Sawbones 529: Frostbite

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[theme music plays]

Justin: Hello everybody and welcome to *Sawbones*, a marital tour of misguided medicine. I'm your cohost, Justin McElroy.

Sydnee: And I'm Sydnee McElroy.

Justin: Feelin' a little shaken up now, Syd.

Sydnee: Why are you shaken up?

Justin: Well, we just did the ads and one of the ads, I'm not gonna specify which one 'cause I don't want anybody to be— have their feelings hurt, but one of the ads I think was the best ad read I've ever done in my whole life.

Sydnee: It was a—

Justin: It was—

Sydnee: It was a really good one.

Justin: It was like natural, it was warm.

Sydnee: Yes.

Justin: I felt really connected to the brand.

Sydnee: Right.

Justin: And it is— like I'll— I feel like sitting here I'll never top it, you know what I mean? And I feel like that's important for people like me to have these aspirational goals out there.

Sydnee: Mm-hmm, sure.

Justin: They— We need something to climb, we need a goal, we need a mountain. You know, we need a pole, we need something to strive for that pushes us to the very limits of human endurance.

Sydnee: Oh.

Justin: For me, for a long time, it was doing the best [chuckles] ad read possible, and I know in my bones, and you saw it, and you can deny it if you want to to save my ego, but you know I've peaked during that ad read.

Sydnee: It really— I mean, you did. No, it's true.

Justin: I did. But what's next for me on the horizon, Sydnee? I don't know how I'll continue to strive for excellence and push myself to the very limits of human endurance.

Sydnee: You could climb a mountain.

Justin: Mmmm!

Sydnee: Have you thought about that?

Justin: I have, I've tried. Attentive viewers of the McElroy Family website will see some of that prowess.

Sydnee: Was that mountain?

Justin: I don't— we— I can't say anything else, it's a secret.

Sydnee: Okay.

Justin: But listen. [chuckles]

Sydnee: [chuckles] I don't— We live in the mountain state.

Justin: Yeah.

Sydnee: So I feel like you should know what mountains are.

Justin: But we don't have mountains in the mountain state. There's no mountains here, no technical mountains.

Sydnee: But we are nestled within the Appalachian Mountains.

Justin: You can nestle, but there ain't any in the state.

Sydnee: We're the only state that exists entirely in Appalachia.

Justin: And entirely outside of any mountains, 'cause the aren't any in this state. [chuckles] None.

Sydnee: Did— [chuckles] Did y'all hear 'em at the Super Bowl singin' "Country Roads?"

Justin: Yeah.

Sydnee: Yeah, that song's about us.

Justin: That song's about us, well—

Sydnee: I bet you didn't know it was about West Virginia, except that for when they say West Virginia, but.

Justin: Yeah well, probably confusing, 'cause it was written about Virginia, just didn't [chuckles] fit the meter as well. [wheezes]

Sydnee: No. And sorry Virginia, we're cooler.

Justin: Sorry.

Sydnee: Sorry.

Justin: Sorry. No, this is themed. This is a theme.

Sydnee: I know.

Justin: I did that introduction for you.

Sydnee: You did.

Justin: And then I feel like you kinda lost the plot, you know?

Sydnee: I did lose the plot.

Justin: Yeah.

Sydnee: Forgot.

Justin: Okay.

Sydnee: Justin, you know somethin' that can happen when you're climbin' a mountain.

Justin: I do, Sydnee.

[pause]

Justin: Oh—

Sydnee: You already know.

Justin: [in a British accent] "Oh Lord, it's come off in the boot. Oh Lord."

Sydnee: That's right, Justin. Frostbite. Frostbite is a good topic to talk about for a couple reasons. One, it's February, it's still cold here.

Justin: [sighs] It was re— It's a little more temperate now. Y'all, we had a few weeks here that I know in some of the colder climes probably wouldn't phase you, but hatchie machie, there was a few weeks here were it did not get above freezing, and I thought I was going to die.

Sydnee: And it— I mean, it— Yes, it got extremely cold, we had a snowstorm, then an ice storm, and then more snow. And then it stayed below freezing down into single digits for like a week, and so nothing could melt, so we were just sort of encased in ice for a long time.

And I think because of the kind of medicine I practice, I am now much more acutely aware of the temperature because many— most of my patients are unsheltered, and so they— So I think about it a lot more, which is a good reminder, I think for all of us, that there are, you know… That we're lucky to be inside if we are.

And it is also a good reminder that frostbite still happens. I— One of the issues with frostbite, Justin, that we're gonna get into is one, I think that unless you are someone who is in a position where you are vulnerable to it, like you're— because of your life circumstances, you may encounter it, you're not gonna think about it. You probably don't really know what exactly is happening.

Justin: Right.

Sydnee: Or how— what to do about it if it does. And on the medical end, there's definitely a lack of… I don't wanna say aware— Well, awareness is fair.

Justin: Mmm.

Sydnee: Among a lot of physicians, because we just— we don't see it a ton.

Justin: I would also say among the populace, and this— I do feel like I kinda show my butt a little bit sometimes by trying to speak for the common man in terms of their ignorance.

But I feel like frostbite is one of those things that's enough a part of the popular imagination that I often hear it like tossed about, and without people seeming to really know— I'm absolutely including myself in this group, as to what frostbite actually is.

'Cause sometimes your hands— I get— Any— Get a kid's hands cold enough to go numb and they will be convinced that they have frostbite. [chuckles]

Sydnee: And we say that, right? Like even as our girls are going out to play in the snow, I would be like, "Now, if you start to hurt, come inside so you don't get frostbite." [chuckles] Which that's— I— There you go— That's like a classic—

Justin: You're laughing and I have absolutely no idea why. [chuckles]

Sydnee: That's like a classic.

