Sawbones 558: Methylene Blue

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["Medicines" by The Taxpayers plays]

Justin: Hello, everybody! And welcome to Sawbones, a marital tour of misguided medicine. I'm your co-host, Justin McElroy.

Sydnee: And I'm Sydnee McElroy.

Justin: Let's address the elephant in the room, Syd, because I can't… I can't pretend that we're not on the same side of the table right now.

Sydnee: That's true, we are on this—we're not facing each other directly. I have to angle my body to see you.

Justin: And it's very—in theater, of course, we know this is three-quarters.

Sydnee: I'm cheating out.

Justin: Cheating out.

Sydnee: I'm cheating out.

Justin: Cheating out.

Sydnee: Mm-hm.

Justin: Yeah, but we're always sitting on the same side of the table. I don't think it's gonna change the energy that much. At least, I hope it's not.

Sydnee: I was hoping it would bring more of a live show energy, because we do this in a live show.

Justin: Yes, that's true.

Sydnee: So… although, generally, that is accompanied by people cheering for us. More loudly for me, I would just like to note, usually more loudly for me. So, I am missing that.

Justin: [spoofs someone cheering at a live show] Yeah, Sydnee! Yeah, Sydnee, yeah!

Sydnee: That's pretty good. That's pretty good. We'll work on it. You can build up to—

Justin: [spoofs someone cheering at a live show] Your husband's great too! We love him too!

Sydnee: Can't you get me—can't you get me a machine? Don't—aren't there machines that do that?

Justin: Oh, applause machines?

Sydnee: Mm-hm.

Justin: They have actually condensed a lot of those just onto phones. [chuckles] It's just—they're just buttons. It's just buttons. It's all—

Sydnee: You have a whole machine for white noise, I don't know why you wouldn't get a whole machine for applause?

Justin: That's true. Me, specifically, I think could use that in my day-to-day life.

Sydnee: I think you would make more use of that than a white noise machine.

Justin: I mean, around the house, I would love a little bit of extra support.

Sydnee: Mm-hm?

Justin: I don't feel like I'm getting a lot of, you know, that reinforcement from you and the girls sometimes. And the cats. I don't feel like me or the cats are getting enough positive reinforcement.

Sydnee: Justin, I'm excited to talk about our topic this week, because I encountered it in the wild.

Justin: Ooh?

Sydnee: And so, sometimes something that's sort of pseudoscientific or… not necessarily based in good science, not necessarily evidence-based, will pop into my own Facebook feed, through people that I know.

Justin: Sydnee, you gotta understand, Sydnee is keeping the AI guessing. Sydnee is keeping the algorithm guessing, because it's—they cannot get a beat on this lady!

Sydnee: [chuckles]

Justin: Because as much as she looks into pseudo-scientific nonsense, she's also looking into like… real pills and stuff.

Sydnee: Real pills and stuff! That—

Justin: I don't know…

Sydnee: That's the website we use. That's what they tell you, when you start medical school, they're like, "You don't need to learn anything here. Just go to realpillsandstuff.net." [chuckles]

Justin: Just because I'm a patient, doesn't mean I should be patronized, Sydnee.

Sydnee: Sorry. I'm sorry.

Justin: What are you talking about this week? What did you—what did you discover? What did you encounter in the wild?

Sydnee: Okay, in the wild, I encountered methylene blue being used for, in the post that I saw, being suggested as a possible cancer treatment.

Justin: Yes.

Sydnee: Yes. I was outraged.

Justin: Uh-huh?

Sydnee: I responded. I normally don't—I am that person, I responded. I was outraged and I thought, why would a medical professional be recommending methylene blue in this way? What is—where did this even come from? And then we got an email from Priya, thank you, Priya, who is also a fourth-year medical student, so good luck. Good luck in your fourth year. You get lots of vacation that year.

Justin: Nice!

Sydnee: Yeah, it's the—I mean, you're supposed to, because you gotta go interview and stuff.

Justin: Yeah.

Sydnee: So, it's a good year. You should choose family medicine. I'm not biased, but you should, because everyone should. I'm biased.

Justin: And also, she is biased.

Sydnee: Yeah, I am. It's great! You need to do everything! Anyway, but Priya also asked about methylene blue as a new sort of wellness trend. And so, then it clicked; okay, this isn't just this one person that I happen to know on Facebook touting methylene blue. This is part of a larger… fad.

Justin: A new cool, thing.

Sydnee: So, what is methylene blue? Why are we talking about it in medical circles? What are the legitimate medical uses? And where do things get a little wonky?

Justin: You're asking me that, and it's sending a real panic through my body, Syd, because I had not heard of this stuff until about two minutes ago, so I don't know! I hope you were not relying on me for this. [chuckles]

Sydnee: I have 'em all. I have—I have it all. I know it all.

Justin: *Whew*! Okay. [chuckles] Normally, over at that side of the table, I'm able to read you a little bit better. But like you're in my periph now, and I don't know, I'm flying blind.

Sydnee: So, tell me about it, Justin. Do you—so, if you had to guess…

Justin: [chuckles]

Sydnee: Wait, if you had to guess what methylene blue was—

Justin: Don't—[titters]

Sydnee: What would you guess it is?

Justin: Well, because the truth of the matter is, I was thinking… I figured it was the stuff from Breaking Bad! I figured it was the stuff from Breaking Bad—

Sydnee: You thought it was meth?

Justin: He made blue meth, notably. In Breaking Bad, he made blue meth, so like… I used context clues, I don't know? I'm doing my best.

Sydnee: Let me ask you a quick question about Breaking Bad. Did he make meth that was just blue, or did he color his meth blue so you would know it was his meth?

