Diabetology with Dr. Mike Natter
Ologies Podcast
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Oh Heeeyy, it's your friend who looks at listings of houses she has no intention of buying, Alie Ward, back with another episode of *Ologies.* So, this is a real sweeeet one! It's got everything, everything you crave. There's a personal connection to the ology, a very surprising backstory, my copious sweating. There's human cyborgs and there's reasons to drink pee.

But first, a quick thank you to everyone who's supporting on Patreon, and who tells friends and co-workers and fam. This week *Ologies* was Number 3 on the science charts, up there with the NPR giants. So thanks to everyone who listens, and subscribes, and rates, and of course reviews. Old Dad Ward vonPodcast reads 'em all. And because talking into a microphone in your closet toward a pile of laundry can be kind of weird, kinda lonesome, your reviews always keep me going! I read a new one each week. This week, this one's from Dermal Dentical who says:

Kept my ADHD attention! I thought podcasts might just not be for me, but I'm so glad I gave Ologies a listen. Thanks for making everything from my college commute to shoveling a crap-ton of snow off the driveway a little joyful. I hope to listen to these as an ologist one day.

Well, thank you Dermal Dentical for spending time in the freezing cold with me.

Speaking of ologists, let's meet this week's *Diabetologist,* which as I say often, is a real frick'n word. But what is it? What is diabetology? [phonetic: di-uh-beh-TOL-ogy] First off, it is not *diabeteology* [ph.: di-uh-BEE-tee-ology] as I thought, so I was wrong. Oops! Diabetology is the science of diabetes; its diagnosis and its treatment. So it's a term, it's used in medicine, but just not super formally. It might refer to a doctor who has an interest or special skills with diabetic patients, which this ologist very certainly does. He has been studying the disease for over *25 years*, and he's only in his mid-30s.

We became internet pals in 2013; he makes these really great science drawings, and I have watched his journey from med student to M.D., and I have never met a doctor so passionate about his work, or his patients, or the cause of diabetes. He has a vested, deep, and gloopy interest in the hormones that regulate our blood sugar, which I'm *so* excited to talk about. He was in LA from New York City over the summer, and so we sat down in my living room; we had a gab, even though it was blazing hot and his Friday afternoon Lyft across town had him arriving an hour late. He was so stressed out, he didn't realize that in LA showing up an hour late is pretty punctual.

So we cleaved this episode in two. In this first one you're gonna learn of his staggering, very heart-warming journey to being a doc, what blood sugar does, how it affects your mood and energy and every cell in your body, the Keto diet vs. veganism, how many people have diabetes, what could cause it, and why I fall asleep in pants a lot. Also, how to handle the emotional aspects of a busted pancreas. So, we're about to spill some *un*sweetened tea on the topic of your blood sugar with wonderful person and diabetologist, Dr. Mike Natter, M.D.

[i*ntro music*]

Alie Ward: Dr. Mike Natter

Dr. Mike Natter: Dr. Alie Ward.

Alie: I'm not a doctor, you are! Dr. Natter, you *are* a doctor.

Dr. N: I am.

Alie: You have been a doctor for how long?

Dr. N: Three years. Let's see; I finished med school in 2017, so I have been a doctor for almost three years.

Alie: Let's talk about your shitty pancreas.

Dr. N: I have a shitty pancreas. It's busted.

Alie: You've been a diabetic longer than you've been a diabetologist.

Dr. N: True.

Aside: Dr. Natter is in his final year of internal medicine residency and he will soon be a board-certified internist, which then leads to a two-year endocrinology fellowship, but he sees and treats patients with diabetes, and again has been studying diabetes for decades.

Alie: At what point did you realize that you're not only the president, you're also a customer? At what point did you realize, "I'm baby Mike Natter, and I've got a busted, shitty pancreas"?

Dr. N: At what point did I realize I was diabetic?

Alie: Yeah.

Dr. N: Oh, the origin story. We're gonna dig in.

Alie: Yeah, we're gonna dig in. As long as I've known you, I've known you're diabetic, type 1.

Dr. N: Yeah. We've known each other for five years! Oh, Dr. Ward, we go back!

Alie: I know! I've known your pancreas this long, and it's *still* not working!

