ORIGIN STORIES
THE LEAKEY FOUNDATION PODCAST

Episode 56

Bonus Episode: Short and Sweat

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https://traffic.libsyn.com/secure/originstories/Bonus_Episode__Short_and_Sweat.mp3

**Meredith Johnson:**
This is Origin Stories, The Leakey Foundation Podcast, I'm Meredith Johnson.

I don't know how the weather is where you are, but here in California it's late September and it still feels like summer. As bad as the heat is here, we humans do have one unique adaptation to help us cool down, we sweat. And it's a bodily function that researchers are still working to figure out.

For today's bonus episode, our guest is Andrew Best. He's a biological anthropologist at the Massachusetts College of Liberal Arts, and he's a Leakey Foundation grantee who studies human endurance and the evolution of sweat. He's also an endurance athlete who spends a lot of his time running and biking and sweating. I think it's fair to call him a sweat enthusiast.

His PhD research focused on the evolution of sweat glands and the differences in sweating between people who are raised in different climates. Andrew, thank you for being on the show.

**Andrew Best:**
Thanks for having me. I love everything Leakey so this is very cool.

**Meredith Johnson:**

So I invited you on the show today because I wanted to ask you about sweat and the evolution of human sweating. A lot of people don't know much about sweat beyond the fact that we all do it. Is there this whole world of sweat information that experts know about?

**Andrew Best:**

I was really surprised in doing my dissertation project to find that there are big questions about sweating, especially evolution of sweating that we just don't know. Like before I was a scientist, I was a high school teacher for 15 years and I always thought science has a lot of answers and we've really got the world conquered in terms of understanding things. And as soon as I dug into one topic, which is what a PhD is, you realize that we've really only been at this process for a couple of hundred years. And we know like less than 1% of what there is to know.

**Meredith Johnson:**

So there are all these things that we think about when we think about what makes us human, like walking on two legs and having big brains and using tools. How does sweat fit into this list?

**Andrew Best:**

I think that sweating and the expanded ability to get rid of heat allowed some of those other things to happen. Humans are remarkable runners in the heat. We are not fast in terms of sprinting and we do have really good endurance in terms of long distance, but that's especially true in the heat compared to other animals. So sweating is one of the few ways of really efficiently covering ground in the heat and cooling off at the same time. So the thinking is that whether early humans were walking or running or both, they were surely covering longer distances on a daily basis to find food. And to do that on the African Savannah, you need a really good way of cooling.

**Andrew Best:**

And so sweating is one of those adaptations that allowed genus homo to develop the ecological niche that we did expanded foraging, maybe persistence hunting, scavenging and sweating would have been even more important if early humans were doing this physical activity in the heat of the day, which is a safer time to do it in terms of predators. So a bigger brain seems to have co-evolved with this ecological shift to covering more distance, to get more kinds of food out of this Savanna habitat. So in that way, it goes hand in hand with some of the stuff near the beginning of our genus, maybe around one and a half, 2 million years ago. So I guess not the very beginning of our genus, but some of those things that are becoming more human, I think are probably happening along with the ability to sweat.

**Meredith Johnson:**

You've mentioned some dates, but skin doesn't fossilize. So how can we know when we might've evolved the ability to sweat?

**Andrew Best:**

It's really a bummer that sweat glands don't fossilize. So you can try to tie it to when we think hair was lost, so maybe two to 3 million years ago. But the rest of it's even more direct. If we're starting with the assumption that sweating and better cooling is necessary for some of these other adaptations then we can say they probably co-evolved. So then you'd say, okay, if we want to know when we got sweatier let's look at when brains got bigger. When was there more meat in the diet? When was the habitat drying out and becoming more open and imposing more of a challenge such that our ancestors would have to cover more ground? So it's all really indirect.

**Meredith Johnson:**

And it's all seemingly connected.

**Andrew Best:**

You know, it's really like how did these 10 things make us human? And they all really had to go together.

**Meredith Johnson:**

But I think it's a way to look at it that people haven't really considered before, because we tend to think about sweat as just, I don't know, we just tend to not think about it unless it's giving us trouble.

**Andrew Best:**

It's really interesting that we have this at least in Western society and certainly America, we have this lens that we look at sweat through. And I almost wonder if that has to do with our relative sedentary lifestyle. Maybe that's why we're viewing sweat as something gross. But then there was also this other shift whereas sweat is detoxifying. The pendulum is swung on the other direction and we think that sweat is amazing for all

these reasons that it's probably not. It's amazing for one reason and that's to cool off and that's it.

**Meredith Johnson:**

So it's a not detoxifying. Can you talk about that a little bit?