Justin: Oh, no, no, no, his—

Sydnee: Like as a hallmark of his meth?

Justin: Walter White's stuff was just—it was just blue, but it was *the best stuff*. Like, he wouldn't use artificial dyes. Later on, I think some of the other guys in the drug… fight, they started dying theirs blue. [chuckles] To kind of like… to compete.

Sydnee: Just to—because like, to—

Justin: With Heisenberg.

Sydnee: Some real-world context—

Justin: Yeah.

Sydnee: Often—

Justin: Mine—sorry… Mine was from Breaking Bad, so it was—

Sydnee: Right, so not real-world, like that—

Justin: That's—that has been thoroughly researched!

Sydnee: That's a television show.

Justin: It's thoroughly researched!

Sydnee: Television show.

Justin: Thoroughly researched.

Sydnee: In—

Justin: Vince?

Sydnee: In our community—

Justin: Thoroughly researched.

Sydnee: The color of a certain product usually has nothing to do with what's in it. It's that the person who's selling it might add colorant, so that you know like this is so and so's stuff.

Justin: Right.

Sydnee: And so sometimes we will say like, "Oh, watch out for the pink stuff." But it's not because there's something about it that makes it pink.

Justin: Yeah.

Sydnee: It's that we know right now, that, wherever that's coming from, has bad stuff in the supply.

Justin: So, stay away from the pink stuff. But do try the gray stuff. It's delicious. Believe me. [titters]

Sydnee: But it can change. More recently, it was the purple stuff. So you never know.

Justin: Yeah.

Sydnee: So, the color is not always—

Justin: Purple stuff—I hate when my mom gets purple stuff and I just want Sunny D, you know?

Sydnee: [chuckles]

Justin: Do you have any other color plus stuff? Because I would like to see how many others I can do. [titters]

Sydnee: The most recent—well, there was the yellow stuff for a while, but most recently, it's been pink and purple. I don't know.

Justin: I don't have anything for those.

Sydnee: Anyway. So, as you—I thought you might guess methylene blue is a dye, because it's… got blue in the name.

Justin: Okay.

Sydnee: So, it sounds like a dye.

Justin: Yeah.

Sydnee: Do you know why? Because it is. It was a dye first. Like, it was—

Justin: That's cool.

Sydnee: It dyed things. It was synthesized—

Justin: Blu Cantrell also has blue in her name, and she's not a color, notably, she is the singer. So, I don't know what your point is.

Sydnee: Okay, well, it was a dye, that was—

Justin: Okay.

Sydnee: It is a dye. Initially, that's all it was. Synthesized in 1876 by German chemist Heinrich Caro, it was a very pretty blue. It was used in textiles.

Justin: We used to get so wild—

Sydnee: That was it, that was the end.

Justin: We used to be so wild about—I know blue and purple especially. We're wild about this stuff, because we don't get a lot of blue and purple in nature. And we've done some wild stuff to get blues and purples over here.

Sydnee: Mm-hm. And we made the synthetic dye, and we were all very excited. And the crossover point—because then, how did we end up using a dye as a legitimate medication? Because it is. I mean, that's the thing. There

are things we legitimately use methylene blue for. How did that happen? Okay. The crossover is probably the advent of staining techniques in the laboratory, so we realized as we developed microscopy.

So, we can use a microscope to look at small things. Just getting the small thing onto a slide, that's not always enough, because we're looking for certain structures, and maybe we need to highlight different pieces. And so, we started playing around with dyes to stain different parts of the specimen, so that we could look at specific structures or features, or just look at like a bacterial pathogen and not the tissue it was invading, that kind of thing. Does that make sense?

Justin: Yeah.

Sydnee: So, we started putting stains and dyes on tissues and organisms in a laboratory setting, because of that.

Justin: Hm. And we noticed in the process of doing that, that something was up?

Sydnee: Well, we did, because as we started using them to highlight specific tissues or pathogens, we noticed that they would selectively bind, sometimes, to just the pathogen.

Justin: Mm-hm!

Sydnee: And so, that was intriguing, because if this is a substance that I can put in a human body, and it's only going to attach itself to the invading organism, what does it do to the invading organism? You know, I'm looking under a microscope and maybe everything's already dead, but if I put it in a human body, will it kill the organism and leave the human body alone? Because then, all of a sudden, we got a medicine, right?

Justin: Oh!

Sydnee: Like if—[titters]

Justin: Medicine.

Sydnee: Well, maybe!

Justin: There you go!

Sydnee: Maybe. We got a medicine.

Justin: Oh! Medicine, right there.

Sydnee: And it's great, because then we're—one, we're gonna turn it blue. [chuckles] And two, we're gonna kill it.

Justin: Yeah!

Sydnee: Which is the goal.

Justin: Yeah.

Sydnee: Turn it blue, kill it. So, that's probably the crossover point. And there was like a lot of interest at that time period, when we were moving into like the late 1800s, in these stains and dyes, these synthetic substances, using them as some sort of treatment for something.

Justin: Mm-hm.

Sydnee: So, this—and that is probably why it came to be. "We use them to stain things, let's put 'em in—"

Justin: Yeah, "You put 'em on stuff, let's see what happens!"

Sydnee: Right, "Let's put 'em in living humans." And this was—and it probably started with Koch, of postulate fame. Koch's postulates, we've talked about on the show before. Paul Ehrlich was really the one that first started experimenting with different dyes and like, how would they attack different microorganisms? And we know—he knew—you'll see these really pretty cross sections. If you ever look up like methylene dye as a stain, they would do like cross sections of like—

Justin: If I—sorry, say again?

Sydnee: [titters] If you ever look up methylene blue as like a stain, like a laboratory stain, or a tissue stain—

Justin: Yeah, mm-hm?