Dr. N: It's a lazy piece of shit! Yeah, it's just terrible. [*"I can hear you!"*] Okay, so I was... This was two weeks after my ninth birthday. I remember it very well. It was pretty traumatic, unfortunately. I was super lethargic, I was really tired, and I would wake up at night; three, four, five times to urinate, but also to chug water. I was parched beyond belief. You would chug, and then you'd need to chug more. You would be thirsty like you wouldn't believe. Nothing would satiate it, and then you'd be peeing constantly. ["*Wow, that's a lot!"*]

So those were, kind of, the symptoms initially. This went on for maybe a week or two, and then it just got to the point where I was losing weight, I looked very ill, and there was one day in mid-September when I started to get ill... I was vomiting, and couldn't move, and I just looked awful. And my dad scooped me up... I'll never forget. He actually scooped me up in his arms and carried me to the ER at Mt. Sinai in New York City. I was kind of in and out and ended up kind of falling into a coma. Yeah, it was very traumatic. But I had - from what they told me at the time - the highest blood sugar on history at Mt. Sinai, at the time in '94.

Alie: What were we talkin'!?

Dr. N: It was up there. If the normal range of blood glucose... Yours right now is probably like 100, you know, you run in that range. High glucose is typically 200s, 300s, 400s. My glucose was *1600.* It was really bad. It was not good.

Alie: That's so bad! In a baby nine-year-old! How long do you think you had had type 1 diabetes before you were diagnosed?

Dr. N: Probably a few months. I would have probably died if it was more than that. I don't think anyone can live with type 1 undiagnosed for more than a few months. Probably less, maybe like a month.

Alie: Oh my god. Let's dig straight into, what *is* diabetes?

Dr. N: Yeah, let's do it. So, diabetes… There's flavors of diabetes. We're talking about diabetes mellitus, you and I. If we look at the etiology and the etymology - I'll let you dig into that - my understanding is, I think, *diabetes* itself translates into *siphon.* And the idea is that it's a

siphon because you're ingesting so much fluid and you're just peeing it out. So back in the day the doctors who were observing this were like, "Oh, they're like a siphon, there's just fluid going in, fluid coming out."

Mellitus translates to something like 'sweet' or 'honey coated' or something like that. Back in the day physicians would actually take a little taste test [*lip smacking*] and that's how you could tell if there was sugar in the urine. And so siphon of fluid coming in and going out, and sweet urine, diabetes mellitus.

Alie: Really?! Oh my god, you're a honey colander!

Dr. N: [*laughs*] That's right.

Aside: PS: If you haven't heard the *Melittology* episode, it's about bees! And honey! Also, if your name is Melissa, *and* you have a bad pancreas, your name means 'bee', which is sweeet, like maybe your pee. [*warped: "Oooh-noooo"*]

Alie: Is it hygienic to drink urine?

Dr. N: No, it's not a good thing. Yeah, I wouldn't recommend it. Although, if there's no infection, technically I guess it's sterile. But no, we're not gonna… We're gonna put another disclaimer on this whole deal. I have and MD: There is no medical advice being given on this show [*both Alie and Mike laugh*] Don't drink your pee.

Alie: Don't drink your pee. I'm sure there are so many people out there right now, just toasting to a glass of their own room-temperature urine. So many people right now, oh my god! With the healthcare industry what it is, what else are you gonna do?

Dr. N: Cheers.

Alie: Cheers.

Aside: Okay, quick side note - why not? - on pee drinking as long as we're here. Do people do this?

[*Gwyneth Paltrow: "I mean, I did draw the line the other day. Apparently there's an ancient Ayurvedic practice where you drink your own urine…*]

Mm... not even Gwyneth Paltrow does this. And though it has roots in ancient medicine, according to one published study I read titled, "The Golden Fountain - is urine the miracle drug no one told you about?" they say it's a big no. No scientific benefit. Even the army is like, "if you're in a survival sitch, it's not worth it." The army also says not to drink booze, seawater, or blood, just no matter how parched you are. It's got a lot of salt. And though it's sterile when it leaves your kidneys - that is true - it can pick up to 85 different kinds of bacteria on its merry way out of your body tubes.

And I want you to know as I was researching this, I was sipping a really large beaker of lukewarm green tea. Mmm… [*"Big mistake! Big. Huge!"*]

Alie: So, what *is* diabetes? I know there's two flavors; there's type 1, there's type 2, there's probably more. Is that just the name for when your pancreas stops working?

Dr. N: No, there's more than two flavors actually, There's a handful. There's something called LADA, or Latent Autoimmune Diabetes of Adults. That's sometimes called type 1.5, which is strange. There's gestational diabetes. So, there's different flavors of the 'sugar diabetes'.

There's also something called 'diabetes insipidus', which also kind of has that siphon quality where your body, for either central reasons (meaning from the brain or pituitary) or for nephrogenic reasons (meaning from the kidney itself) you're unable to concentrate urine and it's really an issue with water and sodium. That's a whole other can of worms. It's not really at all related to type 1, type 2 or gestational diabetes.

Aside: Okay, this is the foundation of what diabetes is. I'm going to reiterate it because it's compulcated [intentionally mispronounced] and important. We're going to go through that once again so we feel like we *really* know what's up.

