

Melaninology with Dr. Tina Lasisi

Ologies Podcast

February 15, 2023

Oh hey, it's the last person who sat on that velour couch and left a butt print, Alie Ward. We're back to talk pigments, and skin, and sun, and soap... So, so, so much.

Okay, so this ologist studied biological anthropology at Cambridge, got a PhD at Penn State, and is currently doing a postdoc in quantitative and computational biology at USC, University of Southern California. And she hosts the PBS Digital Studios series *Why Am I Like This?* which has the best title ever. And starting this fall, in 2023, she's going to have her own lab as an assistant professor of anthropology at the University of Michigan. So, while she was in LA, she came over one afternoon to sit on the couch and chat melaninology, [*emphasizes the 'a'*] melaninology which, yes, I did find examples of this word used in published work to describe the study of biological pigment. The root means 'dark' and we're going to get right into it.

But first, thank you to everyone who supports the show at Patreon.com/Ologies. You can join for a dollar a month, you can send in questions for the episodes. Thank you to everyone wearing *Ologies* merch from OlogiesMerch.com. We have, also, kid-friendly episodes available, they're called *Smologies*, those are linked in the show notes. And thank you to everyone who rates and subscribes and leaves reviews, I read them all, all of them, such as this fresh one from KittyDaKat, who called the show:

Just the gosh dang best. How many different times can a science podcast make me cry? I don't know but Ologies is helping me find out.

That's what I'm here for, let's cry about science a little bit. But mostly, for the most part, we don't cry that much. Also, Master22345 [*gibberish*] a bunch of 7s, who left a review about how the playback kept jumping around in the last episode. Just FYI, that's not the episode that is just y'all's internet connections, so it's just buffering slow. So, if you think the editing is skipping around, just hang on, download the whole thing if you're in spotty Wi-Fi or service, and then it'll be smooth sailing, I promise. We would not put up an episode like that; we love you too much.

Okay, onto the episode. Oh, you're going to love this one. Grab a hat and get ready for dark skin, light skin, in-between skin, ginger locks, beards, sunscreen, UVAs, UVBs, shower habits, cultural colloquialisms, medical math, ochre, freckles and so, so much more with biological anthropologist, who is just a hoot! Oh, you're going to love her. Science communicator, and soon-to-be assistant professor, melaninologist, Dr. Tina Lasisi.

Dr. Lasisi: Hello! My name is Dr. Tina Lasisi, and my pronouns are she/her/hers.

Alie: And Doctor...

Dr. Lasisi: *Dr. Tina Lasisi.*

Aside: So, Dr. Lasisi was the first Black student to graduate with a PhD in anthropology from Penn State University after she presented her PhD defense about a year and a half ago.

Alie: How was your defense?

Dr. Lasisi: My defense was really great actually. It was awesome. And I'm so grateful for that because I hear so many horror stories of basically being grilled and publicly humiliated, but it was just

such a lovely event where I got to tell everyone my story. It was on Zoom; I was actually happy that it was on Zoom because that meant that all of my friends and family from overseas could participate equally to anyone who would have been in person. And I got to tell everyone, you know, “This is the wild ride that I’ve been on for the last six years,” and it was great. Great questions at the end, my committee afterwards was just like, “Yeah, so we’re going to ask you a really difficult question. What are your plans next?” [laughs] Just like, god bless them, they were great, they were great. It was such a beautiful way to end six years of research.

Alie: What was your dissertation?

Dr. Lasisi: My dissertation was on the genetic architecture and evolutionary function of human scalp hair morphology.

Alie: How did you get to the point where you were like, “Okay, I want to study scalp hair morphology,” in all of the things in biological anthropology? Did you go through different... kind of a maze to get to that particular dissertation, or was there a broader area that you really loved?

Dr. Lasisi: Okay, buckle up. I’m going to tell you the whole story.

Alie: I’m buckled.

Dr. Lasisi: Basically, gag is, I wasn’t even planning to go into biological anthropology. So... [small chuckle] Trust me, it’s going to make sense. [laughs] [“You have my full attention.”] But when I was very young, living in the Netherlands, we had the Cambridge English Dictionary and I remember asking my dad, “What’s a Cambridge?” And he brought me there when I was 12. I went, I was like, “Oh my god, it’s like Harry Potter,” and I had decided then and there when I was 12: I need to go to this university, I want to go to Cambridge, I want to have my Harry Potter experience. I didn’t know what I wanted to study there.

And throughout my youth I had known I was always interested in culture. So, I’m Bulgarian-Nigerian, I was born in Bulgaria, lived in Switzerland, grew up mostly in the Netherlands, so basically, so used to being in between cultures that it felt like such a thing for me. I was like, I love learning about different cultures. I was really interested in Japan, but I was like, instead of Japanese studies, what if we did something that allowed us to look at more cultures?

And I was scrolling through the course options, and they had this thing called archaeology and anthropology and I was like, “Huh, what is that?” I read through it and basically, they were like you could study archaeology, cultural anthropology, and biological anthropology. And I was like, “You know, cultural anthropology sounds like fun. I don’t know about the other two but that one sounds good.” So, I went there, to Cambridge, thinking that I was going to be a cultural anthropologist, which made sense because I wasn’t really a science person; I loved, you know, people.

And then I was in this lecture on human biological variation in the first year where they talked about skin color, and I saw this very well-known set of maps that we often show people of the distribution of ultraviolet radiation around the world and the distribution of skin color around the world. And it’s like, “Do you see? Ohh, yeah that makes sense!”

Aside: And for more on this, you can see the 2010 study, “Human Skin Pigmentation as an Adaptation to UV Radiation,” which was published by Dr. Nina G Jablonski.

Dr. Lasisi: So, I saw that and it really blew my mind. I was like, “Wow!” I have always been aware of the fact that people had different skin color, but I never thought about how it was patterned around the world. And so, that made me think, what about other traits? How do those vary and why did

those evolve? And my immediate question as a Black woman was, “Okay, what about my hair?” I understand why my skin is brown, why is my hair curly? And the wild thing is that there wasn’t a good answer!

What should have been a really quick Wikipedia search that satisfied my curiosity became this rabbit hole where I basically had this postdoctoral fellow who was at our college, who took me under his wing and was like, “Hey, let’s talk about bio-anth.” And I was like, I have all these questions, but I can’t find anything about hair, and he basically was like, “Well, sounds like that could be something for your undergraduate thesis.” And as an undergrad I decided, okay, let me get hair samples and measure them. And yeah, long story short, basically this thing that should have been a short Wikipedia search [*Alie laughs*] ended up being a decade-plus journey into understanding this trait and why humans have it.

Alie: Does that mean that when someone goes to Wikipedia in the future, they find your stuff?

Dr. Lasisi: I mean they better cite me. [*both laugh*] But in fairness, step number one is also, let me finish publishing everything. If my advisor is listening to this, I’m sorry, I’m working on the paper.

Alie: You *just* got a PhD. Come on, fresh! [*Dr. Lasisi laughs and groans*] Now, you mentioned this map that was a really big eye-opener for you. Most people haven’t taken those courses and normally I’d be like, okay, I’d go and look at the map, I’d do an aside, and I’d explain it. But since you’re here, [*laughs*] how do you describe that map and what you got from it?

Dr. Lasisi: Yes. So basically, the way that I would describe it is, you look at the map of ultraviolet radiation. So, ultraviolet radiation, it’s why you wear sunscreen. A lot of people are like “Oh, UV radiation, wear sunscreen for that,” so that’s basically what you need to think of. It’s something that can affect your skin and actually your DNA if you’re exposed to it too much.

However, it affects you differently depending on how much melanin you have on your skin. So, you look at this distribution, this world map where closer to the equator you have higher intensity of solar radiation, and further from the equator, in general, the pattern is less UV radiation. The exceptions are if you live in a very high-altitude place; if you’ve ever been hiking and gotten sunburned while you’ve been hiking on a mountain, you know that’s the case, that makes sense. And then there are some places, very far up north in the Arctic, where you can have a little bit more solar radiation. But that’s generally the pattern: closer to the equator, more UV radiation, further away you have less.

And you look at the distribution of skin color around the world and you see the same pattern. You look close to the equator, and you see, okay, people who live in these regions seem to have darker skin than people who live further away from these regions. And what’s pretty significant about that is that we might think of it as, “Oh, well in Africa they have dark skin, in Europe they have light skin.” The pattern is actually more complicated than that because within Africa you see that closer to the equator, populations have darker skin than African populations who are further from the equator. They’re all African populations but they’re all adapted to the UV radiation there. And what’s more is that you have populations across Asia, across the Pacific, the Americas, that are close to the equator who have skin that is as dark as many African populations that are closer to the equator.

So, from the perspective of a discipline that’s very interested in human variation and that has unfortunately contributed to ideas of race and this idea that there are different types of people, this directly challenges that. It tells us that human variation is structured in a way that is much more complex than saying, “There are three types of people; Africans, Europeans, and Asians.” Absolutely not. It’s much more complex than that. And so, for me, that’s really what it gave me.

Aside: Remember that 2010 study I mentioned with this map? So, the author, Dr. Nina Jablonski, also happens to be an anthropologist at Penn State and Dr. Lasisi has now co-authored papers with her. Absolute boss move, a joy to witness. But yes, this anthropological work changed so much for her.