Justin: I have no clue why you're laughing.

Sydnee: Because as I say it, the— if you are in the medical field or if you had a parent who was in the medical field, this is a common thing. It— I will say things that are so flippant, like, "If the tip of your nose starts hurting, it might fall off, so come inside."

That is such a doctor mom thing to say, like I own it, I realize that. Like more concerned parents would be like, "Only go outside for so many minutes," and you know whatever, and I'm like, "You know, if your fingers start hurting, come inside."

No. But I don't think a lot of people know, and I think because of the kind of medicine I practice, I think about frostbite a lot, and I'm very aware, and I'm looking for it, and I'm educating my patients.

There is still a lot of education that we need to do to get people more aware, to prevent frostbite, just because of the awareness, to come seek help quicker, and to prevent more tissue damage, more amputations that can recur.

Justin: Yeah.

Sydnee: Can occur from frostbite. So I think it's good to talk about because it's an area where education is needed, but on the doctor and patient end, and there was a new medication approved for frostbite just last year.

Justin: Oh.

Sydnee: So fairly recent. The first FDA approved medication for frostbite.

Justin: Hmm, is it topical or intravenous?

Sydnee: Intravenous.

Justin: Interesting.

Sydnee: Yes, yeah it— We'll get into what it does.

Justin: Oh, and what an interesting question, hmm.

Sydnee: So first of all.

Justin: [chuckles]

Sydnee: Frostbite, the first case [chuckles] that we knows about— know— That we knows about? What is that? That we know about.

Justin: [in an old prospector voice] The first case we knows about!

Sydnee: [laughs]

Justin: [in an old prospector voice] Frostbite comes from must've been 1648! My uncle—

Sydnee: What happened?

Justin: [chuckles]

Sydnee: 5000 years ago.

Justin: [in an old prospector voice] 5000 years ago in this very hamlet.

Sydnee: In the Andes, they found a mummy that—

Justin: [in an old prospector voice] It was Andy's place, out there near the farm! [chuckles]

Sydnee: [chuckles] They found evidence of frostbite in a mummy. So—

Justin: B-S. [laughs]

Sydnee: Yeah.

Justin: I don't believe it.

Sydnee: Why?

Justin: [laughs] I don't think they did.

Sydnee: Well they did!

Justin: I'm off— Nah, it's a mummy man, no way.

Sydnee: It's also— I think that's one of those things where that's like an easy win, I feel like. If you're looking for how old is a disease? A di— like some sort of medical condition that is just because you got too cold, obviously that has existed as long as humans have existed, right?

Justin: Yeah.

Sydnee: Like there was no way there was a long time before anybody got cold enough. [chuckles]

Justin: Right.

Sydnee: Like humans were around for thousands of years before they got frostbite? No, of course, frostbite is as old as humanity because it results from prolonged exposure to freezing temperatures. And certainly throughout human history, there have been many occasions where we're had prolonged exposure to freezing temperatures. Let's talk about what it is first before we talk about the history of it.

Justin: Mmm.

Sydnee: What do you think frostbite is, Justin?

Justin: Ooo.

Sydnee: You might— If you just guess, you might be right.

Justin: Okay. Let me guess. Here's what I think. I think that your… It is a period of time after which the flesh is like cold enough that blood can't reach it, and so without the blood, the skin on the outside dies.

Sydnee: That's pretty smart, that's— So you got— Okay, there are two things that are happening in frostbite, and you basically got it.

Justin: I'm glad our audience doesn't know the pleasure that you looking at me and saying "It was pretty smart" fills me with. I'm glad that I'll go to my grave with that secret. Go on.

Sydnee: [chuckles] So first of all, there is an aspect where your tissues are kind of freezing, I mean they're freezing. Ice crystals are forming outside the cells, drawing fluid out of your body cells.

Justin: Right.

Sydnee: So there's actual freezing of your tissue.

Justin: Right. And I think that you're also, if I had to guess, you're seeing… I'm not sure if sublimation would be the right word here, but you're seeing… Because of the freezing moisture pulled out of the tissue, right?

Sydnee: Mm-hmm.

Justin: And pulled into the atmosphere. Right? You're—

Sydnee: Oh into the ice crystals that are forming.

Justin: Ice crystals that are forming.

Sydnee: In the tissue.

Justin: Like in condensation, like with a similar process that happens with—

Sydnee: Yeah.

Justin: — drink condensing or with freeze drying, the moisture is being pulled out of the thing, and—

Sydnee: Mm.

Justin: — and forming on the outside.

Sydnee: And it— if you pull all of the moisture— if you pull all of the fluid out of a cell, it will dry up and die.

Justin: Right.

Sydnee: So there's tissue damage happening.

Justin: Right.

Sydnee: And also there's like ice crystals in the tissue.

Justin: Mm-hmm.

Sydnee: And then also there is the blood flow part, that's the other piece you mentioned that is important to understanding why frostbite happens, and also has been really critical for us to understand better, to try to treat frostbite more effectively. So the other thing that happens is blood carries oxygen, right?

Justin: Mm-hmm.

Sydnee: So if blood stop flowing to an area, it also gets deprived of oxygen.

Justin: Right.

Sydnee: Ischemia.

Justin: Mm-hmm.

Sydnee: Is the word for that. And then that's another kind of damage that's gonna happen to the tissue at this point, 'cause first we've go ice crystals, dehydrating cells, tissue damage. Second, lack of oxygen, cells can't breathe, tissue damage.