Once again, type 1: an autoimmune issue causes your pancreas to stop making insulin. And your pancreas, by the by if you're like, "What is that?" it's a large, dong-shaped organ that's hiding behind, kind of like, your liver and stomach area. And most medical illustrators seem to draw it like if a corn on the cob had matching nards. Or a lumpy butter sac. Once again, I'm not a doctor.

Type 2, according to the American Diabetes Association, is the most common form of diabetes. Type 2 means that your body doesn't use insulin properly and 90-95% of diagnosed cases of diabetes are type 2. Now, *between* the two there's a type 1.5, and we are not clowning you. This is a real thing. It's called latent autoimmune diabetes of adults, or LADA, and it shares characteristics of both type 1 and type 2 diabetes.

Dr. Natter also mentioned gestational diabetes, that happens in about 10% of pregnancies in otherwise non-diabetic folks and it's caused by hormones in the placenta messing with how your body responds to insulin. So gestational diabetes, it's usually diagnosed about the 24th week of pregnancy and it can lead to preeclampsia - which is high blood pressure - depression, or having a large baby. As I like to call them: real lunkers, which is a fishing term I just applied to your big baby.

There are also a few rare types, like monogenic diabetes - that's caused by just a single gene. There is cystic fibrosis-related diabetes, there's brittle diabetes, and something called *Wolfram Syndrome*, which sounds kinda like the backstory of a hairy superhero. And finally, there's diabetes insipidus which Dr. Natter mentioned. It is a hormonal issue that makes you unable to make concentrated pee. So you're just thirsty, and you pee up to *20 liters* a day! And 'insipidus,' by the way, means 'bland' or 'lacking flavor.' So you're a siphon with flavorless pee, which is a sick burn.

And how huge is a health issue is diabetes? The CDC says it's the 7th leading cause of death in the U.S., and in the last 20 years cases have doubled. Almost 10% of Americans - more than 30 million people - have diabetes, and one in four of them does not know they have it. So if you are listening to this on the subway, or at a rave, or a crowded gym, there's a good chance someone near you has the 'beetus, and may or may not even know it. You can tell them about this episode if you want, but you don't have to.

Alie: When did you decide that you weren't just going to be a patient, but you were going to be a doctor?

Dr. N: That's a really good question. So, I grew up as an art kid. I used to draw my whole life and I still do. But there was no medicine in my family. I never really thought that I was smart. I didn't excel academically my whole life. I was really bad in math and science. I did pretty well in, like, history, and English, and art obviously. I never really thought that a career in medicine, or anything that people considered 'intelligent people would go into' was something in the cards for me.

Aside: Obviously, I am appalled by this.

Dr. N: When I was diagnosed with diabetes I gained this, kind of, appreciation or this awe of our physiology. If you think about it, the pancreas is doing so many things and it would do it automatically. It was autonomously regulating a homeostasis of blood sugar. And now at nine years old this crazy responsibility is thrust on my shoulders, and it gave me this appreciation for, "Holy crap, this is really cool, really intense, really beautiful."

And so I said, "It would be really interesting to be a doctor." But I never thought of it seriously. It was almost like if a kid saw an astronaut and they would be like, "Oh wow, that

would be cool to be an astronaut!" but they knew they never really could *actually* become an astronaut. That's what I thought about, as being a doctor.

Alie: And then here you are! *Doctor* Natter!

Dr. N: Yeah, it was crazy… Thank you.

Alie: Well, at what point did you decide that you were going to pursue medicine? Did you have a moment where you said, "I can be an artist *and* a doctor."? What did you do?

Dr. N: Yeah, so I went to undergrad, I started studying studio art and in the end of my junior year… I had been taking some classes in neuroscience because I found neuroscience interesting, but I was doing it, kind of like, as an aside. And to my surprise I did well. I was getting really good grades in neuroscience and so this was the first time - you know, I was twenty years old - in my life that I had good grades in a science-based class. So I thought, "Oh, I have some academic confidence," and I had this epiphany of, like, I need to go to medical school, this is what I need to do.

Aside: So Dr. Natter graduated with an art degree, without taking organic chemistry or calculus because he was afraid he wouldn't be good at it. So he moved back home to New York City and got up the courage to go back to school and tackle those pre-reqs. How did he do?

Dr. N: I moved back home to New York and I did a post-bacc, pre-med program where you kind of do all those pre-reqs. And I struggled. I didn't do so hot. I did very mediocre. I mean, I did well for myself, but to get into medical school it's, like, very competitive. So, I did decent, and then you take the MCAT, which is the entrance exam, and I also did very, very mediocre, not so fantastic. And I got, essentially, rejected from almost every school I applied to except one, and that one offered me an interview solely based on the fact that at the time I had created and was making a comic book about a diabetic superhero. [*laughs*] Very nerdy. Super nerdy.