Dr. Lasisi: A lot of us... I mean, I would say most of us, we grow up learning how to categorize people, whether it's by ideas of sex and gender, and ethnicity and race, we are socialized to think "Okay, if you see this, this, and that, you put a person in this box. If you see this, this, and that you put them in that box." And seeing this map or these two sets of maps broke those boxes for me. I was like, "Huh! Okay!" And it made me really think about why. Why does this variation exist? Instead of necessarily, immediately thinking we need to ignore differences because differences are bad, it brought into new light. It said, "Okay, there are differences and how those differences are distributed is really complicated," and it has a really interesting story that tells you something about history, big history, evolutionary history. So that, to me, was just super cool.

Alie: And is anyone studying what's happening since cars, and planes, and boats? Because it's relatively recently that we've gotten around so rapidly, you know? I live in California, the sun beats down on my face all the time, I have not a lot of skin pigment, [Dr. Lasisi laughs] I'm mostly northern Italian and British. What's happening as we move around in climates that we maybe didn't evolve in?

Dr. Lasisi: That's a great question. So, in general, the thing about evolution is, evolution by natural selection, and that's really what we're talking about, when we say you're adapted to a particular environment, the idea is that over multiple generations, individuals have traits that fit the environment better. And by fit the environment better, we mean you thrive more in that environment.

A lot of times, when we ask questions about people having a mismatch between whatever trait and their environment these days, it has to do with the fact that there's been too short of a time for there to be a difference. So, looking at something like skin color for example, a lot of times I get this question of, "Oh well, I have ancestors from this region, and it doesn't match what you say is expected by the map." Or of course, if we think about places like the US where we know that people came there pretty recently, it's not going to fit those expectations because there haven't been enough generations for natural selection to act on it.

And it's not just that there haven't been enough generations, it's that since humans have had culture and have developed all kinds of technologies to stop natural selection from taking out those of us who aren't really a great fit for the environments, [Alie laughs] it's been a thing that has stopped us from being shaped by natural selection as much as we may have been 10,000 years ago, 20,000 years ago, and so on. ["Do you have some sunscreen?"] In general, what I would say you need to focus on and think about is "How can this affect reproduction?" Evolution, at the end of the day, is who has babies and who doesn't.

Alie: Yeah! [big laughter] It does not care how happy you are!

Dr. Lasisi: It doesn't care.

Alie: It doesn't care [still laughing] about anything else.

Dr. Lasisi: Doesn't care how happy you are, doesn't care how healthy you are, even. A lot of people are like, well, if evolution is supposed to make us better adapted, why do things like cancer exist? And why are some people balding? And I'm like, well, tragically, evolution doesn't care about your post-reproductively. That means, have you had babies? Done. That's it. You can die now. [Alie

laughs] It's pretty harsh, it's pretty harsh, but evolution be like, "I don't care about you anymore."

Alie: Literally it's like, "Fuck off and die. In that order." [*laughs*]

Dr. Lasisi: Truly. That is all that matters. And so, what's actually really interesting is when we talk about fitness, and even today with all the culture that we have, there are going to be various factors that affect people's fertility, their fecundity... Don't ask me exactly what the difference is between those two, I think fertility is like how many surviving offspring you end up having versus fecundity is the ability to actually have kids biologically.

Aside: So, this is correct. The fecundity rate worldwide of childbearing peoples is 20 children. That's how many children you can make if you can make 'em. But the actual fertility of birthing people, 2 children, at least in the US. So, it's kind of a can-versus-will situation. But you know, after 6 or 7, they really start raising themselves. Am I right? I don't know.

Dr. Lasisi: But those things, if they are affected by anything, it doesn't matter what else it does to you, that is going to affect how many descendants you have. And at the end of the day, that's all that evolution is really about.

Alie: Augh. And okay, UV, UVA, UVB? Does our skin care or know the difference?

Dr. Lasisi: Basically, UVA is associated with more, like, immediate erythema or redness in the skin, and that immediate sunburn. And there's actually different types of tanning. So, there is the tanning that you have immediately after being exposed to UV radiation and UVA radiation, where you go into the sun and you're a little toasty and it can fade pretty quickly. So, that and the redness can fade quickly. Then you have UVB that's responsible for your more long-term tan. So, if you go to tan over, you know, multiple days, it stimulates your melanocytes to start making more melanin and that is tan that stays for longer.

UVB is also responsible for converting this precursor to vitamin D to its active form. So, in a way, I like to say that humans also photosynthesize, it's just something different that we photosynthesize. And that is one of the reasons, evolutionarily, that it is beneficial to have less pigmentation where there is less UV radiation overall, because as great as it is to be protected from UV radiation, we actually need some of it to make vitamin D. And so, there you go, we have this careful balancing act that occurs, whereby in some places the UV radiation is so strong that it damages your folate, which is another nutrient that's really important for healthy pregnancies. If you don't have a healthy pregnancy, you don't have a healthy baby, you lose in evolution. So, boom. We don't like that.

Aside: So, UV radiation can lower folate levels and lead to issues in fetal development. But not enough sun penetrating your skin and you get low vitamin D, which can happen to more pigmented people who live in cloudy areas. So, if you're feeling sluggish, or tired, losing hair, maybe losing sleep, say, "Hey Doctor, why don't you do me a solid and check my vitamin D before I cry on you?" That's how I'd phrase it.

Dr. Lasisi: But there's a lot of reasons why you need enough vitamin D as well that affect your health. So, that's the other thing that you have to play around with, and that's why we see this really impressive close fit around the world with the skin color that people have when their ancestors have stayed in the place long enough. It's like, wow, it's like you're optimized for this; you're protected enough but also letting through just enough radiation so you can make enough vitamin D.

Alie: And so, without that vitamin D these days, if you're not going out into the sun, or maybe you're working the nightshift and you live in a basement, what happens if you're not getting vitamin D from the sun?

Dr. Lasisi: So, a lot of things happen and we're actually still actively learning what the consequences are. And what's really funny, and funny not ha-ha but funny-tragic, is that there are plenty of people who are honestly, almost translucent, who are vitamin D deficient. [*Alie groans*] Look, even if you have no melanin, you can *not* be getting enough sunlight, that is possible.

So, there's effects on mental health, there's effects on the immune system, there's all kinds of things and they're still learning. They're associating vitamin D with so many different things, I think some people were also making some associations with how people were able to fight off COVID infections like, as a more recent example.

Aside: So, one November 2022 study titled, "Association between vitamin D supplementation and COVID-19 infection and mortality" notes that half of the US population is vitamin D deficient. And that vitamin D deficiency is associated with a crappy immune system and more infections, and that folks with lower vitamin D levels experience higher rates of COVID-19. So, in this study, military veterans with low baseline vitamin D showed the largest decrease in COVID-19 infection after they got supplements. And Black veterans had even greater COVID-19 risk reductions with supplementation than white patients. So, vitamin D, if you have darker skin, or if you live at high latitude during the winter, if you're a nursing home resident, if you're a healthcare worker, or a nocturnal goblin, maybe you're scrolling TikTok until dawn, you might want to look into it with a doctor who is not a podcast host.

Dr. Lasisi: But it is intimately involved in a lot of physiological processes, it seems.

Alie: Now, getting to melanin.

Dr. Lasisi: [*hushed raspy voice*] Yes.

Alie: [*matches tone*] Exciting.

Dr. Lasisi: Very.

Alie: Melanocytes. Are there different types of skin pigment? Is it all melanin? Are there different types of melanin? Are there different shades of it? Or is it just a quantity thing? My ears are open.

Dr. Lasisi: Wheuf! Okay, so melanin is super complex and super awesome. So, melanin isn't actually one distinct coherent thing, it's melanins, plural. It's like a class of chemical structures that have certain similarities and one of the main distinctions that we can make is eumelanin versus pheomelanin. If we're looking at humans, those are two kinds of melanin that we have in our body.

So, eumelanin is a type of brown-black pigment that is what's responsible for the range of variation from light to very dark colored skin and light blonde hair to dark, pitch-black hair, and eye color, and all that good stuff. There's also pheomelanin. Pheomelanin is like this orange-yellow-reddish variant of melanin that is most obvious in redheads like, that is a different kind of melanin that has this different color.

And so, there are a lot of differences in the two kinds of melanins, but even for both of them, we don't know the definitive chemical structure of melanin. That is a thing that always surprises me, it's a polymer that we don't really understand. So, it has like a bunch of units that are

repeating in a way that people haven't— we don't know what the final form is, it hasn't even reached its final form yet. [*"I'm still evolving."*] And it's the same with pheomelanin.

And so, that to me is something that's always impressed me. It's so complex that we don't really even know its structure and it's inconsistent. So, there could actually be a lot of subvariants of melanin but in addition to melanin itself, we need to think about how it's packaged. So, melanin is made by melanocytes and it's usually in these little vesicles called melanosomes. So, in these melanosomes, you have a bunch of chemical processes that occur that create melanin. So, you start with various precursors that go through this huge number of processes where you end up with either eumelanin or pheomelanin. And depending on the pH in the melanosomes, you get a different balance of eumelanin to pheomelanin. So, this is something that we've learned, it's that all these melanocytes, they make both eumelanin and pheomelanin. So, it's something they call mixed melanogenesis.

And in certain cases, like if you have a certain variant of some genes like MC1R, it's a very important gene for pigmentation in general, if you have certain variants, it switches something whereby your final product is way more pheomelanin than eumelanin, and that's why some people have red hair. But in other cases, it can completely shut things down and that's where we have certain kinds of albinism, and you can also have a lot of it, where you can have just a lot of eumelanin at the end. So, that is something that I think is pretty magical. [*"Complicated, messy, and quite wonderful."*]

Alie: Okay, so it's not just a matter of amount but it's also different variations. What happens with freckles?