So you've got like— you've got a couple different mechanisms that are happening. When you are exposed to cold temperatures, there is— there's a specific thing that your body does called the "hunting reaction" and it's like—

The blood vessels alternate between dilating and constricting. And the reason they're doing that is it's trying to continue to pump blood, oxygen in the blood, pump oxygen to all the different tissues in your body, and also warm them through the blood flow.

Justin: Mm.

Sydnee: So when a— when you get vasodilation, a blood vessel dilates, gets bigger, it warms that area.

Justin: Mm.

Sydnee: But you need all your areas warmed when you're outside in the cold, so you get this like cycling through, the blood vessels get tighter, and then they open more. So more blood, less blood, as they continue to— as they pump blood to different parts of your body.

Justin: Right.

Sydnee: Eventually, that hunting reaction can stop if it— if you're cold for long enough, and then that's when you get areas of tissue death, because now you're got areas where the blood vessels are constricted, and they stay constricted.

Justin: So you're basically talking about the sort of like old adage that— Not I guess an adage, but a common wisdom that heat is lost through your head. Like the hat is very important because all the heat will escape through the head without a hat there.

Sydnee: Well not all of it, but yes, you do lose heat through your head.

Justin: Much of the heat, you will lose.

Sydnee: Yes, you will lose through the top of your head. [chuckles]

Justin: From your unexposed parts, right?

Sydnee: Yeah.

Justin: So you gotta have a hat there to keep the heat in your body.

Sydnee: And—

Justin: 'Cause otherwise it'll all leave through your head.

Sydnee: And then you've got to start thinking about like amount of blood flow to different areas. So some areas of our body have lots of different blood flow to it, right?

Justin: Yeah.

Sydnee: Like lots of— They're large and they've got lots of vascular input.

Justin: Muscles, like my muscles, like my biceps and stuff.

Sydnee: If you— then if you think about like the extremities, how many blood vessels could possibly get to the tips of your fingers, the tip of your nose, the tips of your toes. It's just a smaller space, right?

Justin: Right.

Sydnee: So the amount of blood— the amount of blood flow is restricted already. These are the areas that are most vulnerable to frostbite.

Justin: Mm-hmm, that make sense.

Sydnee: Fingers, nose— Fingers, toes, tip of the nose. It's also the tip of your ears, but that doesn't fit in my rhyme, you could probably rework it.

Justin: Yeah. I was thinking about—

Sydnee: But fingers and toes and tip of the nose.

Justin: I was thinking about— [chuckles] I was thinking about that would be a helpful pneumonic to remember your case of frostbite, but then I— it occurs to me that should you experience frostbite, you would probably be well aware of where [through laughter] you are experiencing frostbite.

Sydnee: Well, it hurts. [chuckles] Yeah no, and— But that's why you see those areas most vulnerable. They're also typically the areas that are most likely to be exposed, right? Like most of us are walking around with

like a shirt on or pants on, covering— [chuckles] covering your fingers, you know, if you don't have gloves, that becomes an issue.

Keeping your toes warm, it seems like, "Well, isn't everybody wearing shoes?" Well how thick are they? Are your feet submerged in some sort of— Are they in the snow? Are they in the ice? Are they cold? And then your nose I think is— and ears are a little more obvious if you don't have proper coverage of your face.

Justin: Yeah.

Sydnee: You know, and it's cold enough. So you get why these areas. So anyway, you get a lack of blood flow, the blood vessels tighten and you're getting a lack of blood flow, you're getting tissue damage from the ice crystals, and then you can also get little blood clots that start forming inside these little blood vessels—

Justin: Eugh.

Sydnee: — from the slowed blood flow, like the blood gets so slow that it starts to clot.

Justin: Okay.

Sydnee: And so then what you get, what we call "microthrombi," which are these tiny little blood clots, which further block blood flow to these areas. You also, because then now you have blood clots and you've got slowed—

You're getting tissue damage, now you've got inflammation. Inflammation is your body's response to an injury, so something's damaged, we'll send a bunch of inflammatory things, factors, to this area. And because of that you get swelling and oedema, so swelling of the tissues, which causes more tissue damage.

Justin: Ahhh.

Sydnee: So it's this sort of cascade of events, there's actually stages in it. There's like your pre-freeze phase where you're exposed the freezing temps, okay?

Justin: Mm-hmm.

Sydnee: And everything's getting cooled down, but you're not actually damaged yet. Then there's this freeze thaw, where these ice crystals start to form, the blood vessels are still doing the like constricting, dilating, constricting, dilating kinda thing, and you get all this cellular damage. Then you get the part where the blood stops flowing, that's either clogged off or just stopped.

Justin: Right.

Sydnee: And then you get the ischemic phase, where there's just— there's no blood, there's no oxygen. Everything's damaged and everything starts dying. And as you progress through these stages, obviously the injury can become more severe.

Justin: Okay.

Sydnee: So for the person experiencing frostbite it would go from the initial like, "This, you know, my fingers are hurt— or like pale, they're hurting, they're really cold. There's pain, and then it progresses to a numbness."

Justin: Mm-hmm.

Sydnee: And then you start becoming aware like, "I don't feel— Like I can't feel my fingers, I can't feel my toe."

Justin: Mm-hmm.

Sydnee: And then eventually to these where you can start seeing the visible damage. Blisters start to form as the tissue on top is dead, and then especially if you've being rewarming and refreezing, that's really dangerous. And then you can start getting like I think what we think of as like classic frostbite is like the black extremities.