Sydnee: You'll see these beautiful cross sections of like the human brain with specific pieces of it dyed blue.

Justin: Okay, cool.

Sydnee: Is that the kind of thing you find beautiful, maybe?

Justin: Yeah, of course. I feel like if I was the kind of—

Sydnee: Do you? [titters]

Justin: Person that finds that beautiful, I probably already would have searched for images of methylene blue. But I don't know, maybe I just missed out.

Sydnee: Well, I did—do you want me to—I mean, I have—they're saved. I could pull 'em—

Justin: Let's save—

Sydnee: I don't have them pulled up, but I could.

Justin: Let's save it, and I'll put it on the big screen upstairs, and we can really get into the details and stuff, because I got a lot more pixels up there. We can really get into it.

Sydnee: He noticed that you could do this even in like living human tissues. And so the thought was like, "Ooh, okay, so this is… you know, this is safe." For the most part, inert. I mean, it's not, and we'll get into that, it's not completely without risk, but like, it's a safer substance to put in human

body. And it binds specifically, we figured out, to the parasite that causes malaria.

Justin: Mm-hm!

Sydnee: And so, as early as 1891, we started proposing that maybe methylene blue could be used to treat malaria. Because when we put it in a human body, it attaches itself to the malaria parasite, the plasmodium, but it doesn't harm human tissues.

Justin: Hm…

Sydnee: So, great. So, there were some studies done in the late 1800s to look specifically at, hey, could we, instead of the other medications we have for malaria, would this be a safer, less side-effecty kind of route, right?

Justin: Okay.

Sydnee: And basically, what they found is, it's not as good. Does it work? Yeah, maybe a little. It's kind of like—

Justin: Is it pretty?

Sydnee: It's pretty!

Justin: It's pretty!

Sydnee: It's pretty.

Justin: And it kind of works. [titters]

Sydnee: But it's not—so, a lot of times, if we're trying to—

Justin: Hey, pretty and kind of works is better than crystals?

Sydnee: [titters]

Justin: That's only half of it.

[both chuckle]

Sydnee: I mean, honestly, like, I think this lesson and the fact that they latched on to this so quickly, I mean, we're talking, again, we're still developing how we go about, you know, making therapeutics. And the idea of a synthetic drug is still pretty new.

Justin: Mm-hm.

Sydnee: Something that you just made in a lab and then put in a human, that's still—I mean, this is probably the first one.

Justin: And it's blue, which we still are using for medicines to communicate that they're futuristic. Like, I still think if you see like a little blue vial in a movie, it's like, oh, that's—don't drop that! Because we're all dead if you drop that. [chuckles]

Sydnee: Exactly, exactly. And so, they—but they looked at this, and they did the studies, and they compared it to quinine, which was the treatment of the time, that was what most people would have received for malaria. And what they found was that it was not as good. It was—what you're looking for is what is called non-inferior. You're testing a new drug, is it not inferior to the existing drug? That's the study you want to do.

Justin: And quinine is naturally occurring, right? Or are we refining that?

Sydnee: Well, no, we were—we got it out of the bark of the cinchona tree. So, yeah, it was… yeah. But we… what we found is that methylene blue was not as effective, and so it did not supplant quinine as the primary treatment. And I think that that—the fact that that was latched on to so quickly is informative. Because I find stuff today that people will be like, hey, if you take, you know… red rice yeast is a great example. People will say you should take that instead of a statin medication, to lower your cholesterol. Well, it doesn't work as well. And if you take really high doses of it, it can have the same side effects as statins do. So, it doesn't—the fact that it's natural doesn't help.

Justin: Yeah.

Sydnee: Does that make sense?

Justin: That's a bias.

Sydnee: Right.

Justin: It's a bias to think that something is natural, and thereby it is more effective.

Sydnee: So, in this case, they did the study, and they found, eh, it doesn't work better. And this also wasn't natural, so maybe that was biased too. Also, it can kind of turn things blue. So like your pee was blue if you took it, sometimes the whites of your eyes, the sclera would turn blue. [chuckles] So—

Justin: That, okay, pee is blue when you took it is huge. For me, I think that would be so exciting. You know how excited I get about asparagus, and what a rewarding system that is for me.

Sydnee: Mm-hm, that's true.

Justin: And I wish more foods kind of rewarded you. Not a reward, necessarily, but like a, "I noticed, I see you." You know what I mean? Like, it makes me feel like my body sees the… what I'm doing for it. And the fact that it's like, I could make my pee blue, I feel like that would be my body saying like, "Thank you for this medicine. It's working as intended." [chuckles]

Sydnee: I think—I think, actually, what you're hitting on is why, as we get to the end of the episode, you're gonna see a resurgence in methylene blue. I do think people want to see the effect it's having.

Justin: That's right. It's weird that we haven't had—we should look into asparagus. [chuckles] Because I do wonder if people have harnessed the power of asparagus in a refined form, where you take these pills and all of a

sudden your urine is just like off the charts stinky. [chuckles] Unbelievable, the impact.

Sydnee: I will—I was gonna say you're the only person I know personally who wants to eat something to make their pee stinky. But Cooper, our daughter, has said the exact same thing, so…

Justin: So she also told us that she wanted butter chicken this morning to load up on fart power, which we did provide to her, and her sister, who are—both of them are going to be on a bus today.

Sydnee: Listen, I would rather eat butter chicken than eggs and bacon, so…

Justin: It's like, I don't understand butter chicken at 6:45AM though. I like legitimately don't get—it sends me for a loop. I feel like I'm in a David Lynch movie every time I open a container and I'm like, "Okay, sure!" [chuckles] I *love* butter chicken; I *love* chicken tikka masala. It is like, it would be like—[chuckles] it would be like waking up at 4AM and putting on a tuxedo, and going into a swimming pool. It's madness.