Dr. Lasisi: [*mutters quickly*] Oh, what happens with freckles, that's a great question. So, with freckles, basically what you have is a combination of uneven distribution of melanin with more pheomelanin. So, in general, our skin color is mostly a question of eumelanin, but people with red hair often have freckles as well so it seems that some variants of MC1R, is mostly what we think of, also affect your skin in a way where you can have basically this patchy structure of what we end up calling freckles.

Aside: So, you can call freckles 'ephelides' if you're a doctor, or if you're trying to impress one. And that word comes from a Greek term meaning 'rough spot which studs the face,' and I think maybe the ancient Greeks were a little jealous of how hot people with freckles are. I don't have freckles, but I have blackheads, and no one tries to fake those with henna and a tiny paint brush.

Oh, and if you have real freckles, those are caused not by more melanocytes in those areas but just an increased production of the actual melanin granules or the melanosomes in response to UV radiation. And once again, there are a few types. So, UVA radiation makes up 95% of all the UV rays that hit Earth. And UVA, that shit can pass right through glass, it hits deep within the skin. And that is what they blast you with in tanning beds and it makes you tan but also wrinkly, and saggy, and when combined with UVB rays, potentially full of cancer.

So, the UVB rays, they're higher energy but they don't penetrate the skin as deeply, but they can damage the DNA of your skin, they can lead to melanoma and other flavors of skin cancer. UVB could also cause cataracts. The best way to avoid UVB rays is to just hide under the porch from 10 AM to 2 PM when they are the highest. Or you could also wear a hat.

Dr. Lasisi: But I do know that pheomelanin does a lot of things that are surprising. So, one of the things about pheomelanin is that it doesn't respond to light in the same protective way as eumelanin. So, eumelanin is photoprotective which means that it's really good at taking that radiation and making sure that it doesn't damage your DNA and... basically, it's holding it down.

Aside: So, eumelanin comes in brown and black forms and it's there dissipating up to 99% of the UVA and UVB radiation that you do absorb. So, thank you eumelanin. Now, pheomelanin, which tends to be yellow and reddish, well...

Dr. Lasisi: Pheomelanin, on the other hand, is phototoxic. So what's really interesting is that they found that people with red hair who have a higher proportion of pheomelanin seem to be more prone to skin cancer in a way that doesn't just relate to, you have less pigmentation.

And another interesting fact is, we don't just have melanin in our eyes, skin, hair, these visible places, we also have neuromelanin. And I actually went down a rabbit hole because I'm like... I don't even study neuromelanin like that. Neuromelanin is made from eumelanin *and* pheomelanin. It goes through this process, you already have these precursors, and you make this final form of neuromelanin, and one of the things that they found is that neuromelanin is involved in a number of different things, but I started reading up about it in the context of Parkinson's. And I remember reading that people with red hair are more prone to having Parkinson's or have higher rates of Parkinson's, something like that, which is something that might have to do with the relative proportion of eumelanin to pheomelanin that they have and the neuromelanin's ability to clean up whatever it's supposed to be cleaning up in the brain. So, it's just super interesting that melanin does so many things and that's just in humans.

And I'm trying to stay in my lane, but I'd be remiss to not mention that you have melanin in all kinds of organisms, fungi as well. That's a thing that got me, I was like, [*squeals*] "What?! Fungi have melanin?!" Fungi have melanin. [*Alie sounds shocked*] You can extract melanin from plants and fungi, and especially fungi are a really efficient way of getting more of them. And I remember reading about certain kinds of fungi that are in particularly hot environments that have more melanin, it seems to be doing something to protect them from some thermal radiation. And in some cases, some fungi are thought to have evolved this melanin to actually absorb more solar radiation to heat up more quickly because they're in very cold environments.

So, melanin is this beautiful, multifunctional thing. And if you think about it, from an evolutionary perspective, even though there are different forms of melanin, this structure is so old that we share it with the last common ancestor that we have with... *fungi!* That's absolutely wild.

Alie: That's nuts! That's nuts! That actually makes me wonder if you're closer to the equator and you have more skin pigment and your hair is darker, let's say, do you get hotter?

Dr. Lasisi: This is like a fascinating question to me.

Alie: And I also ask this as a transparent goth girl that has no skin pigment but wore all black all the time...

Dr. Lasisi: Boom.

Alie: ... and was *sweating*. But still, yes.

Dr. Lasisi: It's so funny. As somebody who grew up as a little teenage goth in the Netherlands, heat was not so much an issue, but I really respect your dedication to gothdom in California.

Alie: [*through laughter*] So hot.

Dr. Lasisi: That's real. So, this is really interesting to me. I love history and philosophy of science. One of the most fun things to me about science is the fact that it is done by scientists and scientists are subject to their own biases. And when you think about skin color these days, I would say that, in general, nobody questions that it is useful in a very high solar radiation environment to have

darker skin. We're like, "Yeah, they seem to be doing good. I think that they've got the right trait for the job."

However, back in the '50s even, which is pretty recent, you can find articles where people are saying that it does not make sense that people have darker skin in places with more solar radiation because darker objects heat up faster in the sun so there's no way that it's useful. They're like, "There's no proven reason that it's useful *at all*, it's probably very maladaptive." And it's super funny because I like to think of those people as like, published in some British journal I'm like, "You know that the second you went out to colonial whatever, you were walking around looking like a lobster, but you said, 'Nah, those people seem like they're struggling.'" That's fascinating to me. [*Alie squirms*]

So, this is a great question. Do we have the same issue with black materials as we do with darker skin? And it doesn't seem to be the case, in part because the effect that it has doesn't seem to be distinct enough, it doesn't seem to be that you get that much more solar radiation on darker skin as you do on lighter skin because lighter skin is not able to reflect as much and that's probably because the radiation touches the surface of your skin, so you're already in trouble. You can't necessarily reflect enough of it back for it not to affect you. That's different than necessarily wearing those colors.

One of the things that people remarked is that various tribes that lived in the desert would wear very dark clothing and there were also very dark-haired goats in the Sahara. What it seems to be is that absorbing that radiation can be a good thing if it never reaches your skin. But in general, as far as people go, it does not seem that if you are darker-skinned, you significantly heat up more than lighter-skinned individuals.

Alie: And where in the dermis, that's a scientific term for skin, [*Dr. Lasisi laughs*] (I don't know what I'm talking about) but where in the dermis or epidermis or quasi-dermis is our pigment?

Dr. Lasisi: Great question. So, it's in the epidermis. And so, the melanocytes live at the bottom, at the base of the epidermis and the way that they work is they have these tentacles, these dendrites, that stick out into the epidermis and can deposit these melanosomes, so those little vesicles of melanin, those little melanin-creating sacks, into keratinocytes, so the keratin cells that are actually your skin. And in those keratin cells, as you are making more of them, basically you end up pushing more up. So, you make them at the base and then you slough off what's at the top and you have newer and newer ones. That's kind of how exfoliation works; you take the top layer off and then there's new cells underneath.

Now, whether those melanosomes stay intact doesn't seem to be clear. In some cases, I've seen people say that it basically is like melanin granules and dust that's spread out. In some cases, it may stay more directly in a melanosome. But that's kind of where it lives, at the very surface of your skin, basically.

Aside: So, your skin has the epidermis, that's the top layer, and then the dermis underneath that. And the dermis is kind of the hangout center for your hair roots, and your sweat glands, and other gooey things like that. But right before your surface epidermis turns into that deeper dermis, right at that border, there are those cells called the melanocytes and they look kind of like an upside-down octopus with a bulbous end and kind of arm thingies reaching toward the surface of your skin. And in these melanocyte octopus-looking cells are organelles and they're called melanosomes, and they make the melanin granules, and then they shoot them out of the ends of the arm things into your keratinocytes, just call them skin cells. And this whole shebang,

it deserves a fancy word, and you know what? It has one: melanogenesis. Look at your arm, look at your arm. All that drama just unfolding in it every day.

Alie: And what about in your hair?

Dr. Lasisi: In your hair, so that's interesting. It gets deposited in your hair shaft in a similar way. We don't necessarily know exactly how that transfer of melanosomes happens in the hair, there's like some different ideas about options of how the melanosomes get transferred. But once it's there, it's in the keratin cells in your hair, which are different than the keratin cells in your skin. But the distribution of those melanosomes seems to be a little bit complicated because an individual's hair shaft can be very different. You have individuals who have very thick hair shafts, you have individuals with very thin hair shafts, you can have a medulla in the middle of your hair, so like a hole, or it might entirely be solid. And so, if you look at microscope images of cross sections of hair, thin slices of hair shaft, you can see that there's differences in distribution. Some hairs have melanosomes that are just like clumpy distributions, others are a little bit more evenly distributed across the hair. There's just a lot of variation and all of that variation influences how dark it looks.

So, one of the things I did, in my undergrad actually, was I worked with these really cool melanin chemists in Japan who had developed a way of chemically measuring the amount of eumelanin and pheomelanin that existed in the hair, which is really... It's just so cool. So, they took all kinds of hair samples that I had and measured exactly how much eumelanin and pheomelanin was in them.

And one of the surprising things that I found was something that went against my expectations looking at African and African-descendant individuals and their hair and different people of Asian ancestry and my hair. So, I had expected... Well, the Asian hairs that I've seen, whether they were south Asian or east Asian, they're black; they're jet black. That's a thing that a lot of us are familiar with is, like, jet black hair, Asian hair, you know that that's a thing, and it's awesome. So, naturally you would think, there must be more melanin in that than maybe some of these African hairs or people who are from the African diaspora because you hold them up to the light and you kind of see through it, it's kind of brown.