Justin: Mm-hmm.

Sydnee: Like your fingers are turning black, your toes are turning black, and then you worry about them falling off. That's like the most advanced, that is not typical of frostbite, right?

Justin: Right.

Sydnee: Like there are stages of frostbite long before that, but certainly it can progress that.

Justin: Mm-hmm.

Sydnee: And that's called necrosis, tissue death, and then things can… come off.

Justin: Okay.

Sydnee: Or you may have to take them off. I do think it's important, as we talk about what frostbite is to talk about what frostbite isn't. There is frostnip.

Justin: Frostnip.

Sydnee: And I think that this is—

Justin: That's just a little bit, huh.

Sydnee: Yeah.

Justin: [clicks his tongue]

Sydnee: And so when you talk about like your kids come in and their hands are pale and cold, and you're like, "Ah, are they— do they have frostbite?" they probably have frostnip.

I mean hopefully not, they probably are just cold, but like if it has progressed to anything, most of it is frostnip, and you may have experienced frostnip if you are someone who has been outside for a long period of time, if you do work outside, if you didn't wear your gloves or something.

Justin: That wasn't a— Okay, that wasn't a you— A Justin "you" to me, that was a collective you.

Sydnee: No, that was a— Yeah. Everyone. You may have experienced frostnip.

Justin: So Justin may not have experienced it.

Sydnee: It's the whitening of your skin, the paling I should say of your skin. It's gotten paler, it's become numb.

Justin: Mm-hmm.

Sydnee: But it reverses, right. Like you go inside, you warm up your hands, you know, you rub 'em together, you hold a warm cup of cocoa or whatever.

Justin: Right.

Sydnee: Hold 'em near the fire, whatever [chuckles] quaint thing, whatever scene you wanna paint, you warm your fingers back up and then they feel fine, okay. That's not frostbite. You experienced frostnip.

Justin: Got it.

Sydnee: Much more common. Important to know about frostbite, in case you mistake one for the other, but generally not a big deal. There's also trench foot, have you heard of trench foot?

Justin: Yeah, I've heard of trench foot.

Sydnee: Do you know what trench foot is?

Justin: Um… Okay, what I— Let me tell you again what it is. It's like frost— It's just like you're— It's hyper-pruniness. [chuckles] So like if you get pruney in the tub, that's one thing.

Sydnee: Uh-huh.

Justin: But trench foot is when your foot is pruney for like days.

Sydnee: It— That's actually— Okay, yeah. It's— So you're exposed to wet, cold conditions for a very long time, but not freezing. That's what

differentiates trench foot from frostbite is frostbite is— it has to be a freezing temperature that you've been exposed to.

Justin: Mm-hmm.

Sydnee: Because the damage that is resulting is freezing. Trench foot is not freezing, but it is definitely wet, cold conditions, and it does look like I have seen quite a bit of trench foot. I see trench foot—

Justin: Don't brag. Everyone's so tired of the bragging on this show.

Sydnee: I'm not bragging.

Justin: [giggles]

Sydnee: I think part of what I do is raise awareness about things that maybe you thought were like old fashioned, like esoteric sort of medical ideas. Like was talked about whooping cough, I don't know that everybody knew that whooping cough is still a thing, right?

Justin: Yeah. Yeah.

Sydnee: Well.

Justin: Now.

Sydnee: Trench foot is still a thing.

Justin: Yes.

Sydnee: I see it a lot.

Justin: Sure.

Sydnee: I see trench foot way more than I see frostbite, and it is from, you k, people who are wearing shoes and socks for like days no end. There's a reason we're supposed to take our socks off at night.

And if we're not in a, you know, a place in our life where we can safely do that, or where the environment allows us to do that, that's bad for your feet. So they do look really pruney and wrinkly, like you've been in the

bathtub way, way, way, way, way too long, that is kind of what it looks like.

And it's the same idea, you've damaged the nerves and the blood vessels from his prolonged exposure to wet and cold. There's also chilblains, which can come from exposure wet cold, again non-freezing conditions, and sometimes that can be mistaken for frostbite because you can form things like blisters with that too.

Again, this is a different condition, but it's important— I think that probably ER doctors see this. I— Well not probably, certainly ER doctors can see this, or like urgent carers. But then there are a lot of us in the medical profession who, if you're not like me and you don't work in a shelter for people experiencing homelessness, you might not encounter a lot of these things, and so differentiating between them is really important.

And then also knowing what we can do about it. That's the next big step. What have we done about it through history, what have we learned, and what do we know to do about it now? Because I think if you don't know what to do about it… then you might just think we should amputate everything. And it's a little more complex than that, so I'm gonna tell you that, but first we gotta go to the Billing Department.

Justin: Let's go.

[transition theme music plays]

[ad break]

Justin: Alright Syd, sorry about the interruption from us.

Sydnee: So I wanna— what have we learned about frostbite through the years? As you may imagine, a lot of like the early medical writing about frostbite came from the military.

Frostbite really used to be a condition that we associated with people in the military, with armies, with you know, I mean that was where we kind of assumed we would see frostbite. This is really not true now, but a lot of what we learned about kind of comes from that. So like most famously, if we go back to… Napoleon's surgeon Larrey, Dr Larrey.

Justin: Okay.

Sydnee: Famous surgeon, kind of came— I'm sure we've talked about him on the show before. Kinda came up with the first MASH units.

Justin: Oh yeah, okay.