Sydnee: With their paper towels as napkins tucked into their shirts, so they don't get butter chicken on their school clothes. [chuckles]

Justin: It's like, what…

Sydnee: So cute.

Justin: Anyway.

Sydnee: Anyway! So…

Justin: You don't care about our kids!

Sydnee: Yeah, they do.

Justin: Pff…

Sydnee: They do. So, in 1932, we found some more uses. So now that we knew methylene blue could do something, then it, you know, kind of opens the door for what else could we do in the human body with methylene blue?

Justin: [chuckles]

Sydnee: And I mean, that's true for a lot of things. If we find something—

Justin: I'd say it's true for anything. [chuckles]

Sydnee: That kills germs and doesn't kill humans, we're gonna keep playing with it and see what else it's got.

Justin: Yeah, give it a shot.

Sydnee: Right? So, we found—Dr. Matilda Brooks, a cellular biologist at UC Berkeley, in 1932, found some other uses for methylene blue. I do want to note, I think it's really interesting, I was reading about Dr. Brooks, her and her husband were hired at UC Berkeley at the same time to both do research together in the same lab. So, they were researching together. She was technically working as a research assistant to him, because they had an anti-nepotism policy.

Justin: Oh?

Sydnee: So, she—they couldn't both… basically, she didn't get paid. She wouldn't get paid for her work. Even after he passed away, she couldn't be paid for the work she was doing, researching in the lab. But she continued to do her research and work in the lab. Eventually, they gave her—

Justin: Sorry, guys, it sounds like another bad one for us. [chuckles] We did it again, guys. Dagnabbit!

Sydnee: Well, it's just, it's wild. I mean, they wouldn't—they wouldn't pay—she was working? And they wouldn't pay her?

Justin: We gotta stop with this stuff, history, come on?

Sydnee: She was also a cellular biologist, like she had the credentials to work there in the lab. After he passed away, and then, of course, she couldn't live off of his salary—I mean, you know, the rationale at the time would have been like, "Well, he's getting paid. What do you need money for, Lady?" Probably said like that.

Justin: This is my favorite—

Sydnee: "Hey, little lady."

Justin: "Hey, little lady."

Sydnee: "What do you need money for? Your husband's got money?"

Justin: I can't do that character, because I think it will make you mad at me, even though it's just a fun character.

Sydnee: [chuckles] She was given a $500 a year stipend moving forward, basically like, I mean, "I *suppose* you still have to eat, or whatever." They would not like reimburse her for travel or expenses associated with doing her job and presenting her research and findings. So, a lot of it she did on either her own dime or she would write and get her own grants to continue her research.

Justin: Ah, man… I don't know, Syd. That's pretty rough. Guys… man, history, guys? Again! Dang it! [chuckles]

Sydnee: It is not—

Justin: I could really use a W, history. Guys, come on!

Sydnee: No, but listen, this is—this is the best we can do. I cannot go back in time and give Dr. Brooks a fair—a fair salary, right?

Justin: Yes.

Sydnee: I can't do that. I don't have a time machine. Because we'd know, we would know if time travel existed, right? We would know right away.

Justin: Because they won't pay you to be my co-researcher in my time machine project! [chuckles] I'm doing it all on my own!

Sydnee: [chuckles] This is—this is where we reveal that I don't—I don't get paid for any of this. I'm Justin's assistant.

Justin: [chuckles]

Sydnee: We have an anti-nepotism policy here.

Justin: [laughs] Actually, I'm the only one in the McElroy Family Organization that does get paid. Literally, every—

Sydnee: Non one else can get paid!

Justin: Non one else gets paid! Everyone else is an enthusiastic volunteer, learning my trade. [chuckles]

Sydnee: That's not true. I don't want you to think that's true.

Justin: Every night, when we go to bed, Sydnee puts her head on her shoulder—on my shoulder and she says, "I've learned so much from you today, Sweetheart." [chuckles]

Sydnee: "Thank you so much."

Justin: "Thank you so much."

Sydnee: "For the podcast training."

Justin: No, I don't have a trade. [laughs]

Sydnee: So, Dr. Brooks proposed that, because methylene—oh, no, I didn't get to finish my thought.

Justin: I'm so sorry.

Sydnee: So, we cannot go back in time and pay her a fair wage.

Justin: Yeah.

Sydnee: However…

Justin: Yeah.

Sydnee: We can recognize her on this podcast. It is not the same. It is not fair. It is all I have to offer, though.

Justin: It's, you're right—

Sydnee: It is the only thing I can do, which is to recognize her contributions and her hard work, and say her name. It is the only thing I can do, so I can do that.

Justin: And I will say, it is not as good as that recognition at the time. It is better. All they had back then were newspapers. Dusty, old newspapers. This is electronic, and literally six billion people can get at it. Like, it's better. This credit is eternal, digital, eternal, and I think it's actually better than getting in some weird old newspaper at the time.

Sydnee: Yes, I do think the attention is better. I would say that if I were to pull out my Ouija board and ask Dr. Brooks, she would prefer a paycheck.

Justin: Can I ask, do you want a Ouija board, or do you want a time machine? Because it seems redundant to have your Ouija board if you—if the time machine is already functional.

Sydnee: I think—I think we've got to explore all avenues, in science. Let's try everything. So anyway, she proposed—methylene blue is what we call a redox dye. What that means is that, in an oxidized state, it is blue, and then when it is reduced, it turns colorless. Those are helpful when we are doing experiments in a lab, chemical reactions in a lab, to see what happened. Does that make sense? Like if you put it in there and it changes color, you know what just happened.