However, I found that that wasn't necessarily the case. Most east Asian hairs, most Asian hairs in general had less melanin. So that makes you think about, what makes something look dark? If you have a thicker hair shaft, you're going to have more trouble passing light through it so you might need less melanin to make it look completely black [*Alie sighs in awe*] as opposed to if you have a little bit of a flat hair shaft and it's a thin hair, it's like thin paper, doesn't matter how dark the paper is, you can pass more light through it.

Aside: And again, this was Dr. Lasisi's *undergrad* work, it was published in her 2016 *American Journal of Physical Anthropology* paper, "Quantifying variation in human scalp hair fiber shape and pigmentation."

Dr. Lasisi: And there was a correlation with skin color, so that was also something that was a little bit surprising. Within individuals who had dark hair, it seemed that individuals who had darker skin also seemed to produce more melanin everywhere. So, in my sample, I'll never forget, the individual that had the most melanin in their hair was a south Asian person that also had the darkest skin in my hair sample. And that was such a cool example of pleiotropy and the way that... So, that has to do with genes that affect multiple traits. So, you can have something like genes that affect melanin in some places in your body and then you can have genes that affect the entire production of melanin throughout your body. And one of the things you can think

about is, like, blue eyes, a lot of individuals have lighter eyes but could also have darker hair; it doesn't necessarily have to go together. So, there's a mechanism that we have by which we can tinker with some aspects of our physical traits without tinkering with others.

Yet, a lot of times, what's really interesting is figuring out how some traits might be connected with each other because you have the same genome in every cell in your body, pretty much, other than your gametes. So, it's always a question of how are we using that genome to make different things? Are we using it in different ways? Are we using it in similar ways? Are there different pathways? All kinds of stuff.

Aside: So, all those locks of hair that you've been saving in a shoe box under your sink, you can science those.

Alie: Getting back to those samples, were you able to tell that person like, "Congratulations, I have 3,400 samples and yours is special." Are you getting those from salons? Are you getting them from people who volunteer a hair or two?

Dr. Lasisi: Exactly. It's really that. Okay, so it's so funny because... *[voice quiets]* I've literally been doing this for, like, 10 years, I can't believe I can say I've been doing anything for 10 years. *[Alie laughs]* *[whispers]* A third of my life. *[laughs]* I think about that a lot.

So, I'm talking about research that I did when I was in undergrad. So, when I was a cute little undergrad that was like, "I want to do a science," I basically said, "I want to learn about pigmentation in hair, and I want to learn about hair morphology, so I need to get hair samples from people." As a wee baby undergrad, I did not have resources, infrastructure, or money, but I had a lot of pizzazz *[both laugh]* and I had a lot of energy. So, what I did is I started with people that were around me and I was like, "Hey, I'm doing this study, can you give me your hair for this study? And I'm also going to measure your skin color." And surprisingly, a lot of people did. Were some of them my friends? Yes. But it's all good, I had ethical approval to do the study.

But then I also went to salons. It was especially important to me to get representation of people from African origin and people who were Afro-descendants. So, at the time I was living in Cambridge in England, which isn't the most diverse place on Earth.

Alie: Not from what I've heard. Shocking.

Dr. Lasisi: But London was very close by. So, I went to London, and I explained to people, "Hey, this is what my research is about." I went to some barber shops, and I was like, "Hey, you're already getting your haircut, this is what my research is about, can I have some of your hair?" And at the end, I had a little bit under 100 hairs, and I did all my little analyses. At some point I did know who was who, especially people who were my friends. I'm like, "This is their hair." And for one of my friends, I was like, "Girl, you have the literally, quantitatively the straightest hair in my entire sample. Congratulations."

Alie: *[laughs]* That's exciting.

Dr. Lasisi: So, to that person I was like, "Yes."

Alie: To be a superlative at anything is exciting, you know what I mean?

Dr. Lasisi: You have achieved something in my sample. But when I went to Penn State, which is where I did my PhD, I was working with hair samples that were drawn from a larger study of, like, more than 4,000 people, where not only did I not know who those individuals were, I'm not supposed to know. Privacy: very, very important thing. And so, I wasn't able to report back anything like that, unless they were part of a later edition to the study that I did, which was about red hair.

So, I did my master's paper, during grad school, on red hair. [Alie gasps] And we basically got permission to recontact all the redheads, all the people who reported they had red hair, and I was like, "Can I get some more hair please?" And then I measured, I worked together with those Japanese scientists that I had worked with as an undergrad, Ito and Wakamatsu, and they reanalyzed those new hair samples for me, and I also took photos under the microscope of those individuals' hair. And so, as part of that study, basically one of the incentives was, "Hey, please give me your hair and I will tell you about your hair."

So, that's something I really enjoy. And as I'm thinking about future research that I'm doing and when I'm going to be working with people again, that is the kind of information I want to share back because I think it's so cool to be able to learn about yourself, and one of the things I want to offer people is, okay, if we're going to take your hair sample, analyze it, I want to give you a result where you can see, relative to other people, where your hair falls. It tells you a little bit of something about, like, hey compared to the rest of humanity, what are you like?

Alie: Yeah. And as a fake redhead, is there a shade on the market that's closest to real redheads? Mine is always a little too purple.

Dr. Lasisi: Interesting.

Alie: And if you leave it on a little too long, it gets more purple. It depends, sometimes it works out, sometimes it doesn't. Is there a shade? Well, answer that. And then also, maybe this is kind of around the same thing, but when you are having to quantify people's different skin tones, is there like a Pantone wheel that you whip out?

Dr. Lasisi: Oh, I love answering this question so I will tell you, how do we measure people's skin color? First, I have no idea because I have not done any market research on the colors that exist out there. It would... There's two reasons why that question is difficult to answer. The main reason is, there are so many different shades of red hair, because from that research that I did for my master's, you could have red hair in all kinds of ways. You could have red hair where you had a lot of pheomelanin and a lot of eumelanin and so it was very dark and very red. There were some people who had not so much eumelanin but *a lot* of pheomelanin, so it was much more orange looking. So, there are so many different shades of red hair that it would be difficult, just on that basis alone, to be like, "This shade is the most realistic."

That said, there are going to be more plausible colors of red and things where you're like... unless you're some alien life form that has developed a new shade of melanin that is purple, this seems unlikely. But I could not give any good advice. However, that said, it would be a fun study to do and be like, "Okay, who is the real redhead here?"

Alie: Yes! Augh.

Dr. Lasisi: Fun game. [laughs]

Alie: I mean, I literally have googled a picture of a baby orangutan to be like, "This shade, right here."

Dr. Lasisi: That's hilarious. I would like that, please. Orangutans are great. Orangutans manage to be a fun color.

Alie: Do orangutans... do they have pheomelanin?

Dr. Lasisi: It is pheomelanin that makes their hair orange because we know that that is the only pathway we have in mammals, I want to say, to get that red color. I say in mammals because birds can have red feathers and what makes red feathers is actually not pheomelanin, a lot of times it's a type of keratin.

Aside: For more on feathers, yes, we have a whole Plumology episode which I will link in the show notes, you are welcome.

Alie: And then their blue is an absence of pigment sometimes, right?

Dr. Lasisi: Yes, it's a structural color, just like our eyes. This is another fun thing I like to whip out at parties. I'm so much fun at parties, invite me, y'all. [*Alie laughs*] I'm like, did you know that there's no blue pigment in blue eyes? It's a structural color. So, if you align collagen in a particular orientation, the way that the light hits it makes it look blue. Just like there's no blue pigment in the sky, but it's... Is it the Tyndall or Rayleigh scattering? One of the two scatterings.

Alie: I think it's Rayleigh but I'm not sure.

Dr. Lasisi: Yes, or is it Ray-lee? It's Rayleigh scattering in the sky and the Tyndall scattering in the eyes. Now, the difference between those two has to do with the size of the particles reflecting the light... Ask a physicist. [*both laugh*]

Aside: So, of course Dr. Lasisi was right, and as we covered in the Ophthalmology episode on eyeballs, the physics of the blue sky is called Rayleigh scattering and that has something to do with the size of the particulates. But in the eye, in the iris it's called the Tyndall effect. So, in blue-eyed peepers, that lack of pigment lets the shorter wavelengths in blue light scatter and reflect back, like little freaky translucent bounce boards. It's boggling perhaps, but not as boggling as the cultural discussion ignited by a 2016 episode of the FX drama, *You're the Worst*.

[clip from You're the Worst:]

Jimmy: You don't wash your legs?

Gretchen: No way. What am I, a sucker?

Jimmy: You take showers, and you don't wash your legs?

Gretchen: What am I going to do, bend down and wash my legs? Who has the time?

Which continued to cause some really heated debates on Twitter in May of 2019 before Twitter became a place to exchange emergency pandemic information, and then before everyone scattered to Mastodon and Twitter became like an abandoned mall.

Alie: I don't know if anyone asked about this, but as I'm pulling this up, you know the Twitter discussion about how white people don't exfoliate enough, and they don't wash their legs? Are you familiar with this?

Dr. Lasisi: Yes. Yes, I am familiar. [*Alie laughs*]

Alie: Which, by the way, washcloth all the way.

Dr. Lasisi: Yes washcloths, we love washcloths.

Alie: Love 'em. But is there something about not having a lot of skin pigment where you don't realize how much you've... How ashy you are? And I'm wondering if there's some sort of biological, anthropological reason why so many white people are like, "I have to wash my legs?"

Dr. Lasisi: So, two things. 1) At some point we should circle back to me answering how you measure skin color because I never answered that.

