milk properly, then you can get calcium out of milk and it can be quite healthy.

Maggy Benson: Great questions.

Sabrina Sholts: Yeah.

Maggy Benson: All right. Let's learn a little bit more about your research, Sabrina.

Sabrina Sholts: Sure.

Maggy Benson: I know that you do study in the Channel Islands in California.

Sabrina Sholts: Yes.

Maggy Benson: Can you tell us little bit about where those are and why that space is significant for your research.

Sabrina Sholts: I would love too. It's [00:12:30] a great place. The islands are off the coast of southern California, they're beautiful. They're a fascinating place to study changes in people over time. There was the question about, how old are the bones that I study, they're from the Channel Islands because that's how long back our archaeological and bioarchaeological record goes. About 13,000 years from the earliest settlement, up until less than 200 years, when the native people, who we now know as the Chumash Indians, were taken off those islands.

Maggy Benson: They look like a beautiful [00:13:00] places.

Sabrina Sholts: Yeah.

Maggy Benson: Why is this space significant for your research, considering that you study environmental contamination?

Sabrina Sholts: Right, and what's great about this region is that we get a lot of natural contamination with bitumen, which you might know as crude oil or petroleum.

Maggy Benson: Oh yeah, of course.

Sabrina Sholts: Same thing, yeah. So, it seeps naturally from cracks in the ocean and on the land, and forms these seeps, like some people may know the La Brea tar seeps for example [00:13:30] or in Carpinteria, and it was exposed in ways that the people living on those islands and the mainland could actually collect it and use it in their everyday objects. It's sticky, it's viscous, you know, it serves like an adhesive but also a waterproofing material.

Maggy Benson: What kind of objects were they making using this bitumen?

Sabrina Sholts: Well, so, yeah. They were using it for a lot of things, they were building boats. We know, archaeologically, that they were using it as food storage containers and storage for [00:14:00] water, and it's fascinating to see this happening in the archaeological record because we know that bitumen has the same chemicals, hydrocarbons that we call PAHs that you get in cigarettes and car exhaust, and other sources of modern contamination.

Maggy Benson: So it's not good for you?

Sabrina Sholts: No, it's not good for you and here we have a record of thousands of years of people using it.

Maggy Benson: So, what has your research told you about the use of bitumen by the people that inhabited the Channel Islands?

Sabrina Sholts: Well, so we started with the hypothesis, [00:14:30] knowing that hydrocarbons, PAHs, exposure can be bad for you. That this may have contributed to a health decline on the islands. Specifically, we tested the hypothesis that head size would decline over time as bitumen exposure, or PAH exposure, increased. Because we know from modern studies, that women who are pregnant and exposed to PAHs can give birth to babies with smaller heads.

Maggy Benson: And you know from the archeological record that they started using more [00:15:00] and more of this bitumen for more and more of their food storage containers ...

Sabrina Sholts: Over time. Exactly.

Maggy Benson: Sure.

Sabrina Sholts: Yeah. So, what we did is that we went into collections, we got a lot of skeletal material to look at from the islands and we can measure the skulls in ways that we can approximate the head size, you know, as so, and so. And actually, we were able to see that there was a decline in head size over time, as we can see archaeologically, that use of bitumen increased.

Maggy Benson: Wow, that's incredible.

Sabrina Sholts: Yeah.

Maggy Benson: [00:15:30] But I have to bring this up, because you just taught me, that both genes and your environment impact skeletal developments.

Sabrina Sholts: Yes.

Maggy Benson: So, how do you know that it was just this bitumen?

Sabrina Sholts: Well, and that's a great question. We don't. There could be a lot of other factors involved and influences on this effect, pathogens, diseases, stress coming in other ways from other sources. One of our big questions was, how much of the chemicals were actually getting into the water and the food? We know [00:16:00] they're there, we tested the bitumen, but we don't know the concentrations.

Maggy Benson: You know what? That's a great question and a great hypothesis to ask our viewers about. What do you think?

Sabrina Sholts: Yeah, yeah. Let's see what they say.