Alie: Super nerdy, I love it!

Dr. N: Oh, it's the nerdiest!

Alie: Oh my god! So, based on that, they said, "Oh, you clearly you have a passion, you have a background. Let this guy in and let's see what he can do."?

Dr. N: I think that was part of it. I think the admissions dean said, "Well, your numbers are a touch low, but they're not horrible, but you seem to have something that sets you apart. Let's give you an interview." And I was very, very fortunate, but it also did stoke a lot of the impostor syndrome, like, "Ooh, I got in through this back door." I remember sitting on my interview day, you know, there's this big board table, everyone's in their suit. I've already sweat through my shirt *and* my suit at this point.

And everyone goes around to say what undergrad they're from, and you know, I'm sitting next to some kid from Harvard, and someone from Princeton, and Yale. And they ask what they did this summer before they came there and a lot of them would say, you know, "I was curing AIDS in Africa," and, "I was curing cancer in this lab."

Oh, I created a comic book. It was like, "What am I doing here?" [*laughs*]

Alie: But clearly, you need passion, you need drive in order to get through medical school.

Dr. N: You do. What I found is that you don't have to be crazy brilliant, you have to be very motivated because it just takes time. The volume of information is very vast, but the depth… the intellectual difficulty is not… the rigor is not *that* bad. It's just taking the time to comprehend the concepts, and I found that using art actually helped me to do so.

Alie: Right, because I found you because you have all of these medical illustrations, where you were drawing comics to remember certain medical concepts. Are those being used as study guides for a lot of people?

Dr. N: That's the hope. I put a lot of that stuff on social media, and initially it was very didactic in nature. It would be stuff to help me remember medical concepts for tests, and exams, and so on, and that seems to help a lot of other medical students. But as I've kind of evolved into being a resident, a lot of the emotional struggles I've kind of utilized and poked fun at with some humor. So, kind of all those things are hopefully are offering some solace and some help for other people going through the journey.

Aside: So his Instagram handle, by the by, is @mike.natter, and he has all kinds of illustrations and comics based on his life as a doctor. It's hella sweeeet! Okay, speaking of which… Yes that was sugar related.

Alie: So, let's talk a little bit about blood sugar. I have a very overactive pancreas. Over-achiever, workaholic pancreas. I have reactive hyperinsulinemia, postprandial…

Dr. N: Look at you with the big words!

Alie: I know. I've read them off of a lab report, and then I've ignored the advice the doctors have given me. I have a bad system going on. But explain kind of what blood sugar is, and what the pancreas does, and why that's important.

Dr. N: Absolutely. Let's start with the pancreas. The pancreas is *freaking awesome*. It is the coolest. Clearly, I'm a little biased.

Alie: [*laughing*] You always want what you can't have.

Dr. N: [*laughs*] It wears two hats, in general. It wears an exocrine hat and an endocrine hat. The bulk of the pancreas is made up of… More or less, like 90% of the cells are acinar cells and they make exocrine enzymes to help you digest food. Things like trypsin, and lipase, and stuff that helps you break down fats, and carbs, and all this stuff. So that's one hat and that's the bulk of what it does.

Then, a handful of cells are in these islands called the 'islets of Langerhans,' and there's alpha cells, and beta cells, and delta cells, and all these cells, and they make hormones. The beta cells in particular are making insulin. Okay, so put that on the shelf.

Alie, what did you have for lunch today?

Alie: Oh god…

Aside: Y'all, okay… Here's the deal. I have great days where I feed my microbiome a literal shitload of veggies. And then sometimes I'm just the *worst*, and I'm traveling, and I'll just have hotel coffee for breakfast, and some airport Cheetos, and then I'll try to consume a packet of peanut butter with a Q-tip as a spoon. I'm not proud of this.

Alie: I *know* that I have reactive hypoglycemia. I find that I will get to bed, with my contacts out, lights out, when I have a low-carb diet. And I tend not to do it because I just don't want to seem fussy, which is a horrible reason to get diabetes.

On a normal day, I'm a dumpster fire. On a normal day I would have, like, an almond milk latte that probably had sugar in the milk and then I add a little bit more raw sugar.

Dr. N: Sure, sure.

Alie: Yeah, 'cause I like to cronch it. [*laughter*] And then I would probably eat, like, some sort of pastry, at like, 1:00 PM for breakfast.

Dr. N: I love it. Okay, that pastry, which sounds delicious, is made up primarily of carbohydrate. So that carbohydrate, it initially starts breaking down in your mouth with some mechanical digestion with your teeth. But there's also a little bit of chemical with the salivary amylase. So you're breaking down this carbohydrate, which is a complex macromolecule. It eventually goes down the food tube, [*high-pitched "wheee!"*] the esophagus, into the stomach, and then into the small intestine where more of that digestion is taking place.