Justin: Yeah.

Sydnee: And if it doesn't, you know it didn't happen. Okay, so it was already being used in this way. What that means is that it can gain and lose electrons. That's key to understanding what she was doing moving forward. This compound can take an electron on, or give an electron away.

Justin: Okay.

Sydnee: Okay? Cyanide, the poison…

Justin: The apple seeds, it's in that.

Sydnee: But this—but the—we're not talking about apples; we're talking about cyanide.

Justin: Just some trivia.

[both chuckle]

Justin: I learned it from Sawbones.

Sydnee: From a very simplified perspective, the way it works, you know what mitochondria are.

Justin: The generators of the cell—powerhouse.

Sydnee: Powerhouse of the cell.

Justin: Powerhouse of the cell, yeah.

Sydnee: Okay. So, cyanide, very simply, turns off the ability of mitochondria to make ATP, which is the—that's the stuff that makes things go. It's like the energy, right? It turns—it turns that off, and eventually it will starve your cells of oxygen, and you'll die.

Justin: Uh-oh.

Sydnee: That's how cyanide works. What she discovered is that methylene blue can bypass what cyanide is blocking, the point in the chain that cyanide creates a block. Methylene blue can get around that block.

Justin: Whoa, anti-cyanide?

Sydnee: Yes, it can be a treatment for cyanide poisoning.

Justin: This is gonna go in my James Bond novel, unlicensed James Bond novel. Think about it, it's like they get him the cyanide and he's like, "Actually, I have this blue… cufflink." And he's like— [swallowing sounds] And he drinks his blue cufflink, and he's fine.

Sydnee: I mean, that… yes. I mean, because what it—it goes around the blockade—

Justin: That wasn't a joke, that was just sick. [titters] I mean, I don't know, it was cool.

Sydnee: Yeah! I mean, it would be. Probably somewhere, someone has put this in a spy thing, right? Probably.

Justin: Everything's new again, that's not going to keep me from doing it.

Sydnee: [titters] So, she spoke, by the way, she spoke of the—of her findings and this proposed mechanism, like, "Here's a treatment for cyanide poisoning," at the Society for Experimental Biology and Medicine in April of 1932.

I think it's important to note that in December of that year, Dr. JC Geiger, a man, had an article published in JAMA, the Journal of the American Medical Association, titled, "Methylene blue as antidote for cyanide and carbon monoxide poisoning."

Dr. Brooks responded with a letter to the editor, to JAMA, noting that when Dr. Geiger wrote this article, he talked about how he had heard from some other people about how maybe this would work.

And some—there was another guy, another scientist, who told him about some research he'd done to suggest this, and this is how he arrived at these conclusions.

The other guy that he referenced was at her talk in April of that year, passed this information on to this dude, and then he published all the findings. She was not credited, except for in her letter to the editor, where she said, "I'm the one who told him."

Justin: These moments where you're yelling at men I think would be so—a lot more impactful now that we do have the camera. If they were like, "You really gotta just like send 'em out there to—" Like, there's just—

Sydnee: All the men?

Justin: There's one man here, you know? And he's been getting it for thirteen years on Sawbones. What I'm saying is like… let's just send *there*! [chuckles] There's one man here, and *all* the other ones are out there… get 'em!

Sydnee: It just figures, she—like she's not getting paid for her work, right?

Justin: Guys?

Sydnee: A $500 a year stipend. She went to this conference to speak, and she probably paid for her own transportation, her own hotel. She probably had to pay for her own like, I mean, we didn't have PowerPoint yet, so like poster board.

Justin: Guys!

Sydnee: Or whatever. You know, she stood up—

Justin: I'm high and I'm feeling—of us being on the same team right now. It's us versus them for a change!

Sydnee: And she told everybody like—

Justin: She told everybody!

Sydnee: "I have some evidence that methylene blue can be an antidote for cyanide poisoning. Isn't this exciting?" And there was a guy in the audience who was like, "I'm gonna tell my buddy about this." And he went and told his buddy about it, and then his buddy was like, "I'm gonna publish a whole article about it in JAMA, and get all the credit."

Justin: Not now! Look who just said it right. I guess… I guess it takes a good man with a podcast to stop a bad man with a medical journal.

[pause]

Justin: And we'll just freeze—we'll freeze—[chuckles] we'll just freeze it right there! And if we can crop… crop on me where it's like, fixed it. You know? That's good.

Sydnee: I'm done talking about the injustices to Dr. Brooks.

Justin: [laughs] For this half of the show!

Sydnee: For this half of the show. Let's take a break, and then I can—we can just talk about medicine. Okay?

Justin: Okay. Let's go the Billing Department.

Sydnee: Let's go.

[theme music plays]

[ad reads]

Travis: Hi! I'm Travis McElroy, and I'm here with Maria. And we're excited, because this is Member of the Month. Maria, thank you so much for being a listener and a supporter of the show.

Maria: Hi!

Travis: How did you find out about the shows?

Maria: When my daughter was in high school, we kind of connected over TAZ. And she introduced me to Shmanners and Sawbones.

Travis: What made you decide to become a Max Fun member?

Maria: I kind of decided that, with the economy being so difficult, it was worth me giving up my Starbucks to join in with you guys.

Travis: Well, Maria, I owe you a cup of coffee then. At some point, I'll get a cup of coffee into your hands to pay you back.

Maria: [chuckles] Okay.

Travis: Maria, again, thank you so much for your support.

Maria: Thank you very, very much for your time and getting a chance to be the Member of the Month. My daughter was shocked when she found out about it, so I can't wait for her to actually maybe catch a little bit of this. I can rub it in her face a little bit.