Maggy Benson: Viewers, here's another opportunity to participate in a live poll. How would you gather evidence to test Sabrina's hypothesis?

Maggy Benson: Would you use living people? Would you expose living people to more hydrocarbons? Recreate Chumash living conditions? Analyze chemistry of Chumash bones? Or analyze other species bones?

Maggy Benson: Take a moment to think about it and put your answer in the window [00:16:30] to the right of your video.

Maggy Benson: [00:17:00] Sabrina.

Sabrina Sholts: Yeah.

Maggy Benson: We're having fun watching these results come in.

Sabrina Sholts: We are. Yeah. I'm having a great time.

Maggy Benson: 79 percent of our viewers would analyze other species' bones.

Sabrina Sholts: Okay.

Maggy Benson: What did you do?

Sabrina Sholts: Yeah. I mean, that's not wrong, but I'll tell you what we did first, which is that we actually recreated one of these water bottles that they used to store their water. Found that we could measure concentrations.

Maggy Benson: Very cool. How did you do that?

Sabrina Sholts: Yeah. Well, okay. You can see here, we have all this archaeological [00:17:30] evidence and ethnographic evidence to help us find the materials, go out to the islands, gather everything and use traditional methods, as Kevin Smith is doing here. He's breaking up the bitumen that he got from the islands. He's melting it down using these heated rocks and then as he was doing this we were actually measuring the contamination in the air, to get the sense of how harmful it would have been to breathe the fumes.

Maggy Benson: He should be wearing a mask.

Sabrina Sholts: He should be wearing a mask. That's a great point. Here's Kevin actually coating the basket he wove. There's Cecilia, testing [00:18:00] some food that we're pouring into the bottle there. Then also, we tested water because honestly these things are great for nothing else more than water.

Maggy Benson: The first water bottle. Wow.

Maggy Benson: Cheers?

Sabrina Sholts: No way.

Sabrina Sholts: No? Sure.

Sabrina Sholts: Yeah, but so they ... It was great. It gave us a great sample to actually study concentrations, and then we can compare that with modern values.

Maggy Benson: Wow. That's incredible.

Sabrina Sholts: Yeah. Yeah, yeah.

Maggy Benson: Now I have [00:18:30] to ask, again.

Sabrina Sholts: Oh no.

Maggy Benson: How do you control for those other environmental factors, if you're recreating the Chumash way in present day times?

Sabrina Sholts: I know.

Maggy Benson: How do you know that you're doing it correctly and you're getting the results that ...

Sabrina Sholts: Well ... Yeah. You need another question, you need another experiment. You have to keep going and keep digging. So, one of the great ways to sort of isolate environmental effects it to use animal models. Not every one would assume that models would be useful in animals for humans, but [00:19:00] you don't realize that we share so many traits. You know, we share an evolutionary history. Distantly we're genetically related, and so, for that reason, we have some similar skeletal features that allows some animals to be useful models for human head development.

Maggy Benson: What animal models have you used?

Sabrina Sholts: We used the rat actually. The rate was a great model for us because we could look at the adult effects of prenatal exposure, within a few, you know, weeks [00:19:30] or months, because they've got a much shorter growth period and lifespan. Also, they're large enough that we can measure them the way we would the skull. There's my intern, Ashley, using my MicroScribe to measure the skull. We're seeing that there were different effects based on when exposure occurred, which is good to know and consistent with what we were seeing. That there was actually a change in the growth pattern of the skull, related to the exposure and when it occurred.

Maggy Benson: How do you apply [00:20:00] that to human contamination?

Sabrina Sholts: Well, I mean, it shows us that, yes, this can happen in humans, and it can happen in mammals. Also, the fact that we can use this animal model, but also a model compound can help us better understand the contaminants that might be in the environment that we know very little about. Things coming from our pipes, from our ground water, getting into our food, moving up the food chain, and basically giving us more insight into how [00:20:30] those chemicals might behave in our bodies and what kind of effects they might produce.

Maggy Benson: It sounds like animal models are a really smart way to be able to better understand contamination.

Sabrina Sholts: They can be very useful.

Maggy Benson: Have you used any other animals in your studies?