Once those enzymes really break down that carb, it finally gets small enough into a form called glucose. The glucose can then get in through these little finger-like projections that are absorbing all of that goodness from your food into your bloodstream. Bloodstream is kind of like the subway system. It just like transports all the shit to all the things that it needs to go to. You know what I'm talking about?

So, where does it needs to go, essentially, is to the trillions of cells that make up your body. And once that glucose can get into those trillions of cells, the cells can then break that glucose down into ATP and energy and do what those cells need to do, whatever that may be.

Alie: Oh wow.

Dr. N: But the problem - my problem, yours is not a problem - is that the cells, particularly the adipose tissue, which is the fat and the skeletal muscle, have locks on the doors of their cells. And so for that glucose to get into those cells, something needs to unlock that. And that's insulin. So insulin is kind of like a key. This is a very oversimplified metaphor, but I think it works well for people who don't necessarily have a background in science or in medicine.

This is the way in which your pancreas says, "I'm going to dip my toe into that stream of blood, taste it, and say, 'Oh, it's a little bit sweet. Let's pump out some insulin in the right proportion to allow that glucose to get into the cells.'" You want to maintain some glucose in the blood at all times.

For whatever reason, Dr. Ward…

Aside: Once again: not a doctor.

Dr. N: …your pancreas gets *very* excited. So when you eat something with carb, and if you don't have anything with fiber, fat, and protein to help that carb get slowly digested, then your pancreas sees that sugar, and it's a spike, and it goes, "Oh my God!" And it just pisses out all of this insulin into the blood.

Alie: What an asshole!

Dr. N: It's such an asshole! It just kind of… like a sponge, just *squeezes* it in there. And then postprandially, which means maybe like two to four hours after you eat, you'll notice that there's still insulin hanging around so that too much of that sugar gets out of your bloodstream and into your cells. And what does that feel like? What do you feel like when you have that?

Alie: I feel like… It makes mono seem like I've had a Red Bull. I feel so tired. My limbs feel like lead and it just feels like the energy that would be needed to take out my contacts is *massive*. That I just *have* to fall asleep… sometimes wearing shoes. I have fallen asleep with my car in the driveway. I've fallen asleep on the bathroom floor…

Dr. N: It's dangerous.

Alie: Oh, yeah. I know. Never driving, though.

Dr. N: So that's one way that someone might experience hypoglycemia, also known as low blood sugar. And it's miserable.

Aside: While researching this I came across a 2016 paper called "Generalized Anxiety Disorder and Hypoglycemia Symptoms Improved with Diet Modification." One passage read, "Increasing odds of depression and anxiety have been associated with the consumption of foods that have a progressively higher glycemic index, are more sugary, and spike your blood sugar faster." So, doctors and layfolks alike know too much sugar can lead to sadness, and irritability, and mood swings. So much so that after the assassination of Harvey Milk, the defense attorneys cited his murderer's love of Coke and Hostess, and this is now known as, 'the Twinkie defense'. It did not work. But perhaps we need a neuropsychobiology episode. Anyone? Yes?

Also, at this point in the interview, a fluffy indoor racoon interrupted. And my dog Gremmie was a great way to deflect from *my* bad pancreas and hypoglycemia, or low blood sugar, to his.

Alie: [*talking away from the microphone*] Where did she get that? Oh, from over there, okay. She brought me a treat.

Dr. N: Yeah.

Alie: [*to Gremmie*] No, my blood sugar's fine right now.

Dr. N: She sensed it.

Alie: She's like, [*nervous tone, Southern accent*] "Shelby drink your juice!" Did you ever see *Steel Magnolias*?

Dr. N: [*laughing*] Of course. Julia Roberts and the hairdresser.

Alie: Has that ever happened to you? Has anyone been 'Shelby drink your juice'?

[*Clip from Steel Magnolias*]

Sally Field, as M'Lynn Eatenton: Shelby, Shelby you need some juice. You need some juice.

Julia Roberts, as Shelby: Stop it, Mama!

Sally Field: Drink the juice!

Hairdresser: Excuse me, should I call the doctor or somethin'?

Dolly Parton, as Truvy Jones: No, no.

Olympia Dukakis, as Clairee Belcher: She's a diabetic.

Sally Field: She just has a little too much insulin, that's all. We'll just get a little more in 'er, she'll be all right.