Alie: Oh my gosh, yes thank you.

Dr. Lasisi: And to answer that question. So basically, put another way, is ashiness just not visible on lightly pigmented individuals? That could be a significant factor. So, imagine you have, like, dryness

and when our skin flakes off and dries, it's these thin layers that end up reflecting more light, and so they look lighter than the rest of your skin, especially if you have darker skin. So, that ashiness is then probably more evident. I'm not saying this definitively because I don't know if anyone has ever studied this, like, can you just not see that lightly pigmented individuals are very ashy? I think that it's mostly a question of culture and like, you know, whether something is important or not important.

However, the interesting thing about, like, human variation is we think about, you know, light and dark but we also talk about white people. There are lightly pigmented individuals who are not white Europeans, right? And darkly pigmented individuals who are not Black or of African descent. And so, the question would be, are there any other variables that influence how your skin retains moisture that are differently distributed around the world? Because it could also be that maybe there are some aspects unrelated to pigmentation at all, where people of African ancestry actually have skin that loses moisture more quickly and therefore moisturizing is more important.

Now, when it comes to exfoliating, there is just like, so many, exfoliating, and washing, and bidets. I really wouldn't want to rob anyone of the opportunity of going through Twitter and just experiencing firsthand [*Alie laughs*] the observations and discussions that exist there, but I can tell you that from the perspective of anthropology, there is not a body of literature that covers that.

Alie: Perhaps in the future.

Dr. Lasisi: Perhaps in the future.

Alie: We shall see.

Aside: But for now, we have really great articles and op-eds on the matter like the 2019 piece written by Nicole Hernandez Froio who noted that:

Not washing your legs, or not taking a shower every day is not class rebellion, but a display of which bodies are allowed to be unwashed without stigma attached... Being understood as dirty or clean can be the line between violence and survival for minorities.

And in a March 2021 Vogue article titled, "More Than Just Dry Skin: The Cultural Significance of Ashiness," Black journalist and editor Andrea Plaid writes:

Ashiness at its core, colloquially means dry skin — which, along with having red blood, is a trait much of humanity shares at some point in our lives. On skin tones that are darker than a phenotypically pale-skinned white person, the higher contrast of the grayish-white patches and the surrounding areas makes the condition more visible.

However, in that alchemy of Black social struggle, Black personal grooming, and Black linguistic cool, it has metastasized from the dermatological to the cultural and political. Ashy signifies not only a dry epidermis but also a careless lack of self-upkeep and communal neglect...

The battle against ashiness also reflects Black people ingenuity under white supremacy's withering dehumanization.

Alie: And you did mention, as a biological anthropologist, when it comes to even 10 or 15 years ago, I feel like in America someone would say, "This African American man," and we don't say that anymore because it's not always representative of what their heritage is. But when it comes to someone who studies pigment and the difference between the way that people use labels in

ways that are helpful and not helpful, do you see a direction that that's going that's just more respectful of people's backgrounds but also not so categorical?

Dr. Lasisi: I think about this so much. I would say that, like, most of the time what I think about is how we conceptualize, and measure, and discuss human variation, what is the most appropriate way to do it. So, the example that you gave, let's go from there and unpack it.

So, I have had people refer to me as African American because they do not want to say Black, so to say African American is the PC way to say that somebody is Black. And historically, in some cases, people have claimed that so I'm like, I understand that. However, by a lot of definitions, what people mean when they say African American is someone whose ancestors have been in the US for a number of generations and are descended of people who were enslaved. I'm not even a first generation because I just came like what, how many... like 8 years ago, 7 years ago to the US, so I'm not part of that population. So, there's a lot of reasons why that's an issue beyond just thinking about respect.

If you're thinking about scientific studies that we want to do, especially medical studies where we think, hey, this group of people who have a lot of shared ancestors might have a lot of shared genetic variation that's associated with some condition or some trait, you don't want to assume that someone who does not share any ancestors with them at all just because they look similar is in the same group. You don't want to include those people in the same category. So, for example, I experienced that a lot in medical settings where there is a so-called "African American correction." So, kidney...

Alie: Yes, GRFE...?

Aside: So, this is eGFR, or estimated glomerular filtration rate, and we covered in the Nephrology episode that eGFR is the measure of how well your kidneys clean pee and water out of your blood. We also talked about how there's something called a race-based coefficient and that's based on the assumption that Black patients have higher muscle mass. What does this mean for Black patients? Means delays in seeing specialists, less access to kidney transplants, and of course, worse health outcomes.

So, after petitions were started by med students, Mount Sinai announced in 2020 that they switched to the more accurate chronic kidney disease epidemiology collaboration equation to calculate that eGFR, and they eliminated the race-based coefficient. And if you're not Black, you may not have even been aware this existed.

Dr. Lasisi: There's a lot of... There's a number of different metrics in bloodwork where I've seen that and I'm like, "Huh, they gave me an African American correction," which is confusing for a lot of reasons. And also, because I have one European parent and one African parent so I'm like, what's the logic behind that? What do you assume is the reason you need to make that correction? So, this is just a question of labels and the fact that African American confounds a lot of different things.

But in general, what you also want to think about is what you are describing. I have seen people avoid talking about race by talking about skin color instead. They're like, "Oh, people with darker skin." And I'm like, "Do you mean people with darker skin, or do you mean Black people?" Because there are Black people who have very light skin and might, for example, have issues with... let's say facial recognition. That's a huge thing these days. There's a lot of facial recognition, literally our phones, ([nasal voice] me and my iPhone that can't recognize my face half the time) require training data sets that represent a range of human variation. And when we're making those data sets, it's important that we are cognizant of different traits that vary in

people and that we make sure that those traits are represented so that a system is trained to distinguish individuals that are variable on all of those axes.

Now, if you say, okay, we need to make sure we have a lot of people who have dark skin in there, there's going to be other facial variables that aren't taken into account for that. So, you could have a whole group of dark-skinned individuals and not a single person of African ancestry. You could have everyone be south Asian, you could have everybody be Native American from the Amazon and have very dark skin, no African ancestry necessarily. And on the other hand, you could have individuals who are pretty light-skinned, have African ancestry and have features that are shared with other people who have African ancestry, that doesn't have anything to do with skin color.

So, one of the things that I found is there's this hesitancy to talk about human variation. In general, my entire platform is: human variation is not a bad thing. That is what I want to educate people about, and as a professor, that's what I'm going to be lecturing about. I want to empower people to think about human differences as a neutral and maybe even positive fascinating thing instead of necessarily thinking, "we need to say that all humans are the same because if we say that there are differences that's necessarily going to lead to bad things."

Aside: However...

Dr. Lasisi: Bad things only happen when you rank differences, when you say, some types of people are better than other types of people, which is not even a scientifically valid question. That's a subjective, qualitative opinion, theoretically that you could argue in a philosophical context, but not in a scientific context. So, one of the things that we need to think about is how we talk about that variation, how do we want to think about these things?

There's a lot of different ways and one of the more common ways to refer to these differences these days is ancestry, this concept of ancestry. Now, the difference between ancestry, and race, and ethnicity can be complicated, but in general, if I wanted to quickly define it, what I would say is, ancestry can be a useful way of thinking about things if you're thinking specifically about ancestors. Do you have more shared ancestors? Do you have fewer shared ancestors? And one way of thinking about that is, you know, talking about different geographical regions, but you have to be careful about that. You could have people who have African ancestry and are very distantly related because their African ancestors could be from different parts of Africa, haven't had a shared ancestor for a very long time. They could be more genetically different from each other than somebody from western Europe and somebody from central Asia.

So, we have to think about ancestry in this dynamic way that is continuous. We don't have different subspecies of humans; we don't have different types of humans because humans are a relatively new species that has exploded all over the world and has interacted and intermingled in all kinds of ways. And let's not even bring in Neanderthals. I'm not going to bring in Neanderthals. I'm tempted to bring in Neanderthals. [*Alie laughs*] They're on my mind, they're always on my mind.

Aside: Just a quick side note, we didn't even know Neanderthals, AKA *Homo neanderthalensis*, existed until the mid-1800s! But just to give it a little bit of context, humans discovered dinosaurs in 1824. No one knew there were dinosaurs, before the early 1800s. What?! So, of course, we didn't know that there was another species of humanoid that was our western Asia roommate for 40,000 years.

So sure, yes, we boned 55,000 years ago, but species lines, they're kind of blurry and that's why I'm married to a man with a prominent brow ridge who loves equipment of all kinds and can

boast to having more Neanderthal DNA than 95% of other 23andMe customers. But enough about our pasts.

Alie: And I mean, do you think this is something, when it comes to what you'll be studying and lecturing on in the future, how do you decide which direction to go when there's so much that has yet to be explored and really looked at and written on? So many Wikipedia entries that don't exist yet!

Dr. Lasisi: Bro, I don't even know what I'm doing next week. [*Alie laughs*] I struggle to prioritize what I need to do in the day. So like, that's a great question. I wish I had an answer for me, honestly. I wish I had an answer for myself.

But in general, the directions I want to go in research-wise is to continue to answer questions about hair. So that was, like, my first love, and I want to continue because I still don't have the answers that I want about what is the genetic basis of hair morphology? And with that I want to answer, like, why do we have differences in scalp hair around the world? How did those evolve? Was natural selection involved? Was it just random chance? And I want to go even further back and answer the question of, why do humans have scalp hair with naked bodies? Weirdos.

Alie: [*laughs*] It's a great question.

Dr. Lasisi: Freaks. I love it. But I want to understand it. Why? [*quiet yell*] What was the reason?! What was the reason?