Sabrina Sholts: Yes, we have. We are starting a new study, looking at foxes, in the wild. Here we see the foxes on the Channel Islands.

Maggy Benson: They're adorable.

Sabrina Sholts: They're adorable, but you would not guess that they are the top predator, terrestrial predator, on these islands and they are therefore a [00:21:00] really good indicator species for environmental contamination. So this is a situation where we are actually looking at the concentration of chemicals in the bones because they've been taken up and incorporated, and give us some sort of idea of how those conditions may have changed over time.

Maggy Benson: And they're taken up through their diet, really, because you are what you eat.

Sabrina Sholts: You are. Indeed.

Maggy Benson: We have a clip here of you doing some of this work in your lab with some of your colleagues.

Sabrina Sholts: Yes.

Maggy Benson: Can you walk us through it?

Sabrina Sholts: Yeah. There's Cecilia, and [00:21:30] she is doing a great job weighing these bones, because we're interested in concentrations, we have to know how much sample we're using, they're so tiny. But, fortunately, with modern technology you can get a lot of information out of a very small amount of sample. She's diluted that, she's made it into a solution and now Nicole Little is using that to actually analyze the concentrations of dozens of elements in that substance with this ICPMS machine. [00:22:00] It's taking up the sample and everything is happening within the matter of minutes. While Nicole is doing this, and we're watching the machine work, we're getting real-time results of everything that's in there, in trace concentrations and then we can discuss them. Here I think we're probably seeing that some of these foxes are showing high levels of lead, during the middle 20th century.

Maggy Benson: That's interesting.

Sabrina Sholts: [00:22:30] Yeah.

Maggy Benson: Because you weren't finding that with the early Chumash. Was there a shift in environment maybe?

Sabrina Sholts: Absolutely. Yeah, I mean, the Chumash were taken off the islands in the mid-19th century, then those islands underwent a lot of changes. They became a site of a tourist destination, a site of a lot of commercial enterprises. Here we see Santa Catalina Island. There's the drilling for bitumen. We also see ranching happening on the islands, which was devastating to the landscape, and you know, [00:23:00] military, military activities were happening in the mid-20th century. Consistent with what we were seeing with the foxes so far, but the experiment's not over, so stay tuned.

Maggy Benson: So, your research is really interesting out in the Channel Islands.

Sabrina Sholts: Yeah.

Maggy Benson: With both, all of these studies, on the early Chumash people and now with the fox studies, you're really understanding the change of environment over time in that location.

Sabrina Sholts: Yeah, yeah. I mean, we're able to use a lot of different technologies and types of evidence to put everything together to get a [00:23:30] bigger picture of what was happening in the environment over time.

Maggy Benson: It sounds like, the big takeaway for me here, is to be cognizant of the environment that I put myself into and be aware of what I'm consuming.

Sabrina Sholts: Yes, yes. Be aware of what you're putting out into it and what's coming back to you.

Maggy Benson: Sabrina, thank you so much for helping us better understand a little bit more about your research and how our bones develop.

Sabrina Sholts: You're welcome. Yeah

Maggy Benson: Let's get to some of these student questions.

Sabrina Sholts: Yeah.

Maggy Benson: We have a bunch.

Sabrina Sholts: Okay. Great.

Maggy Benson: All right. This one comes from Katie. Katie wants to know, how often [00:24:00] physical anthropologists use archaeological evidence.

Sabrina Sholts: Great question, Katie. I would say, all the time. The archaeological record is an irreplaceable, invaluable resource, archive, of our species history. We're always going to it, and looking at it to see how the things that we might be concerned about in modern times actually play out on a broader temporal span.

Maggy Benson: This one comes from the folks watching here, [00:24:30] at the Smithsonian.

Sabrina Sholts: Oh.

Maggy Benson: In the Q?rius Lab.

Sabrina Sholts: Oh, okay. Hey guys.

Maggy Benson: They would like to know that, did their exposure effect their life span?