Dr. N: I mean, when I have hypoglycemia, which unfortunately happens here and there, my symptoms are a little bit different than yours. I don't get the exhaustion as much as I get

this, kind of, cold sweats, weak in the knees like, “Oh man, I'm gonna pass the hell out,” kind of tunnel vision… Just feeling like just true death. And then you get these weird cravings, like anything and everything looks delicious, and you just shovel it into your mouth. Like what I imagine being pregnant feels like, like peanut butter and ice cream and pizza all at once, and then you immediately feel ill afterward. But yeah, that's my hypoglycemia.

Alie: Now, a type 1 diabetic has to monitor their blood glucose and then inject or have a pump for insulin because your pancreas is checked out, right?

Dr. N: That's exactly right. So you're worried about high blood sugar, which means you don't have enough insulin. You're also worried about low blood sugar, which means maybe you took too much insulin *or* blood sugar can also be lowered by exercise. There's a lot of factors. Blood sugar can be elevated by times of stress. [*Valley girl: I’m so stressed out!*]

Alie: How does that happen?

Dr. N: That's a good question. The thought is that there are a lot of stress hormones, particularly things like cortisol and epinephrine, that, when secreted into your bloodstream, are - this is a good one - *gluconeogenic.* Ohhhh, let's say it again: gluconeogenic. [*low pitch, slowed down*] Gluconeogenic. [*laughs*]

Let's break it down. So glucose: sugar. Neo, like the beginning of, and genesis, ‘the beginning of’ as well. So you're basically making new sugar and breaking things down of storage (things in the liver). Our bodies are super smart, and so they'll store things into forms of glycogen. Glycogen is a storage form of sugar, mostly in the liver. So it'll basically poop out all of that extra sugar because your body is like, “Oh, fight or flight. We need this energy immediately. Let's get this out there.”

Aside: So the type of diabetes Dr. Natter has is the more rare form, type 1, which is typically, but not always, diagnosed in childhood. And Mike found out that he had it one late September day in 1994. Also weird: type 1 may be related to colder weather. It tends to be more prevalent in chillier climates and it’s diagnosed more often during winter months. Which is just cold, man.

Alie: That is type 1. Now, does that happen with an autoimmune problem? Does your immune system attack your pancreas?

Dr. N: That’s exactly right. That’s the theory. Most of the time it's thought to be autoimmune related. Auto meaning ‘self’, and immune meaning your immune system. And I think of the immune system kind of like this little army of dudes. And they have these little spears, and at the end of the spear is this little Y, this little prong. And at the end of those prongs are very specific shapes.

So, our immune system is kind of dumb. You have all these premade antibodies, which is what these spears are, in as many combinations as they can, in case they encounter an invader that looks like one of them so they can clip it and so on. But then you also have memory of that, and so you can pump out more.

The theory is something called molecular mimicry. And it's a very clever theory. It basically states that you have both a genetic and an environmental dual trigger. So, you have a genetic propensity to having some sort of autoimmune disease. It's not well understood, but you have some predilection for autoimmunity, and then in the environment you come into

contact with some common virus. So I think Coxsackie B virus is thought to be one of the leading molecular mimicry theories for type 1 diabetes.

Alie: Really? So you may have come upon a virus that you got and that is what triggered your immune system to go ham on your pancreas.

Dr. N: That's the thought. And the idea is that the epitope, or the small piece of a virus that gets kind of clicked into your antibody, looks similar to that of the beta cells of the pancreas. That's the theory. And then you have all these antibodies that are going ham and chomping down on them pancreatic tissues.

Aside: Coxsackie? Pardon? Ah yes, this is a group of viruses named for the Hudson Bay hamlet of Coxsackie, New York. And if you've ever had hand-foot-and-mouth disease, congrats! You've been a bearer of one type of Coxsackie.

And also Coxsackie is a small town, it's about 100 miles upstate from Manhattan, and its name, Coxsackie, means 'owl hoot'. *And* you can buy a three-bedroom log cabin there for just over a hundred grand. And then tell your house guests, "Yes. This is where some viruses were first isolated in 1948 via fecal samples."

Let's move on from 'number 2' to 'type 2', shall we?

Alie: Well, what happens with type 2 diabetes? And why don't they just call it a different name? Is type 2 enough of a distinction, or do you think that that confuses people?

Dr. N: It's a really good point. If you look at the numbers, by a huge amount type 2 is much more prevalent. Type 1 makes up a very small amount. I think it's something like 300,000 in the United States, something like that, something tiny. Type 2 is significantly more. If you count prediabetics who are pre-type 2, that's also just a mammoth amount. It's massive problem in our country.

Alie: What is prediabetic?

Dr. N: Let's back up. So type 2, that was a really good point. Should it be a different name? It used to be called adult onset, and type 1 used to be called juvenile. But they had to change that for many reasons. One: you're starting to see people who are adults with type 1 getting diagnosed in adulthood. And then you're starting to see younger people, including kids, with type 2, which is a problem.