Sydnee: Like that like the precursors to that were inventions of Larrey, so very famous surgeon, lots of technique, lots of technical understanding of surgical procedures came from him. But also was… responsible for how we use to treat frostbite, came up with the first methods to treat frostbite.

So Larrey, obviously with Napoleon, you know, marching through cold areas for very long periods of time, saw a lot of frostbite, saw a lot of soldiers with, you know… injured toes and hands from frostbite.

Justin: Mm.

Sydnee: And noticed that if these soldiers then took their frozen digits and warmed them by the fire very quickly, that then what would follow is necrosis, so they would turn black and fall off.

Justin: Mm.

Sydnee: Necrosis and tissue death, and he did many amputations for this, right.

Justin: Right.

Sydnee: Like that was the treatment. If it turns black, cut it off.

Justin: Right.

Sydnee: Which you don't necessarily— On that note, in case you're interested, you don't necessarily have to cut it off. It can fall off on its own.

Justin: That's something.

Sydnee: But you have to monitor for infection. 'Cause if it's infected, you don't wanna just leave it.

Justin: That's something, yeah.

Sydnee: But anyway, so that— so did a lot of amputations but also noticed, and did— kind of made this association that I think that it is this rapid rewarming that's causing the damage. Now let me just go ahead and say right now, that is not true, and that is not how we treat frostbite anymore. In case you've— [chuckles]

Justin: [chuckles] In case you've been listening to this episode, just like fast forwarding like, "Okay okay okay, but how do I treat it?"

Sydnee: Right, but this is not the end, so please don't— We changed this, but at the time, the common knowledge, or the common wisdom, is that you need to rewarm the limb or whatever slowly. And the way that Leray actually did it was with snow. So you would coat the hand or toes or whatever in snow, and then slowly rewarm.

Justin: Oh okay.

Sydnee: Very slowly warm. This… Really, this concept that we needed to very slowly rewarm the limb has permeated medical thought for I mean de— I mean hundreds of years after this, like—

Justin: That there would be a shock if we did it too fast, right?

Sydnee: Well, and this is based— this is the other piece of it that we really haven't talked about. So like the tissue damage that occurs from the lack of blood flow can be amplified from the rewarming. So you can get what's called a reperfusion injury, which it's exactly like it sounds. So "perfusion."

Justin: [scoffs] What do you think it sounds like? [wheezes]

Sydnee: Well, okay.

Justin: [laughs]

Sydnee: [chuckles]

Justin: [snorts]

Sydnee: Sometimes I lose track of what is—

Justin: Okay, it's exactly what it sounds, it's just a perfusion situation.

Sydnee: Okay.

Justin: [wheezes]

Sydnee: Perfusion meaning blood flow.

Justin: Okay.

Sydnee: So you didn't have perfusion, now reperfusion has occurred, and with reperfusion an injury results.

Justin: Got it.

Sydnee: And it is as the blood flow returns and you've got like all of these little clots and inflammatory factors and all these kinds of stuff, you can have even more damage to the tissue at this point, okay?

Justin: Mm, okay.

Sydnee: So he was observing that, but the thing is that was goin to happen, right?

Justin: Right.

Sydnee: So he was attributing the necrosis to the fire, to the rewarming, where like the damage has been done.

Justin: It was not from that, right.

Sydnee: So what we all— what we know nowadays is that there is a reason to rewarm things more quickly, but it took us a long time to figure that out, and because of… Larrey's observations and this recommendation that you very slowly rewarm limbs.

Justin: Mm-hmm.

Sydnee: Him using snow, for many, many years, through a lot of military campaigns, that was exactly what people did. They very slowly rewarmed their limbs.

Justin: Mm-hmm.

Sydnee: And then probably ended in an amputation at some point.

Justin: Right.

Sydnee: It was a re— and that's why, you know, I'm talking about like a surgeon was the precursor for this. It was a surgical condition is what the thought was.

Justin: Mm-hmm, mm-hmm.

Sydnee: Either you won't do anything, or you'll cut something off, there wasn't really a lot of anything in between that.

Justin: Right.

Sydnee: And if you look back like to World War II, there were only— like just the German army, there were 150,000 limb amputations performed.

Justin: Wow.

Sydnee: Due to frostbite.

Justin: Wow.

Sydnee: So in the US army, there were 91,000 so a lot of amputations resulting, you know, because we just didn't know what else to do for it yet.

Justin: Yeah.

Sydnee: There were some studies that had been done back in the USSR in the 1930s that looked at like, "I'm not sure that this slow rewarming is really the best thing."

Justin: [chuckles] "Let's try."

Sydnee: "And maybe—"

Justin: "Doesn't make a lot of sense."

Sydnee: "Maybe we should it more rapidly," and they actually found some protocols at the time, some rapid rewarming protocols that the evidence was starting to show like, "Yeah, this might actually be better," but nobody really read it until many, many years later.

Justin: Perfect.

Sydnee: When it was translated into other languages. Like at the time it was just sort of the USSR did these studies, they had this knowledge, and it kind of stopped there. [chuckles] Stopped at the borders of the USSR.

So throughout World War II we weren't able to benefit from that knowledge. We finally figured a lot of this out in the early '60s. Now before I get into what we do about frostbite now and how we figured that out, Justin when… You have your own story.

Justin: Yeah.

Sydnee: Theatrical story of frostbite.

Justin: My own incredible story. No, it's not like… [mutters] It's— Okay, there's a play called *Terra Nova*, written by Ted Tally, it's about a journey to the South Pole.

Sydnee: Mm-hmm.