Travis: That's what we do it for. Thank you, and thanks to everybody for your support. Maria, have a great month!

Maria: You have an amazing month as well.

Speaker: Become a Max Fun member now at maximumfun.org/join.

[break]

Mallory: Hey, there! Do you like books about various shades of gray?

Brea: Maybe 50 of 'em? Or books about winged men searching for soulmates.

Mallory: Is your E-reader full of stories that would pair well with Barry White in the background?

Brea: We're Brea and Mallory of Reading Glasses, and we have a brand-new show for people who crave reads with just a dash of sriracha sauce.

Mallory: That's right! Every other Friday, we dive into books that could be measured on the Scoville scale, and talk to the people who love them.

Brea: You can find our new show by visiting maximumfun.org/spicy. That's maximumfun.org/spicy.

[break]

Justin: Okay, Syd… Listen, if you want to get fired up at men out there again, I love that, because I love this energy of you and me on the same team. But I'm just letting me know… Queen, because I'm ready to fight for you.

Sydnee: You ready to fight for me?

Justin: Yup!

Sydnee: And Dr. Brooks, for justice.

Justin: And Dr. Brooks, and all people.

Sydnee: Can I—can I say, I will—I did really love the interaction. Like, he published the article in JAMA, she sent a letter to the editor where she was like, "This was my thing, and like I presented it at this conference. Like, there's a record of me knowing it first." And he did respond. Immediately below it, there's like author's response. Because they do that, they have like the—the people who write who are like, "I don't know about this." And then the author gets to be like, "Well, here's what I was thinking." The author—

Justin: And then the next person gets like one more little one. And then the person—then the last person gets one picture, where they're like, "Mm-hm." Or, "*Hm*."

[both chuckle]

Sydnee: They just get a meme now; it's just a meme.

Justin: They get emoji—they get one emoji at the end. [chuckles]

Sydnee: So, the author did respond and said, "It has come to my attention that she blah-blah-blah, and I would like to give her recognition, and I would like to alter my thing to say that she came up with this," whatever. So, he like very quickly was like, "Sorry, sorry, sorry. Oops, sorry."

Justin: But that's the thing about systemic, right? Is like he probably didn't know. [titters] And then he gets to be like, "Oh, that was my mess up." But you don't think about like… why did it happen in the first place, man? It's not an isolated thing, it's—just fix it, guys?

Sydnee: I don't, listen, I don't—I'm not gonna sit here and say he probably didn't know. I don't know, 50/50.

Justin: I'm just saying—I'm saying he might have known.

Sydnee: He might have known.

Justin: He might have known.

Sydnee: And maybe he didn't!

Justin: I bet—can I say, can I actually—

Sydnee: But he probably didn't.

Justin: Can I revise what I said earlier? He definitely did. [chuckles]

Sydnee: Yes!

Justin: I'm sure, I'm actually—he definitely knew now, that's where I'm at. He definitely knew.

Sydnee: I will—this happens—

Justin: You have actually said—

Sydnee: This happens to this day! I'm not gonna sit here and put people on blast that like are alive and live in our world right now, but like this happens to this day.

Justin: So, yeah.

Sydnee: Anyway.

Justin: I thought the first half—because at the end of the first half you were like, "Medicine." And I, can I say, I'm so relieved to hear that that was wrong, and that we're still…

Sydnee: Because we have discovered—unlocked this property of methylene blue as something that can give and take electrons away, it opened the door for it to be used for other medical conditions. And this is where you get to the primary use of methylene blue in medicine, as a legitimate medication, that is still indicated and used to this day, is for a condition called methemoglobinemia, okay?

This can either be something that you inherit, you know, that you just have, or it can be something that happens to you when and you take certain medications. But basically, the iron—you know, there's iron in your hemoglobin, in the heme, there's iron in there, it gets an extra oxygen. And this inhibits its ability to transport oxygen, okay?

And the result of this can be some minor symptoms, like some headache and dizziness, onto shortness of breath, you can become lacking oxygen, like cyanotic, turn blue, hypoxic. You can have seizures; you can have abnormal heart rhythm. So, it can be very serious. So, it's important to address this condition. Methylene blue, because it can give and take electrons away, is a really helpful medication to give somebody with methemoglobinemia.

We also give them oxygen. That's kind of like the standard first thing, like put some oxygen on them and get in their body. Then you can give them methylene blue, and it'll help reverse what's going on with the iron, and it

can turn back into the hemoglobin we know and love, that can transport oxygen to your body cells.

Justin: Good.

Sydnee: So, when I went through medical school, and to this day, as far as I know, methylene blue is used in medicine primarily in one way, to treat methemoglobinemia. I will say, you could use it to reverse a cyanide poisoning. There are other things you can do, but you could do that. You could also, there's been some—a resurgence in interest of treatment for malaria with methylene blue, as an adjunct, as an added-on treatment to other treatments that exist.

Justin: Oh, a bonus?

Sydnee: Yes, there's been—I was reading some really recent research—

Justin: God, man, you know what's so irritating?

Sydnee: About that.

Justin: I almost joked earlier that they should have just mixed 'em up together. And I almost said that, and you would have thought I was so smart if I had said it. But dagnabbit, okay, I'll just keep—I… it's a good reminder. I need to just say these thoughts as soon as they come into my head and not second guess myself, ever. I just need to get it out there, no matter what crosses up there.

Sydnee: The seed of a lot of scientific thought is just stuff like that. "What if we mixed it together?" I mean, that really is the base. Now, we don't stop there. Good science never *stops there*.