Aside: Unlike being able to use TikTok, or wearing only Polo shirts, type 2 is *not* an age thing. But, Dr. Natter says:

Dr. N: The end result is similar. They both result in high blood sugar or hyperglycemia, but for very, very different reasons and for very different mechanisms. Type 1 is never ever an issue of someone having a lifestyle choice that might have predisposed them. It's never that. Type 2 is often secondary to some lifestyle choices. That being said, there's genetic components to both.

And I want to also preface that they tell us in med school that 50% of what you learn in med school, after you graduate, is proven wrong and different. [*Price is Right loser horns*]

Alie: [*strained, painful*] Wowwww!

Aside: I checked this out, and yes, type 2 has a stronger connection to family history than type 1! So much so that they have crunched the numbers on twins and found that yep, twins are more likely to share underpants, and all of their birthday parties ever, and also a diabetes diagnosis. So why does type 2 happen?

Dr. N: This may have changed, but my understanding was that there's actually a higher genetic component to type 2 than there is to type 1.

Alie: Oh wow. And does that happen where you, kind of, exhaust your pancreas? It has put out so much insulin over so much time that it just one day is like, "Fuck all y'all, I'm out."? [*low pitch, slowed down*] Fuck all y'all, I'm out.

Dr. N: I think there's a component of that. It's actually a really exciting time in research very, very recently. Most people think, "Oh you ate too much crap. You ate too much carbs and sugar." But what we're finding more and more is that it's actually the animal products and the fat that we're eating, specifically the long-chain fatty acids and the saturated fats. And what's happening is there's fat deposition, so fat is kind of accumulating in things like the liver, your skeletal muscle, and the pancreas. And that is spawning a storm of proinflammatory cytokines, so you're getting a lot of inflammation. That inflammation is really detrimental. You're getting free radicals, and oxidation, and all that stuff, and that's really gunking up the works of the insulin receptors.

Initially it's an issue of insulin insensitivity. The lock is broken, the key is there. And so very early on in type 2, you actually see a hyper-insulin state because your pancreas is saying, "Oh shit, my insulin I'm secreting isn't doing anything. Let's pump out extra." It's falling on deaf ears. For that reason, eventually you'll have some of that, like you said, the pancreas pooping out. But then there's also some thought that this is also secondary to the fat deposition and inflammation in the pancreas as well.

Aside: If you're silently analyzing your diets right now you are not alone, my friend.

Dr. N: The question of like, "Should I eat paleo? Should I eat keto? Should I eat plant based?" Plant-based diets have evidence that suggest that they help treat and prevent certain disease processes like type 2 diabetes. And I do think that is a very healthy way to go. There's good data for other diets that are out there, but the only one that I know that I've seen with empirical data behind it that seems very good is the plant-based diet.

[*stoner voice: "Yeah! I love plants!"*]

Alie: Really! That's so fascinating. And so if you are, say, pre-diabetic, what exactly does that mean and what can you do? Can you turn this boat around? If you have type 2 diabetes, can you turn the *cruise ship* around? What are we talkin' here? What kind of U-turns?

Dr. N: [*laughs*] With a huge buffet.

Alie: Yeah. [*laughs*] Let's flip this bitch. What can you do?

Dr. N: [*laughs*] Let's first get into the definition. In medicine we like objective numbers. We like data. So we use something called hemoglobin A1c. Hemoglobin A1c refers to… If you look at your blood, your blood is made up of cells and plasma. And some of those cells are red blood cells. They're just kinda hangin' out, they're carrying some oxygen, they got some iron in there, they're doing their thing. Sugar is sticky, so sugar ends up sticking to these suckers.

And your blood turns over every 90 days. Every three months, your marrow's like, “yup, here's some new blood.” So if I were to take a sample of your blood every three months or every 90 days, and I took a look at how much sugar is stuck on those red cells, I'm going to get a sense of what your average blood sugar is over those three months by looking at that.

So, a normal hemoglobin A1c is somewhere between 4% and like 5%. A prediabetic is classified as an anywhere between 5.7% and 6.4%. And then if you have 6.5% or above, you are classified as diabetic.

Alie: Oh wow. And so if someone hears they're prediabetic, or they just got diagnosed as type 2, what should they do? What is, like, an emergency tool bag, like, “Ooohhhh here we go!”?

Dr. N: [*laughs*] I mean, I think the thing that we have to understand, especially as medical professionals, is that it's such a multi-pronged issue and just that physician alone in that 10-minute visit saying, “You need to lose weight,” is not going to cut it. There's so much to it. There's culture, there's access, there's availability, there's cost of food, and food deserts. There's a lot to talk about.