Justin: It's the— a sort of race to the South Pole that was conducted by Robert Falcon Scott and an Englishman, and Roald Amundsen, who was a Norwegian, and—

Sydnee: This is one of the most famous examples of frostbite in history, by the way.

Justin: Yeah.

Sydnee: All my frostbite research talked about it, but you know more about it than me, so I wanted to let you—

Justin: Well I don't know if I know more about it than you. I played Amundsen when I was in college, so I think that this period of time is really fascinating. And it is a play where when I mentioned earlier— Well actually Sydnee, I'm kind of excited because I've prepared a— brief scene for you, and if I could just have a moment.

Sydnee: Oh, okay.

Justin: [from a distance] Here you go. I thought this was such a rare treat. [normal] We never get to do this on *Sawbones*.

Sydnee: Okay.

Justin: Is to have sort of like a theatrical component, right. 'Cause we both are—

Sydnee: No, I love it.

Justin: — are theatre people, right. So the longer page is the first page of it.

Sydnee: Okay.

Justin: And Wilson was the doctor on the expedition.

Sydnee: Yes.

Justin: So he was the one who was reporting to Scott who was leading this expedition, which by the way, the context of this is Roald Amundsen and Scott were racing to the South Pole. Amundsen beats— After being the first maybe— He's a— Amundsen is definitely the first person who got the North Pole where it is verified, there are other people that have claim to it before then.

Sydnee: Sure.

Justin: But then he is definitely the first person to the South Pole, he beats Scott by five weeks, and on the way back from the Pole, after they discover this, they miss a— It's not their fault, there is a sled dog company that Scott and his company were supposed to connect with that was not there, despite his orders.

And it was also much, much, much colder than they had anticipated, like negative 40 degrees, it was miserable. So, the expedition fell apart, they all died. One thing that's interesting about Scott, his party, they did— they failed to reach the South Pole, they failed to— I'm gonna cry.

They failed to reach the South Pole, they kept their spirits together somehow on the way back, they all died, but amongst their possessions was a fossil, and it was the first fossil that had been discovered on that continent. And that fossil allowed them to prove that Antarctica had been part of the mega continent.

Sydnee: Pangea.

Justin: That it had been part of the Pangea because they had discovered this fossil that was among their corpses. That's some metal science for you man. So okay, you're gonna play Wilson.

Sydnee: Okay.

Justin: Okay, and I'm gonna play Scott, and we're talking about Oates, who that's who Jason played, but that's not—

Sydnee: He's not doing well, it doesn't seem like.

Justin: No, Oates is having, like many of them, having a really, a really tough time. But this is a scene where Scott is asking about Oates's state, and Wilson the doctor is reporting to him. Now I played Amundsen.

Sydnee: Mm-hmm.

Justin: So I don't know what I'm gonna be able to bring to this role, I'm not gonna bring my Norwegian accent obviously to it, so you know, bare with me.

Sydnee: Okay. Okay.

Justin: So start with a Bower— I'll give you your cue. "Bowers, he's fainted," okay.

Sydnee: Okay. Okay.

Justin: This is about Oates, okay. "He's fainted."

Sydnee: "Lord. His toes have come off in the boot."

Justin: Yeah okay, so they were all pretty British, like—

Sydnee: Oh, I can't do a British accent.

Justin: Well, we'll try. Okay, ready? "He's fainted."

Sydnee: [attempting a British accent] "Lord, his toes have come off in the boot." [chuckles]

Justin: This is the greatest moment of my life. I would ask that it continue.

Sydnee: "Three of them." [chuckles] No, I can't do it, I would have to do like a—

Justin: I would ask that the greatest moment of my life please continue. Why would you deny me—

Sydnee: "Flesh off the bone like a glove."

[phone notification dings in the background]

Sydnee: "Medical kit!" [chuckles]

Justin: Is your phone on during the greatest moment of my life?

Sydnee: No, it was— Yes. Sorry.

Justin: "Scott hands the kit to Wilson, who removes a vial and syringe, and prepares an injection." The narrator's American, I decided. [chuckles]

Sydnee: Oh. [attempting a British accent] "I can give an injection of morphine, that's about it." I don't know how this—

Justin: Stop, Syd please, you've gotta stop editorializing, just be in the role, honey.

Sydnee: Why'd you make me do an accent?

Justin: [sings] "Think of how to use it, use it on the stage."

Sydnee: I can't do any accents.

Justin: "Scott helps him to roll up Oates's pant leg and under legging, exposing blackened flesh. Wilson injects the thigh."

Sydnee: [in a British accent] "There. I don't think there's much feelings from the knee down. The pain is gangrene creeping into the thigh muscles."

Justin: [in a British accent] "What are his chances?"

Sydnee: [in a British accent] "If I keep him pumped full of morphine, he might able to hobble another week, only because he's as strong as a bull. Another man would've collapsed days ago. After that, I don't know. Perhaps if he were on the sledge, we had the strength to pull it."

Justin: [in a British accent] "But what were his chances?"

Sydnee: [in a British accent] "He hasn't any, not a hope."

Justin: [in a British accent] "Even if we carry him?"

Sydnee: [in a British accent] "This kind of decay is irreversible. If we tried to carry him, the effort, weak as we are, could kill us all. It's a horrible thing to say but we were lucky with Evans, and Titus, he's already slowed us down so badly. Well, if he doesn't die within the next few days, we're going to be in a very desperate position, Robert."

Justin: [in a British accent] "Does he know it?"

Sydnee: [in a British accent] "In his heart, perhaps. But you know Titus, he'll march until he drops."

Justin: [in a British accent] "Wilson… How much opium is in your kit?"