Alie: And also soap dispensers that work with people who aren't white!

Dr. Lasisi: Yup, exactly.

Alie: Have you seen those videos?

Dr. Lasisi: I have seen those videos. Yep. Yeahhh.

Alie: How does that happen?

Dr. Lasisi: Actually, that circles us really nicely back to how do you measure skin color?

Alie: Oh right! [*laughs*]

Dr. Lasisi: So, why do soap dispensers not work and what does that have to do with how you measure skin color? So, a way of measuring skin color that we use is using this device called a reflective spectrophotometer. [*"Come again?"*] [*repeated with echo: "reflective spectrophotometer"*] So, what those devices do, there's different kinds but the ones I use, it shines light on your skin and then measures what is reflected back, and color is really about what areas of the visible light spectrum are being reflected, versus which ones are being absorbed, and how much light is being reflected versus how much is being absorbed. And there are different parts of the visible light spectrum that can tell you different things about color components, including melanin.

So, there's this thing that we can calculate called melanin index from that information. So, melanin index is a metric of how melanated your skin is, relatively. And it goes from, like, the lowest numbers I've seen is like 20-something to over 120. And that is a way of objectively measuring skin color. We don't have to do Pantone matching and all that kind of stuff.

Now, what's interesting is that also has to do with why these soap dispensers don't necessarily work because they also use light. I'm pretty sure... I think they use red light. We have similar issues with pulse oximeters where they're not able to measure oxygen content accurately in people with darker skin because they are calibrated to assume that "okay, if this is the information you're getting back, this is the light that's being absorbed or reflected, this is what

that means.” But when you’re doing something that affects light reflection and absorption, you need to correct for various things, like melanin, that absorb light.

And that is what’s really not being done in a lot of those settings because sometimes people assume, “Oh, if it works in these individuals, it must work for everyone.” And again, that is when I get on my little soapbox and I’m like, it’s important to teach people about human variation because there are things like this where, surprise! Human variation is actually going to influence whether this works for everyone. It is not just a basic principle of, it works or it doesn’t. It’s who does it work for and what different features in humans might affect how this works?

Alie: Mm-hm. And when you’re using the machine that gives you a number, 20 between 120, [*repeat of Dr. Lasisi echoed: “Reflective spectrophotometer”*] do you have to do that on, like, their untanned butt? [*Dr. Lasisi laughs*] Where do you do that?!

Dr. Lasisi: So, I’ve had discussions with one of my former advisors about that, and yes, somewhere where the light never touches would be ideal [*Alie laughs*] in some ways. We found a nice compromise using the inner part of your arm. So yeah, the inside part of your upper arm is relatively a place that receives less, what would you call it, less radiation and is less likely to be tanned.

However, sometimes we actually want to measure that, so I have data from some studies where we measure people’s foreheads and that in order to ask a question of, how tan is that individual? How much melanin could they make under the solar radiation that they’ve been exposed to? So, there’s that. And actually, one of my advisors has done a study where, basically, they measured, I want to say, the top part of people’s butts, [*Alie laughs*] you know, how light or how melanated it was, but also how red it was. And then they basically exposed them to a little bit of radiation there and, I don’t know, gave them sunburns on their butt [*Alie gasps then giggles*] and were like, “How sunburned did you get and how long did it take for that sunburn to go away?” Which, just like... There are really fun science experiments out there that people have done.

Alie: You’re like, “I’m helping some researchers... I’m showing them my buttcheeks.”

Dr. Lasisi: I’m helping science. They sunburn my butt.

Alie: Can I ask you questions from listeners?

Dr. Lasisi: Oh absolutely!

Alie: We have so many. We’ll go through as many as we can. We’re going to lightning round. You ready for this?

Dr. Lasisi: Yes.

Aside: But before we dive in, let’s toss some money toward the cause of her choosing, which is The Fieldwork Initiative, which seeks to maintain a network for victims who have struggled with gendered violence while conducting research. And it also promotes pre-fieldwork training seminars that shed light on the realities of trauma and racism and gendered violence in fieldwork. So, shoutout to their founder, Jerika Heinze who Tina says is a wonderful human being. So, you can find out more and FieldworkInitiative.org, and thank you sponsors of *Ologies* for making that donation possible.

[*Ad Break*]

All right, your questions patrons, including first-time question-asker, Eleonoora, Lux, and Sara Ayala.

Alie: Okay, several people among them, Ann Hanlin and some other people want to know: Why does the Sun make your skin darker but your hair lighter?

Dr. Lasisi: Oooh! That's a great question.

Alie: Right?

Dr. Lasisi: Oh, that's such a great question. Okay, so the reason sunlight makes a lot of people's skin darker is because it stimulates melanocytes in your skin that is alive - important - to make more melanin. And so, that is a physiological response that is activated by sunlight. Now, when it comes to your hair, your hair is dead. [*"May they rest in peace."*] So, any melanin that is in your hair, that gets destroyed, can't be replaced. So, if you have already, like, relatively little melanin in your hair, your hair can undergo what is called photobleaching which really just means, the pigment was destroyed by light and it's not there anymore, so your hair is lighter now.

Aside: Plenty of you, Lee T, Sharika Elahi, Manasvi Verma, Jeanette-o-saur, MN_09, Becki Grady, Trevor Doty, all had SPF questions. And Lorie B asked: Can we please once and for all have the final answer about Black folks and sunscreen? Yes? No? Sometimes?

Alie: Brynn wants to know: How did humans figure out how sunscreen works and did humans use substances found in nature as sunscreen? Also, feel free to lecture us about sunscreen right now, open forum if need be.

Dr. Lasisi: Great question. So, first, when and how did humans discover that you can protect your skin from the sun? Unclear. But there are some groups in east Africa, I want to say Tanzania, who use red ochre on their skin. It's basically like this red sand, clay pigment that they can put on their hair and their skin that protects their skin from the sun. So, even if you have dark skin, you can benefit from reducing the amount of radiation that you're exposed to. You can just benefit from it, because why put your skin and melanin through it if you don't have to, especially if there's already enough solar radiation for you to get the vitamin D that you need. We have evidence of humans playing around with ochre, I want to say [*unsure tone*] 200,000 years ago, that's a number that I remember I think, where we have engraved pieces of ochre so it's possible humans started playing around with that, putting it on them and were like, "Hey! This does something." But we can't really know for sure about when they started using it.

Aside: But yes, correct. According to the paper, "Assessing the photoprotective effects of red ochre on human skin by in vitro laboratory experiments" red ochre, or hematite, which is a deeper, red variety of iron oxide has been used in Africa since the Middle Stone Ages some 280,000 years ago. And it has a sun protection factor, or an SPF up to 13. And you're like, what does that number mean?

Well, the SPF number means that fraction of the burning radiation will reach the skin but most sunscreens only block UVB rays, and we know UVA can also cause damage to skin and cancer. So, look for a broad-spectrum SPF, and look into mineral sunscreens, especially if you want to spare negative effects on ecology, like coral reefs, you can see the Cnidariology episode on corals with Dr. Shayle Matsuda for more on that.

Alie: Great question, Heidi Stooshnoff says: Black-white mixed person here! I, and a few other mixed people I know, tend to go blotchy when we tan. What's up with that?

Dr. Lasisi: Interesting. Blotchy, hmm. So, I assume that means you get an uneven tan and I'm going to assume that you're mostly noticing it in your face. I don't know why I'm making these assumptions; I'm acting like I'm a psychic. [*both laugh*]

So, actually as a fellow mixed person that has one white parent and one Black parent, I would say that I don't go blotchy but what's really interesting about humans, especially when you get mixed humans– So people who have parents who are from populations that don't have shared ancestors for a very long time, you could get whatever the fuck in that mix. [*Alie laughs*] I like to call myself an FI hybrid, don't ever call anyone an FI hybrid, you can call yourself an FI hybrid if you want, that's what I do. You never know what you're going to get in that first generation; you can get a lot when you mix genes that haven't mixed together in a long time.

So, my intuition would be if you are going blotchy, do you maybe mean you're getting freckles? Because that can be something that we perceive as that. Another form of blotchiness that people talk about is melasma or like a pregnancy mask. So, during pregnancy and other moments when your hormones are doing things, it's possible to basically get an uneven, patchy distribution of darker pigmentation on your skin. So, that might be a hormonal thing as well, I am not the kind of doctor that diagnoses people with anything, so if it's an issue, definitely talk to people. But my intuition would be to ask: Are you sure you don't have freckles? And two, [*sidemouthing*] could you be pregnant? I don't know. [*laughs*]

Alie: Ooh, interesting questions. Perhaps follow up on their part indeed. A bunch of folks...

Aside: Looking at you, patrons Kendall M, Erin Ryan, Zombot, Cyntia B, Lauren Seibert, Kyla C, Alexandre Catulle, Vero Tavares, Brittney Corrigan-McElroy, Josh Frye, Shannon Bushnell, and Samantha Reyes, who asked: Why has my melanin ghosted me? All of you.

Alie: Wanted to know about the condition of vitiligo, which, from what I understand, autoimmune?

Dr. Lasisi: Yeah. I'm not a medical person so I don't focus very much on that, but from what I know, vitiligo autoimmune condition that destroys melanocytes. So, with a lot of different autoimmune conditions, basically, you're self-destructing things that you don't need to be self-destructing and that is one of those examples. So, that's what's happening there, as far as I know. As to why, I don't... I wouldn't know that.