Sabrina Sholts: Potentially. Yeah, absolutely. That's a great question, everyone. It's hard to give you a number. All I can say is, definitely. There are so many sublethal factors that could contribute to life, and depending on what else was going on, that could have impacted how long someone lived.

Maggy Benson: This question comes in by video, so let's have a look.

Sabrina Sholts: Oh. Okay.

Bianca: Hello, [00:25:00] my name is Bianca. I was wondering, if the tar effecting the Chumash's bones and their skulls, how else did it affect their overall health?

Sabrina Sholts: Okay, that is a great question. So, we know that, depending on how much exposure they were getting through certain compounds, some PAHs are more harmful than others, some are carcinogenic, so they can cause cancer, some can cause anemia. And so, we can also look for those effects that might be consistent [00:25:30] with that sort of response to that exposure.

Maggy Benson: This question comes in from Ethan and Josh, and I think they're looking at the bones on the table here.

Sabrina Sholts: Okay.

Maggy Benson: They want to know why they're different colors.

Sabrina Sholts: That is a great question, Ethan and Josh. They are different colors as a result of how they were preserved. These bones are from people who died at different times and probably went through a long postmortem process to get to a place where they could be studied by scientists today. So we're seeing [00:26:00] differences in the treatment, how much grease was used to preserve them and things like that.

Maggy Benson: Zach asks, can you tell by the bones what environment people lived in?

Sabrina Sholts: Yes. Yes, I mean, sometimes you certainly can. For example, the bones preserve stable isotopes, so these signatures of diet, and also origin. Things coming from the minerals, from the ground water, these sort of chemical composition of the bone [00:26:30] can signal where someone was living and where they came from, and where they moved too.

Maggy Benson: We have another question from Canyon Ridge. Jayden and Asher ask, how long does it take for you to become an anthropologist?

Sabrina Sholts: Oh my goodness, Jayden and Asher, great question. It takes a while, right.

Maggy Benson: But it's worth it.

Sabrina Sholts: It is worth it, you know, I mean if it was easy everyone would do it, but you definitely need to go through a lot of school. Past high school, past college, you need, not necessarily a PhD, [00:27:00] it depends on what you want to do. If you want to be a professor or if you want to work in a lab, there are different ways to do it, but it's, it's a few years. Doesn't feel like it, but, you know, it is.

Maggy Benson: This comes from one of our home school students.

Sabrina Sholts: Okay.

Maggy Benson: They want to know, if you're the kind of scientist that determines how a person died, looking at their bones.

Sabrina Sholts: Yes. Thank you for that question. I think what you mean is, am I a forensic anthropologist. [00:27:30] I mean, I wouldn't say that that's my ... I won't define myself in that way but certainly, any osteologist should be able to look at bones and if there is an indicator of whatever might have caused death at that time. If it's there, you should be able to recognize and at least say something about it.

Maggy Benson: Great questions.

Sabrina Sholts: Yeah, yeah.

Maggy Benson: Thank you so much sending all of them in, unfortunately we are all out of time.

Sabrina Sholts: Oh.

Maggy Benson: Sabrina, it's been so awesome having you here.

Maggy Benson: And learning a little bit more about your work.

Sabrina Sholts: It's been so great to be here and thanks for all your questions [00:28:00] everyone. This has been a blast.

Maggy Benson: Hopefully we'll have you back here another time on, Science How?.

Sabrina Sholts: Oh yeah, absolutely.

Maggy Benson: Can you tell our viewers where they can learn a little bit more about the kind of work you do.

Sabrina Sholts: Yes, I would love too. We've got some great websites and webpages here at the Smithsonian. If you go the Written in Bone webpage you get to see, you know, effects of metals in the colonial population in Jamestown, and World Health Organization, if you're interested in contaminants and health problems around the world - really good, current information. [00:28:30] I would definitely go there.

Maggy Benson: Awesome.

Sabrina Sholts: Okay.

Maggy Benson: Thank you so much.

Sabrina Sholts: You're welcome.

Maggy Benson: If you've missed part of this archive, or part of this show, and want to see it again, it'll be archived later this evening at qrius.si.edu. Thanks for joining us today and we hope to see you next time on, Science How?