Sydnee: [in a British accent] "Hmm… Tablets, 120 of opium and one vial of morphine. Enough to last him perhaps 10 days."

Justin: [in a British accent] "I wasn't thinking of Titus at the moment. That's 30 tablets each, and morphine. That's enough for a lethal dose if we took it all at once, isn't it?"

Sydnee: [in a British accent] "I'm not even going to listen to this."

Justin: So, scene.

Sydnee: Whoa, did they take all the morphine, or did they just die?

Justin: You'll have to come to my production—

Sydnee: Oh. [laughs]

Justin: — of *Terra Nova* to find out. My one-man *Terra Nova*.

Sydnee: I think this is really well reflective of the understanding— Well first of all, like the— it's well represented, the swelling and then the toes that have already fallen off.

Justin: Yeah.

Sydnee: Which does happen. And then they talk about it's irreversible, I mean that's— it's a good representation of it. And that— And at that point like you weren't going to be able to control the infection that would set in.

Justin: Mm.

Sydnee: That's very sad.

Justin: It is, it's very sad, and they were— It's an interesting journey Scott has go— I'm not obviously an expert in— in any of this, but it's interesting Scott has been sort like he was hailed as a hero when it first

happened, and then there was a time period where people kind reexamined and were like, "Well, maybe he was a little bit foolhardy and led these guys to their deaths."

And then it's been another like very modern wave of like, "Actually, it seems like he was doing his best, he got kind of a bad break." [chuckles] So it's been kind of like back and fort, so.

Sydnee: That's humanity, isn't it.

Justin: It's— It's a fascinating time. It's a really good play too, if you ever get a chance to see it, it's great.

Sydnee: Well, we learned more about frostbite too late for these guys unfortunately, but in the '60s there was a Dr William Mills who did a lot of research in Anchorage, Alaska establishing a rapid rewarming protocol for frostbite, which we now know is better because every hour that you delay treatment for frostbite results in 28% more tissue death.

Justin: Hmm.

Sydnee: So there is a— there's a reason that why we— Larrey was wrong, we didn't wanna do the co— the snow slow rewarming process. Basically we wanna put the extremity, whatever is frostbitten, into a circulating water bath.

Justin: Mm-hmm.

Sydnee: That is held between 104- and 107-degrees Fahrenheit, that's 40 to 42 degrees Celsius if you are in most of the world, other than here.

Justin: Yeah. [chuckles]

Sydnee: [chuckles] So really warm, and they usually like to do this kind of thing in a burn center. Frostbite's treated, it's very similar to a burn.

Justin: Mm.

Sydnee: I know it seems counterintuitive, one's really hot one's really cold, but the tissue damage is pretty similar. And honestly—

Justin: It's not because you're— Here's how I— Here's a good thing— way of thinking about it though, you're basically talking about freezer burn.

Sydnee: Yeah.

Justin: I mean it's the— it is the same process, right? We're referring to it by different names, but really that idea of like the outside being damaged by the freezing and the— You know, the— that outside being damaged, like we're talking about freezer burn.

Sydnee: Yes.

Justin: Except for humans.

Sydnee: Yeah.

Justin: It's gross to say that.

Sydnee: And there is a slightly— Most of what I'm talking about in terms of frostbite is a result of atmospheric frostbite, you're out in a cold place. There is also like contact frostbite, if you can imagine touching an extremely cold thing.

Justin: I don't have to. Flip did it for us in *A Christmas Story*, we know what contact frostbite is.

Sydnee: So— [chuckles]

Justin: He lick— You lick the flagpole.

Sydnee: So there you go. So there's also, and that's slightly different. Now most of what I am caring for is— Well actually I can't think of any cases of contact frostbite, I am taking care of people who are outside in the cold too long.

And… now we know that we wanna rewarm faster. Ideally you're gonna be treated inside some, like I said, inpatient, in a hospital, in a burn center.

Justin: Right.

Sydnee: You're— You can have these—

Justin: Inside—

Sydnee: Although—

Justin: Inside being the— "In" being the operative preposition here. [chuckles]

Sydnee: Inside. [chuckles]

Justin: Inside somewhere.

Sydnee: Although as I was thinking about this, like I could easily get like a sous vide situation going I feel like at Harmony House.

Justin: You gotta stop bragging. Again, your ability to sous vide human hands is cool, but like—

Sydnee: Can— Well can you— Can sous vide hold it at that low of a temperature?

Justin: Yeah.

Sydnee: I don't—

Justin: Yeah, what kinda temperature?

Sydnee: 104 to 107 degrees.

Justin: Oh absolute—

Sydnee: Fahrenheit.

Justin: I mean, your— that is like… jacuzzi temperature.

Sydnee: That's what I'm saying, like—

Justin: That's for the jacuzz.

Sydnee: Well I want somethin' I could—

Justin: Do you want… jacuzz? Would that be a good?

Sydnee: No, I don't have room for a jacuzzi.

Justin: Would that be—

Sydnee: In Harmony House.

Justin: That would be a cool shelter for people who are experiencing homelessness—

Sydnee: I wanted an exam room.

Justin: If it's just like, "This— And this is our jacuzz."

Sydnee: No, but I could make a little sous vide bath, I feel like.

Justin: Yeah.

Sydnee: And help treat frostbite bet— This has inspired me, like I've learned about this and I'm like, "Oh, I could maybe get this better."

Justin: Let's get this goin' today, Syd.

Sydnee: Because we wanna rewarm things, and then the other thing with frostbite, and this is where this new medication comes into play. So we have known for a while that you can use clot busters in some cases of frostbite.