Justin: Well, but some of our brightest scientific minds do, in a sense? Some of the biggest scientific minds are the ones that just have the guts to ask the questions, and then don't follow up. They say like, "What if we mix 'em together, and then I'm like, I will leave you all to it." You know what I mean? Like a— "What if we mix 'em together?" And then I just back out of the room.

Sydnee: It depends on what your metric of success is, Justin. Because I would say that while our leading scientific minds don't do that, there are a lot of influencers and very successful… I don't know, YouTubers, podcasters, whateverers—

Justin: Yeah.

Sydnee: Who that's exactly what they're doing.

Justin: On the grand spectrum of the human experiment, I'd love to pretend I'm more the former. But let's be honest…

Sydnee: So, I think it's important to know, as we—there are legitimate medical uses, methylene blue is a real medicine. Not debating this. There are some side effects and danger—risks to using it. I shouldn't say danger, there are risks. It's like any—it's like any medication, right? You go over the risk, the benefits, the alternatives and the side effects. So, because of the way that methylene blue functions in your body, it can actually interact with certain other meds, specifically antidepressants. So, medications that increase your serotonin level by preventing it from being taken back up, selective serotonin reuptake inhibitors, SSRIs, a lot of the most popular antidepressants are those.

Justin: Mm-hm.

Sydnee: So, a lot of people are on these medications. I'm saying they're very common medications. Methylene blue can interact with those, because it also can increase your serotonin levels, and you can develop something called serotonin syndrome. So, it's not a good idea to take it if you're on other medications, without talking to a healthcare provider. So, there are some risks to it. Also, as strange as this sounds, methylene blue can cause methemoglobinemia in somebody who doesn't have it, if taken at the wrong dose and too much and all that kind of stuff, right?

Justin: Mm-hm.

Sydnee: And so, anyway, there are some risks to it. It is not completely benign. It's not one of those things that it's like, "I don't know, just do it if you want to. What's the harm?" Right?

Justin: Mm-hm.

Sydnee: It's not. There are real harms if you shouldn't be taking it. Back in 2015, there was a study that came out which looked at methylene blue as a potential treatment for progeria, which is a rapid aging disease.

Justin: I think it's… I know that it's not technically Jack disease, but I do want to clarify that, in the past, I have referred to it as Jack disease to explain what it is.

Sydnee: Yes.

Justin: But not to make light of it.

Sydnee: Right, exactly.

Justin: Because Jack disease is not real. And neither is Benjamin-Button-itis.

Sydnee: No, Benjamin Button, that is not real.

Justin: Progeria is real.

Sydnee: Yes. And this is a specific kind of progeria that they were looking at. Basically, the idea is that through certain effects on mitochondria, because we know methylene blue can do that, because of the cyanide history, that maybe we would be able to slow the progression of progeria by giving somebody methylene blue.

Justin: Mm-hm.

Sydnee: So, there was this study published in 2015, it showed that there were some effects on the mitochondria. And these weren't—this was not in people. This was in a lab, so in vitro. Not in vivo, that's in life. There was

some suggestion like, "Hm, this could be something. Maybe there's something here. We should do some more research on this to see if methylene blue or compounds like it—" Because there are other things that can give and take electrons away, it's not the only compound— "Maybe this could be something in this very specific condition." Maybe.

Justin: Maybe, maybe, maybe.

Sydnee: And that's all it takes for wellness influencers to run with something. So, the next—I think the next step in the story was there's a fitness influencer named Ben Greenfield. And he told his Instagram followers that methylene blue is a potent cognitive enhancer.

Justin: Yeah.

Sydnee: And what, I think, what really—you talked about how you can see the effects of it, and that people like that. I think that's exactly why this, over other things, maybe caught on very quickly. Is because he would give himself methylene blue, and it would make his tongue blue. And so he posted a picture of himself with his tongue out, blue.

Justin: Yeah.

Sydnee: And then encouraged other people to take methylene blue, and post pictures of yourself on your methylene blue! So you take it and then you…

Justin: It's very Instagrammable.

Sydnee: Post a cute little picture with your blue tongue.

Justin: Mm-hm.

Sydnee: Which like, you could also just get one of those really great blue raspberry… Blow Pops?

Justin: Those are great, yeah.

Sydnee: Those are much better—

Justin: Those are much better.

Sydnee: Than methylene blue.

Justin: Mm-hm, yeah. And they'll go full blue. Full blue tongue.

Sydnee: Full blue.

Justin: And you got a nice little—and if you get a Blow Pop, you got a nice little piece of bubble gum to look forward to? Come on.

Sydnee: But he touted—so you should do this, not just for the cognitive benefits, but it enhances mitochondrial function. So, he's—this is sort of… it's based in an idea. It's not true, but like it's—you know what I mean? Like it's… it's related to the truth. It's truth-adjacent.

Justin: Okay.

Sydnee: That it provides neuroprotective effects against brain inflammation, increases memory and cognitive function, enhances the effects of light and oxygen therapies, and much more.

Justin: I feel—nootropics that he's referencing here, as I understand it, is the is the idea that you can add chemicals to make your brain work better, right?

Sydnee: Yes.

Justin: There's substances that are gonna make your brain work better.

Sydnee: Yeah, it's like a Limitless pill.

Justin: It's like a Limitless pill. I think that—I think it is weird to me that more people have not wised up to this. If you look at the vast number of people who believe that they are into nootropics—[titters] it is certifiably provable that nootropics do not work. Look at the people who say their

brains are functioning better on nootropics! Okay? And then see if their brains are functioning better! It's not a Venn diagram, it's Mr. Magoo, okay? [chuckles] Nootropics, the end.

Sydnee: The problem is that a lot of rich people say that, and we have this bias in our society to equate the ability to accumulate wealth with intelligence.