**Andrew Best:**

Yeah. I don't think it's entirely inaccurate to say that sweat is detoxifying and that almost anything that's in your interstitial fluid, in your blood and like stuff can get out through your sweat. So sweat is almost entirely water and salts, but there's a very little bit of other stuff that comes out. But you have liver and kidneys for that. I've seen the sweat glands listed as part of the excretory system before and that's true in that they do excrete things, but they're not excretory in the sense of the kidneys which are actually filtering the blood and detoxifying. So the stuff that comes out in your sweat, just along for the ride.

**Meredith Johnson:**

How is human sweat different from the way other animals deal with heat? What are some other heat strategies?

**Andrew Best:**

Sweating is the most effective way of cooling, especially if you're talking about endogenous heat, so heat that you are producing. Sweating is super effective, but you need to be nearly hairless for it to be super effective. And you need a ton of sweat glands and you need to be able to produce that sweat without getting super dehydrated, because that has some really big consequences. So other animals have not evolved this, very few have.

So what do other animals do? They pant, so similar to sweating it's heat lost through evaporation. So they're bringing air into their mouth and the respiratory tract and moisture is evaporating in there and taking heat with it, into the air that they're breathing out. But most animals cannot pant and run at the same time. So they are limited. This is why you shouldn't take your dog running if it's too hot. And if you do, you should let it cool down every so often.

**Andrew Best:**

So like sometimes I go running or biking with a friend who has a dog and we make sure that it lays down in the stream and drinks plenty of water, gets a chance to rest because even though there are great runners than humans they can't cool off as well. So panting

is effective, but it's limited. Now you've probably seen kangaroos on TV ...licking their legs and stuff. That's just a way of evaporative cooling on their skin rather than making their skin wet with sweat glands, they're using their own saliva.

**Andrew Best:**

And some other strategies include, try not to get hot in the first place, which is obviously very limiting. But this is why in hot climates most mammals who are really at danger of hyperthermia do a lot of physical activity in the heat of the day. This is why many mammals are more active at dawn or dusk or they're nocturnal because they are limited in their ability to get rid of heat. So those are kind of all the strategies that I can think of, I'm really glad that sweating is the one we've come up with.

**Meredith Johnson:**

Humans have two kinds of sweat glands. The glands that send odorless, watery sweat to the surface of your skin to help you cool down are called eccrine sweat glands. You have millions of these. Eccrine sweat glands on your hands and feet also help when you need a little extra grippiness. Ancient primates have them there too. In fact, most modern mammals have them on their paws and nowhere else. The other kind of sweat glands are called apocrine sweat glands.

**Andrew Best:**

And in other mammals and other primates they are on the whole body surface, and they're usually associated with a hair follicle and they secrete a more oily or waxy type of sweat. But in humans, they've retreated just back into the pubic region and armpits as the eccrine glands spread over the body surface. So they have a much smaller role in humans.

**Meredith Johnson:**

Our team came up with a few burning questions about sweat, and we were hoping you could help us answer them. All right. Are you ready? Here's the first one, how is kids sweat different and why is it not smelly?

**Andrew Best:**

Why is the sweat from adults smellier than the sweat from kids? Because the sweat that smells is really coming out of apocrine sweat glands. And those are the sweat glands found in the armpits and the pubic region. And there, the sweat that's coming out is fed

on by bacteria. So the bacteria living in those places are the things that are making the smelly compounds and that are producing body odor. And there are eccrine sweat glands in your armpit, but it's mostly sweat from the apocrine glands and the bacteria are living off of that and they're making the smell. So kids who haven't gone through puberty yet don't have that same population of bacteria in those regions to be producing the smells.

**Meredith Johnson:**

Is it true that people who exercise more sweat more?

**Andrew Best:**

Yeah. So your individual sweat glands seem to be hugely plastic, meaning they can get way better at producing sweats and getting more efficient at sweating. So sweat glands are like a muscle fiber in that way you can train them. But if you're exercising and generating heat that you have to get rid of, very quickly, your sweat glands learn to sweat earlier during exercise and sweat a lot more. So people who exercise more do tend to produce more sweat.

**Andrew Best:**

And in my study, this was an enormous difference. It was mostly college students. We were counting their sweat glands and we found that there were a handful of endurance athletes in this study, and everyone else did varying levels of different types of exercise, but the endurance athletes, especially those that I tested during the summer when they were heat acclimated produced like five to 10 times more sweat than the other people. So the difference can be really profound and so that's a really effective way of pretty quickly getting your body used to cooling off in the heat.

**Meredith Johnson:**

So does this only apply to like heat that the athlete is generating themselves in their body or say they were just trying to hang out in a heat wave. Would an athletic person be able to deal with the environmental heat better?