Aside: So, patrons Jules and Jennifer Huseman also asked this, and vitiligo can occur in up to 2% of the population so it's pretty frequent, if you ask me. And it happens when your T cells go bully your melanocytes and then areas of skin wind up with less pigmentation. And right now, there isn't a cure for this but there's laser therapy which can help, and corticosteroids can also benefit some folks, as can phototherapy with that shorter but more intense form of light, the UVB rays. So, you can look into that, but also, it's gorgeous. [*whispers*] I think it's gorgeous. So, there's your internet Dad's two cents and I have good taste.

Now, this next question was asked by patrons Beth Kennedy, Scott Sheldon, and first-time question-asker Marianne Thomas, and it's a real chin-scratcher.

Alie: I thought this was a great question, Nina Giacobbe wants to know: Why do some people have brown scalp hair but red beards?

Dr. Lasisi: [*loud whisper*] Ohhh that's *such* a great question!

Alie: What's up with that?!

Dr. Lasisi: That's one of my favorite things– I was going to say, I'm a criminal, I'm not a criminal, please do not arrest me, this is not a confession. [*phonetic*] Howmst ever, I'm a weird person. People who have beards I'm like, "I saw that you have some red hairs in your beard and now I'm interested, do you want to talk about that some more?"

Alie: [*laughs*] You have a PhD in this.

Dr. Lasisi: Yeah, exactly. It's like, this isn't weird, it's for science, it's okay. That's how I justify. I'm like, "This isn't weird because I study this."

So, we don't know the exact reason why, but we can infer that hormones have something to do with it. So, beards are a great example of a secondary sexual characteristic. So, sex is a whole dimension of variation that you can have in people that we can most clearly see within an individual as they age because you go through puberty, and things happen, and you can go through other things in your life where your hormones are doing things. And when it comes to beards, you know that those come through during puberty when you're having an increase in certain kinds of hormones and there's going to be an interaction with the hormone receptors and their distributions in certain places.

So, what we can infer is that it's probably interacting with melanocytes in some kind of way and there is melanocyte-stimulating hormone, so hormones aren't just sex hormones, there are all kinds of hormones that are giving each other signals and basically affect how different traits are expressed. So, this is totally just a random tangent where I'm giving you more questions. We don't understand how, but basically, hormones, probably, are doing something.

Alie: Ah! Katie Munoz wants to know: I heard that blonde-haired, blue-eyed people inherit their coloring from Neanderthals. Is this true?

Dr. Lasisi: Oh, that's a very interesting question. To my knowledge, that is not the case.

Alie: Too simple, that's too simple, right?

Dr. Lasisi: It's always just... too simple. It can never be simple, right? It has to be complicated. So, absolutely we think that there's probably some genetic variation associated with skin and pigmentation that was contributed to some populations by Neanderthals. We don't necessarily think that blue eyes and blonde hair are a gift from Neanderthals. You may have also heard something about Neanderthals having red hair, so that is actually based on a study that got a lot of things wrong, and we do not have any evidence that Neanderthals necessarily had red hair, nor do we know much about what they would have looked like, necessarily. Because they have some types of genetic variation that aren't present in modern people.

Alie: Aha! So, they fucked that one up a bit.

Dr. Lasisi: [*nasally voice*] A little bit.

Alie: [*nasally voice*] A little bit, little bit. Graying hair, Kate Stomps wants to know: Why do some people go gray/white earlier than others? Their hair has significant white and they're in their late twenties. My grandmother was a real Steve Martin, and she went white early but she also had 11 children.

Dr. Lasisi: Wow.

Alie: By like, 30.

Dr. Lasisi: Ahhh!

Alie: Catholic on a farm, what are you going to do? [*laughs*]

Dr. Lasisi: What have I done with my life? This person... I have one dog.

Alie: I know! She, evolutionary...

Dr. Lasisi: Won!

Alie: [*still laughing*] Very successful.

Dr. Lasisi: Won. She understood the assignment.

Alie: She got it.

Dr. Lasisi: She understood the assignment.

Alie: She got it.

Aside: So yes, Grandma Ward, she was a real one. 11 kids by 30 and I have more cousins than I can literally count, I don't know how many cousins I have. We wanted to add Manic Panic to my grandma's hair *so bad*, but she had access to farm equipment that could kill us.

But anyway, patrons Kate Stomps, Delaney, Frederick A Schweighardt, Catherine Wood, Abby Saks, Naomi Jane, iHazQuestions, Pacheecha, RogueDookie, Jenna Congdon, Nina Eve Z, Trevor Durning, Earl of Greymalkin, Jess Loeffler, Lacy, Pavka34, Rachel Casha, and first-time question-askers, Jenn Crawford and LB all asked about silver streaks and death's icy grip.

Alie: But gray hair, Tim Pfarr wants to know: Can gray hair ever regain its original coloring, or are we just screwed once it loses its color? So, yeah, is it that the stem cells or the melanocytes are just like, "I'm out"?

Dr. Lasisi: "I'm out." And that is really interesting, right, because we see that happen with hair, but we don't have evidence of, in age, a kind of senescence or aging where skin melanocytes are just like, "Oop, I'm completely out." There is some evidence that, you know, in some people there's decreased melanocyte activity in their skin as they age, but nothing like hair where it's just like, "I'm out." Also, I would like to state that I do not have a single gray hair to demonstrate the amount of hardship that I went through in my PhD [*Alie laughs*] so I'm very, very jealous of anyone who does have it and I will sometimes fake it by braiding my hair with like, gray hair and being like, "No, I am learned and wise."

Alie: You're professorial.

Dr. Lasisi: I'm professorial.

Alie: At the temple.

Dr. Lasisi: Exactly, exactly. Boom.

Aside: So yes, gray hair has a little bit of eumelanin, the black kind, and appears silvery because that's all of the pigment it has. But brown eumelanin without other pigments gives someone blonde hair, a little bit of brown eumelanin and some pheomelanin, that's a recipe for ginger hair.

But back to gray hair, that loss of pigment as you age or maybe if you're under a lot of stress, so I looked this up and there's a July 2021 *Cell Biology* paper titled, "Quantitative mapping of human hair graying and reversal in relation to life stress," and it noted that:

Aligning the hair pigmentation patterns with recent reports of stress in the hair donors' lives showed striking associations. When one donor reported an increase in stress, a hair lost its pigment. When the donor reported a reduction in stress, the same hair regained its pigment... White hairs contained more proteins linked to mitochondria and energy use. This suggests that metabolism in mitochondria may play a role in hair graying.

I don't know what this means for your hair or for my hair, maybe it's all stress. Let's just, let's take our phones, let's agree to throw them in a hole and then let's just go live in hammocks.

Alie: Speaking of aging, Suzy K wants to know, their friends, who are all on the cusp of 40 were all talking when one asked what lotions were used for aging? So essentially, does more melanin prevent you from aging so quickly? Or does it prevent the appearance of aging?

Dr. Lasisi: Yes. So, this is one of the things that I find useful to talk about and also when I'm trying to convince, you know, darker skinned people or people who are from populations where a lot of people are dark skinned to use sunscreen. Radiation damage, UV radiation can- it's not just going to give you sunburns, it's not just going to give you cancer, but it just damages things. It is a damaging thing; it can damage collagen in your skin. And collagen is one of the things that gives your skin structure and makes it taut, it is one of the targets of a lot of cosmetic treatments to make you look young, and have your skin be plump, and all that kind of stuff.

So, long story short, if you have more melanin, the damage that you are being protected from is not just folate damage, DNA damage, it's also damage to your collagen. So, that is why dermatologists are so... Like, if there's one thing that dermatologists all seem to agree on it's just wear sunscreen. I don't know what they traumatize them with [*Alie laughs*] in dermatology school, but the fear in their eyes is just like, [*desperate, raspy voice*] "Wear sunscreen."

Alie: Photos of cancer! That's what they do.

Dr. Lasisi: It's probably... you know what, you're right, you're right.

Alie: It's photos of blistering tumors! As a person who has gotten some nasty sunburns in my life, like, I pretty consistently have worn sunscreen every single day since high school and there's maybe a handful of times that I have left the house and been like, "[*gasps*] I forgot it today," and it's like I've panicked, it's like I left a child in the oven or something. Just like, Argh!!

Aside: And I did look this up and I found some articles that pointed to good sunscreens that don't leave behind chalkiness such as Fenty, Cay Skin Universal Mineral Face Lotion SPF 55, Supergoop has a matte sunscreen, SPF 40, Black Girl Sunscreen, and EltaMD is rated highly for clear sunscreens.

And yeah, there are two kinds of sunscreen, there's visible sunscreen which has minerals like titanium oxide and zinc oxide that just straight up block the rays. And then there are chemical sunscreens which absorb the UV rays and convert them to heat energy, which is bonkers. So, as Dr. Flip Taneda recommended in the Scotohylogy episode, do your homework and [*clip from "Wear Sunscreen" speech: "Wear sunscreen. If I could offer you only one tip for the future, sunscreen would be it."*]. But onward, to kind of more important matters.

Alie: Trevor Doty wants to know: What's the gene that makes me fairly fur free above the waist and elbows and then it's fur town from there down to my fingers and toes? How come some people have furry butts and others don't?

Dr. Lasisi: That is a great question, and again, it's one of those things where I'm like, hormones. There's multiple factors that are going to affect any trait, but when it comes to the distribution of hair, a lot of times there are certain types of hairiness that occur after puberty so you can say, "Okay there seems to be something that was activated after puberty that wasn't the case." You look at babies and they're relatively furless [*Alie laughs*] and they smell so good and they're so soft. Anyway, that's a tangent, that's separate, that's not an evolutionary question, they're just delicious sometimes. But at some point, there seems to be an interaction with various parts of the body that are influenced and have a different distribution of hormone receptors, probably.