Justin: Yes.

Sydnee: And those—there is… all over the board. All over the board there.

Justin: Yeah, yeah.

Sydnee: Now, you might be wondering where are people getting methylene blue, because I've just referenced, it's a prescription medication.

Justin: Yeah.

Sydnee: So—

Justin: And they don't have the special cufflinks I invented earlier. [chuckles]

Sydnee: So, where are they getting it? Well, it is also used as an antifungal dye that cleans fish tanks. [titters] So, you can buy it to clean your fish tank.

Justin: Oh?

Sydnee: And then you could take it.

Justin: I feel like—

Sydnee: Don't!

Justin: I feel like I would look for more natural alternatives to even clean my fish tank. [chuckles] That doesn't even feel—that doesn't even make me feel good, for Stove Top stuffing, to have to deal with methylene blue.

Sydnee: Yeah. No, but that's—that is where—I mean that was the idea, is like, it's really easy to purchase. It's sort of like everybody was going after ivermectin, by like getting it for your horse or whatever, and then taking it for yourself. Please don't do that either. But it's the same idea like, "We'll just—ah, we can cheat the system. Buy it to clean your *fish tank* and then take it in your human body."

Justin: Mm-hm.

Sydnee: So anyway, a lot of influencers and people who push pseudo medicine and pseudoscience started following in this—you know, I mean, this is great. Like, it's really easy to tell people—it's kind of like we've talked about laxatives.

Things that make you poop, and diuretics, things that make you pee, have always been popular in medicine that isn't really evidence-based. And the reason is that if it's working or not, is objective.

Did it work? "Well, yeah, I was in the bathroom for an hour, so it worked." Did it do any of the things it was supposed to? "I don't know, but I was in the bathroom for an hour, so it did something."

Justin: Yeah.

Sydnee: So, I think, like you said, methylene blue, you can see the blue on your tongue. If you take enough, it might turn your pee blue. You could get blue eyes. So like, you can see that it's working. And now it's being pushed, there are all kinds of supplements you can buy online with methylene blue in it, that are anti-aging, that will increase your energy and stamina.

Or, as I saw on my own personal Facebook feed, another physician saying, "If you have nothing else to lose, why not try it?" In reference to using methylene blue as a treatment for stage four breast cancer. Along with the eye drug, which I think must have been ivermectin, but… I do want to note

that the—one I think these things take on interest because they're—you can see them, and they're Instagrammable, and whatever.

Justin: Mm-hm.

Sydnee: Two, for most people, taking methylene blue isn't going to harm them.

Justin: Mm-hm.

Sydnee: That isn't me saying you should, because for some people, it can absolutely do harm.

Justin: Mm-hm.

Sydnee: But for most people, it won't do harm. And so, you're going to take it and maybe placebo effect, maybe you feel better, or whatever. But it's not going to hurt you, and so you're going to think it's good, right?

Justin: Mm-hm.

Sydnee: So, for those reasons, it catches on. But then that specific point, "If you have nothing else to lose, why not try it?" Is one of the most dangerous statements a person can make. And if somebody says that to you, a red flag needs to go up in your head about everything else they've told you, because we have *lots* of handrails put on the things we do in medicine.

There are tons of checkpoints in our studies, especially when it involves humans, alive human bodies that we're putting substances in, that check us to make sure we are not taking advantage of people who are desperate, of people who know that their condition doesn't have an effective treatment or cure at this point, and who will try anything.

That is exactly why we have guardrails on the science that we do in humans, to prevent charlatans from taking advantage of people who are desperate. So if somebody says to you, "Go ahead, take it, you got nothing else to lose," that is—that—no scientist says that. No one who is operating out of a

place of evidence and good faith will say that to you. The people online who are selling you supplements; they'll say that every day.

Because all they want to do is sell you a supplement, and they don't care what happens to you. All of this is added to the claim that, supposedly, earlier this year, there was a picture taken of RFK Jr. on Air Force One about to have a drink, and he was adding drops of a blue liquid to his drink, and everybody went wild. "RFK likes methylene blue. It must be the real thing." I don't know. I don't—

Justin: It was MiO berry pomegranate, though. I guarantee it. I know that stuff anywhere! [chuckles]

Sydnee: Also, predictably, Joe Rogan really loves this stuff.

Justin: *Nootropics*.

Sydnee: Yeah. So, it's just like a lot of the cure-alls. It's easy to get and sell, and see that you're—you know, I mean, it's blue, so you know you're getting the thing. You can see that it's happening. At this point, other than its legitimate evidence-based uses that we have researched and found to be true in medical science, that you could be prescribed it or given to it by healthcare provider for, other than those things, we have no evidence to suggest that you should just be taking methylene blue. And we definitely have reasons to suggest that it could potentially harm you. So… please don't do this.

Justin: And that's going to do it for us for this week on Sawbones. I want to say thanks to The Taxpayers for the use of their song Medicines as the intro and outro of our program. Thanks to our editor, Rachel. And thanks to you. Hey, one last quick thing, we do lots of different kinds of episodes of Sawbones, and we have tried lots of different kinds, and we like doing all of 'em. We're curious sort of what you guys think, the folks out there in the listening world.

If you'd like to weigh in, we'd love to hear from you, there's a link in the description of this episode. So, if you would go check that link, there's a survey there. If you would click it and take that survey, gosh, I'd sure

appreciate it! Thank you so much. It's—you know what? It's science. You guys like science, right? Think about it, you could be part of an experiment, basically. We really appreciate it. That is going to do it for us for this week, until next time. My name is Justin McElroy.

Sydnee: I'm Sydnee McElroy.

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

["Medicines" by The Taxpayers plays]