**Andrew Best:**

Oh yeah. Sure. I think there's a couple of things in that question, would an athletic person be better able to deal with environmental heat? Yes. A, because they're more heat acclimated and they can sweat more right away. So if you put them into a sauna or in hot weather just hanging out, they will cool off better through sweating, but also because they exercise more, they probably have a better ability to send blood to their skin and radiate heat that way and make sweating more efficient that way.

**Andrew Best:**

They have higher blood volume so they can support sweating without getting dehydrated. Their heart is more efficient so if they get dehydrated, they can still maintain that blood pumping. So a lot of the adaptations you get from exercise also help you with effective sweating and cooling. So in those ways, both directly and indirectly athletic people or people who exercise are better at cooling for. For people who are lean and lanky that backfires when it's cold out and you lose heat just through radiation and convection much faster in the cold.

**Meredith Johnson:**

Okay. Is humidity so terrible because your sweat can evaporate?

**Andrew Best:**

Yeah. Yeah. For sure. So sweating is way less effective when a candy wrapper, because your body's like, this is all we got. This is like the biggest weapon in our arsenal or you'll keep sweating. But humid heat is just way harder to deal with for exactly that reason.

**Meredith Johnson:**

Here's another one. Does air conditioning make you less able to deal with heat?

**Andrew Best:**

Yeah, probably. If you're in air conditioning all the time and you're not doing something to challenge your heat dissipation ability, then yeah. You're just not going to acclimate just as we all lose some heat acclimation over the winter, if you live in a temperate climate, you will lose it if you live in air conditioning all the time. I just love to talk about sweating like a muscle. If you want to get bigger muscles you can't just lift the weights 24/7. You lift the weights and then they have to have a period of repair. And it's got to be the same thing with a lot of the aspects of heat adaptation. You need a chance to replenish your body fluids and if you're building more blood vessels or whatever to your skin you need a chance that your body can rest and do that.

**Meredith Johnson:**

So you mentioned that it's like a muscle. Does that mean that it might be possible for our bodies to continue to get better at dealing with heat as we're dealing with intensifying heat waves and a warming planet?

**Andrew Best:**

Individuals, and probably entire populations could get better at dealing with heat if we all heat acclimate, which we're all capable of doing. There's obviously limits to that. I don't think anyone is going to live comfortably in 110 degrees and I don't know that anyone could really acclimate to that and then still sleep well. So there are limits to how well we can acclimate. You're going to get dehydrated, there's going to be problems. I am hoping that modern technology and culture, ways of avoiding the heat and mitigating it like air conditioning and things will hopefully step in. But then there's going to have to be socio-economic change to protect these vulnerable populations who are being disproportionately affected by rising temperatures.

**Meredith Johnson:**

Yeah, absolutely. I guess that was a way of saying, I don't know if we're going to be able to adapt to it like biologically, I don't know. It's a grim idea.

**Andrew Best:**

Yeah. It's just something that I've been thinking about a lot and people are going to have to migrate... Migration is another tool we have.

**Andrew Best:**

Yes, absolutely. The people that will most need to do that probably have the least means of doing that.

**Meredith Johnson:**

Exactly. Yeah. So there's disparity everywhere. What do you most want people to know or understand about sweat?

**Andrew Best:**

Okay. Our ability to move our body, especially over long distances is pretty unique and pretty awesome. And it's enabled in part by sweating and so I think what I want people to know about sweating, isn't really a thing about sweating. It's just that you sweat really so that your ancestors could move and Hey, guess what? Moving is the best thing you can do. And it's good for your body. It's good for your brain. And we know that people who get enough exercise are happier, healthier, and there's lots of ways to move, find the way that you'd like. And when you start sweating just remember it's one of your body's responses, enabling you to keep doing that. So do it.

**Meredith Johnson:**

Thanks so much to Andrew Best for taking the time to sit down and chat about sweat. If you want to check out his research or learn more about how he became an anthropologist who studies perspiration, please check out his website, therunningprimate.com. Check your show notes for that link and more.

**Meredith Johnson:**

Origin Stories is a project of the Leakey Foundation, a nonprofit organization dedicated to funding human origins research and sharing discoveries. You can support this show and the science we talk about by making a donation to the Leakey Foundation today, go to leakeyfoundation.org/donate.

**Meredith Johnson:**

This episode was produced by Ray Pang, who I'm thrilled to say has joined our team at Origin Stories. I'm excited for you to hear more from him and if you want to keep up with his work you can follow him on Twitter @PangRay we'll have the link in your show notes.

Our editor is Audrey Quinn, lead music by Henry Nagel, closing music by Lee Roosevelt. We'll be back with a brand new episode on Tuesday, October 5th. Contributor, Neil Sandel brings us the origin story of our closest animal companions and explores the journey from wolf to dog. Thanks for listening to this bonus episode of Origin Stories.

See you next time.