One of the ways that you can see this is also in pigmentation. So, our groins are actually much darker than other body parts and it's not because there's more sun exposure, right? But it's one of those areas in your body where you can be like, oh yeah, hormones, doing something.

Alie: This might make me do an aside on butthole bleaching, we'll see.

Dr. Lasisi: Ahhh.

Aside: It's true, you can buy creams but some of them might be carcinogenic and there's another one made of mercury, so don't do that. But a doctor can also point a laser at your butthole and try to lighten it if you're worried about skin pigment uniformity down there. You do you, it *taint* my business.

Alie: I went to Thailand, and I was so surprised in the drugstores in Thailand how many bleaching creams there were, which we don't see here in the US as much.

Dr. Lasisi: Yep. Hydroquinone is something that I hear about a lot, and I think that might be one of the substances that is actually allowed here. I think there are a number of different substances that you can use to destroy melanin basically, but they can be very dangerous, unsurprisingly. So, there are regulations that prevent them from being available in the US and in a lot of Europe, but there are other countries where you can get them and there's all of this pressure, certainly contributed by colonialism, to have lighter skin. So yeah, skin bleaching is a huge issue in a lot of parts of the world.

Alie: It was funny to me that there are so many tanning creams on our shelves and then there were so many... And I was like, wow, this is just...

Dr. Lasisi: A gag. It's hilarious.

Alie: Yeah, it's all so arbitrary and it's all so lucrative.

Dr. Lasisi: I mean, it's actually much more sinister than that, in my opinion. Beauty has to do with what is unattainable to some extent. We value things that are hard to get. And so, in a lot of historical cases, you can see this and around the world it's like, what the elite has is difficult to get and if it's easy to get then it's not elite anymore, and it's not special, and therefore it's not beautiful. So, what is beautiful isn't objective, but it has to do with people of high status having it.

Alie: And at one point that was food and extra adipose tissue that meant you didn't starve and then at one point it was the time to have a trainer.

Dr. Lasisi: Yup, and now it's BBLs.

Alie: And at one point maybe it was staying indoors and not getting a tan because you weren't laboring. And then at some point, it was being able to go vacation and get a tan year-round. And it's... yeah, it's just what can we get you to spend your money on? How can we get you to hate yourself?

Dr. Lasisi: How can we get you to hate yourself?

Alie: Just to spend your money.

Aside: See the Kalology episode about beauty standards for more on this just infuriating nonsense. Anything else terrible? Difficult?

Alie: Other than being a science communicator while you're also doing your postdoc and you're getting ready to have your own lab and everything, what's the hardest part about your job?

Dr. Lasisi: Other than all those things? I feel like those are probably the difficult things. I think the most difficult thing for me is picking one thing to focus on, really. Because there are so many interesting questions to pursue and there are so many ways to try and answer those questions. There are just not enough hours in the day, there's not enough hours in the day for me to do all the reading I want to do, to do all the experiments I want to do, to learn all the analyses that I want to do, to collaborate with as many collaborators as I want to collaborate... There's just not enough time for all the things I have to do, which hopefully is going to be alleviated a little bit by moving on from being like, you know, a one-woman show.

So, starting next fall I'm going to be assistant professor of anthropology at the University of Michigan and I'm going to have grad students, and a postdoc, at least one postdoc, so if anybody's interested in the evolution and genetics of human pigmentation, hair morphology, and you know, skin pigmentation, facial morphology, hit me up! I'm going to have my own lab so hopefully having more people on the team and working together on answering questions is going to make that easier because the more the merrier.

Alie: Ah, that's so exciting! If you need to burn my butt, let me know, I'm there.

Dr. Lasisi: For science.

Alie: For science, I'm so there. What about your favorite part about your career? Your job? Your discipline?

Dr. Lasisi: I mean my favorite thing about my discipline is that I get to think about human variations just like, you know, humans are weird and variable, and I get to just sit back and ask like, "Huh, why did that happen?" [*Alie laughs*] And to me that's just so much fun. So, I enjoy that about my discipline. And my favorite thing about my career is that I have cobbled together a weird career where I get to do academic research and I get to do science communication and hang out with amazingly cool people like you Alie, so that just makes me super happy.

Alie: Thank you so much for doing this, you are just a joy. Thanks for battling LA traffic to be here.

Dr. Lasisi: Honestly, it was worth it. A lot of things are not worth the LA traffic, [*Alie laughs*] and I would just stay home but this was beyond worth it.

Alie: You're the best, thank you! [*sings*] Doctorrrrr!

So, ask lovely people ludicrous questions because how are we supposed to know everything if we don't ask? And Dr. Tina Lasisi is absolutely a gem on Earth, we're lucky to know her. You can follow her on social media at the links in the show notes, her sci-comm is aces, I enjoy her TikTok so much. Thank you so much Doc, for being here. There's tons of links up on my website at AlieWard.com/Ologies/Melaninology. We are @Ologies on Twitter and Instagram, I'm @AlieWard on both, I'm at @Alie_Ologies on TikTok, so do say hi.

Thank you to Erin Talbert for adminning the *Ologies* Podcast Facebook group with assists by Shannon Feltus and Boni Dutch. Thank you to Noel Dilworth for *all* of the scheduling and so much more. Susan Hale handles merch and so much for *Ologies*. Thank you, Emily White of The Wordary for making transcripts available for free at AlieWard.com/Ologies-Extras. We have kid-friendly episodes up called *Smologies*, you can download them all at AlieWard.com/Smologies, which is linked in the show notes. Thank you, Zeke Rodrigues Thomas and Mercedes Maitland for making those. Thank you, Kelly R. Dwyer for the website help, huge thanks to my valentine, Mr. Jarrett Sleeper. And of course, thank you to lead editor and our favorite Canadian, Mercedes Maitland of

Maitland Audio for being the lead editor on *Ologies* now. Assistant editing was also done by Mark David Christenson. Nick Thorburn wrote and performed the theme music.

And if you stick around until the end of the episode, I tell you a secret. And this week's secret is that tiger nuts, who's had them? What are these things? Got them at Trader Joe's, they're like these little tubers and they're really chewy and you can get them covered in chocolate. Apparently, they're like tiny potatoes? Some people say that 80% of our ancestors' diets were just tiger nuts. Never heard of 'em before, obsessed with them.

Also, as long as we're telling secrets, yesterday was Valentine's Day, we were supposed to get this up yesterday and I was too sad, absolutely weird grief sideswipe. I've been doing pretty well and then Valentine's Day came around, my dad was always the sweetest on Valentine's Day, would leave us little chocolates outside our rooms, little valentines, I always have loved Valentine's Day. And yesterday I just all of a sudden... [*deep breath*] we went to my friend's house who just bought a house to bring her a welcome gift and then I went in the backyard, and I cried a lot... But I'm feeling better today. Anyway, we're all humans. Tiger nuts, delicious. Okay, berbye.

Transcribed by Aveline Malek at TheWordary.com

Links to things we discussed:

Follow Dr. Tina Lasisi on [Instagram](#), [TikTok](#), and [Twitter](#)

Visit Dr. Lasisi's [website](#)

A donation went to [The Fieldwork Initiative](#)

[The Evolution of Human Skin and Skin Color](#)

[Human Skin Pigmentation as an Adaptation to UV Radiation](#)

[Association between vitamin D supplementation and COVID-19 infection and mortality](#)

[Etymology of ephelides](#)

[The Damaging Effects of Long UVA \(UVA1\) Rays: A Major Challenge to Preserve Skin Health and Integrity](#)

[Quantifying variation in human scalp hair fiber shape and pigmentation](#)

[More Than Just Dry Skin: The Cultural Significance of Ashiness](#)

[Do White People Get Ashy?](#)

[The Hygiene Culture Wars That Started on Social Media](#)

[Role of Neuromelanin in Parkinson's Disease and Brain Aging](#)

[Removing the Racial Coefficient From Calculations of eGFR](#)

[The Evolution of Human Skin and Skin Color](#)

[Assessing the photoprotective effects of red ochre on human skin by in vitro laboratory experiments](#)

[The Black Girl's Guide To Mineral Sunscreen](#)

[Quantitative mapping of human hair greying and reversal in relation to life stress](#)

[Homo neanderthalensis via Smithsonian](#)

[Human skin pigmentation as an adaptation to UV radiation](#)

[“Wear Sunscreen”](#)

[Himba woman covered with a traditional ochre pigment](#)

[Sunscreen vs no sunscreen?](#)

Other episodes you may enjoy:

[Plumology \(FEATHERS\)](#)

[Nephrology \(KIDNEYS\)](#)

[Trichology \(HAIR\)](#)

[Cnidariology \(CORAL\)](#)

[Kalology \(BEAUTY STANDARDS\)](#)

[Scotohylogy \(DARK MATTER\)](#)

Ologies info:

[Sponsors of Ologies](#)

[Transcripts and bleeped episodes](#)

[Smologies \(short, classroom-safe\) episodes](#)

[Become a patron of Ologies](#) for as little as a buck a month

[OlogiesMerch.com](#) has hats, shirts, masks, totes!

Follow @Ologies on [Twitter](#) and [Instagram](#)

Follow @AlieWard on [Twitter](#) and [Instagram](#)

Editing by Mercedes Maitland of [Maitland Audio Productions](#) and [Jarrett Sleeper](#) of [MindJam Media](#)

Transcripts by Emily White of [The Wordary](#)

Website by [Kelly R. Dwyer](#)

Theme song by Nick Thorburn