So we know that blood clots are part of it, and we have medicines that are in this class, they're called "thrombolytics," they break up— they lytic, they lice, "lytic," it means break up. And "thrombus" is a clot, so they break up clots.

And there is a whole bunch of drugs like that that we could probably be using to better effect, but honestly we don't think about it a lot. We see frostbite and we're like, "Ooo, you're gonna lost that," and I don't— and part of that is when people present.

Justin: Mm-hmm.

Sydnee: Part of it is I have only a couple of people who I can think of who came in and said like, "I think I just got frostbite." Most of what I see is "I have— I got this injury last week, and here's the result."

Justin: Mm.

Sydnee: You know what I mean?

Justin: Right.

Sydnee: So I… Unfortunately, by the time I'm seeing it, I couldn't do this. But if you are seeing it fast enough, you can give medications that might break up clots, and specifically there's a brand-new drug called iloprost, which was just approved by the FDA last year, it's the first drug approved specifically for frostbite.

They've already used this before in things like Raynaud's, which is a specific disorder that's totally unrelated to frostbite, but similarly causes your blood vessels to close up and cut off blood supply briefly to an area. So same idea. To open up these blood vessels, that's basically what this medication would do. Open back up blood vessels to limit the tissue damage that's occurring, right?

Justin: Okay.

Sydnee: So it's really cool that there's a medication out there now, it's an IV thing, it's an injection, it's not something that I can have on hand like in a shelter. But it's a really important thing for doctors to be aware of, 'cause if you are in an ER and you see an acute case of frostbite, you may be able to save a limb.

Justin: Mm-hmm.

Sydnee: And we could reduce the number of amputations that are performed, or the sort of like— What I see more often is this kind of passive, auto-amputation attitude, like, "Well, there's nothing I can do for that finger, you're not gonna— It's going to fall off. Be prepared."

Justin: Right.

Sydnee: And then people are just sent out to— Which is a lot to cope with, by the way.

Justin: Mm-hmm.

Sydnee: Like you're— Like that toe or finger is gonna fall off at some point, just deal with it. And it's a— especially a lot to cope with if you're someone who lives maybe in, you know, either outside, you're camping, or you're trying to stay in abandoned houses, and so you're not able to necessarily like keep everything as clean as you would like to.

Justin: Mm-hmm.

Sydnee: Like that's a really intimidating thing to leave people with. So if there are drugs and methods that we could use to salvage that tissue… obviously, that would be ideal.

And then the goal would be that we can see a day where we reduce the number of amputations. There was— There has always been this sort of adage in medicine that like frostbite in January, surgery in June.

Justin: Mm.

Sydnee: That eventually that's the— like that's what's gonna happen. And this is a really exciting area of medicine where maybe we're paying more attention to frostbite, and we can find better ways of managing it so we don't necessarily have to lose digits. And it's also very painful.

Justin: Mm-hmm.

Sydnee: The whole rewarming process is extremely painful, that's something to remember. If you were gonna engage in any of this, like a— I was talking about like a sous vide water bath, that's a painful thing.

So if there are things we could do to limit that, that would be fantastic. As you may imagine, one last note about frostbite, the demographic of who gets frostbite now has shifted dramatically through the ages. The military—

Justin: It's not just British explorers anymore.

Sydnee: No. [chuckles] Well the military specifically has a lot— I mean like they have spent a lot of time and effort preventing frostbite in their soldier, like they have gear specifically so they don't lose their fingers and toes, right? That they have the ability to do that.

What we now see as opposed to people in the military getting frostbite, much more often we see people who are experiencing homelessness, people who are severely mentally ill, people who have various substance use disorders, where like maybe because you were under the influence of a substance, you're not able to make the best decision, or you pass out outside, or something like that. Something that would prohibit you from… getting in out of the cold for some reason.

Justin: Yeah.

Sydnee: So we definitely have seen that demographic shift, as well as it can always happen in people who engage in extreme outdoor adventures. I don't know, is it a sport, mountain climbing? Is it—

Justin: Triple X, people like that. Huh, yeah, extreme—

Sydnee: Adventure sport? Adventure sport?

Justin: Expenditure— Adventure outdoors, yeah.

Sydnee: Yeah, I mean certainly that's always a risk. If you are not properly—

Justin: Yeah.

Sydnee: — suited up for those things, so.

Justin: But they love the risk. They love it. They live for it.

Sydnee: Protect your fingers, toes, and tip of your nose, protect your ears.

Justin: Yeah.

Sydnee: And come in out of the cold. I guess I'll tell you like I tell my kids, if they're starting to hurt [chuckles] or go numb, you wanna warm those things up. And be aware of it in the healthcare profession, because this new drug is out, there's more we could do, and this rapid rewarming we could maybe save some fingers and toes.

Justin: And I sent you a link on this sous vide thing, I think it's got legs. Folks, I have terrible news. After I did the best ad read of my life, I had decided to reset my goals on doing the best podcast episode I've ever done in my life, and I'll be darned [chuckles] if I didn't just go ahead and do that first time out, first shot.

So now I don't know what I'm gonna do. I'm gonna have to think about it 'cause I'm obviously in my prime, and there's nowhere to go but down. Thanks to the Taxpayers for the use of their song "Medicines" as the intro and outro of our program, and thank you to you for listening.

[theme music fades in]

Justin: That's gonna do it for us. Until next time, my name's Justin McElroy.

Sydnee: I'm Sydnee McElroy.

Justin: And as always, don't drill a hole in your head.

[outro theme music plays]

[ukulele chord]

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