Part of the reason I want to go into taking care of folks with diabetes is because I get it. It's *so* difficult. It is life altering. You have to think about it *constantly,* and it's never going away. And so for that reason, I think having that connection and that empathy with the patient is first and foremost.

But usually, prototypically, type 2 diabetics and prediabetics can spare some pounds. So losing weight is key. Exercising is really important because exercising in and of itself, even without the weight loss, is going to help re-sensitize to insulin. Losing weight with using things like a plant-based diet, and cutting out a lot of the carbs, and a lot of the refined sugars and stuff, as well as staying away from some of those saturated fats is going to help significantly lower A1C and get people back on track.

Aside: People with diabetes, type 1 and 2, come in all shapes and sizes. I know beanpoles and even someone who’s a world-renowned boxing coach who has diabetes, in great shape. But doctors agree that higher body fat in some patients can be one aggravator and part of the environmental factors. So why does lowering body fat seem to help some patients?

Dr. N: It’s still not really well understood. The more recent studies, like I said, are looking at the fat deposition on our organs themselves. The excess fat that we carry around our waist and so on is kind of an external marker of some visceral fat. Interestingly, if you carry your fat like in your thighs and your butt, it's considered more healthy than if you were going to carry it in your belly. That spare tire is particularly bad. But I think there's also this idea of something called lipotoxicity. Just having fat in and of itself is very inflammatory, and having inflammation kind of cascades all of these biomarkers in our body to go haywire, and kind of gunk up the normal mechanisms, and therefore making you less sensitive to the insulin.

Alie: Are we learning more and more about inflammation? Are we starting to realize like, “Oh, inflammation. You're really awful. We forgot to look into you before.”?

Dr. N: It's all about balance. Because inflammation can be good. If we get sick, inflammation is going to bring all of the characters of our immune system to where it needs to be and do a really good job. A fever in and of itself is actually potentially a good thing. But then if the

fever continues after the infection has been quarantined, after you're feeling better, you're going to cause damage. And so it's all about finding that balance.

Alie: Okay. Do we have maybe more inflammation than we need these days? Do we have more factors that are contributing to increased inflammation?

Dr. N: Absolutely. And I think unfortunately a lot of it is diet, smoking, drinking, all of the vices that… I wish I could sound more sexy and say like, "You have to stay away from this One Thing!" But it's everything we already kind of know, but we're just learning more and more about how bad some of it really is.

Alie: And what do you use to manage your diabetes? You're a robot, right? [*Dr. Natter laughs*] Like, you're a cyborg?

Dr. N: That's correct. [*laughs*] I have an insulin pump, and I have something called a CGM. And my CGM, it stands for continuous glucose monitor. My insulin pump basically has a reservoir of insulin that I change out every four to five days, and it automatically will pump in what's called the basal rate into me through a subcutaneous little cannula.

Aside: Side note: a subcutaneous cannula is just fancy talk for a tiny hose that goes under your skin.

Dr. N: And then every time I have something to eat that has carbohydrates, I have an estimation of how many carbs that is. I have an insulin-to-carb ratio, plug that guy into my pump and I get a bolus of insulin to hopefully cover that meal.

Alie: And who is a good candidate for that? 'Cause that seems way better than poking your finger and poking yourself with a needle.

Dr. N: Right. No, it does – I mean, it does and it doesn't. It's interesting, a lot of type 1s prefer to not have the pump. You have to be attached to it all the time, it's kind of annoying. The main question you get asked is like, "What do you do when you're having sex?" Ya know?

Alie: Oh, yeah! You've got this thing dingle-danglin' off of you, like a mic pack or something?

Dr. N: [*laughs*] Exactly! It's just kinda floating by the side.

Alie: Yeah, what do you do? I mean, you haven't ever had sex before, but when you, one day…

Dr. N: I don't do those things so... Alie, I'm not an animal! [*both laugh*] I feel like this is a good plug for your sexology episode!

Alie: [*laughs*] But what does a person with type 1 diabetes do about being an android?

Dr. N: Yeah, so, when I was first diagnosed, a lot of these technologies didn't exist, so you would use syringes. The technology has come to be so that the disease can be very well managed and hopefully kind of fall into the background a little bit. And the pump allows a lot more of that. And so now we have what's called a closed loop system. My continuous glucose monitor, which I have on my arm, sits in the interstitial space, and it's detecting this flux of glucose across cells. Why that's so amazing is because it's given me a sense of the direction of where my blood sugar is heading before it gets there. So if I'm on my way down or on my way up, I can take care of that before it actually hits. And my pump has now the ability to say, "Oh, you're going up, I'm going to give you a little more insulin," without me having to do anything, which is phenomenal.

Alie: Who is not a good candidate for a pump? Isn't it really expensive, too?

Dr. N: It is. It's crazy expensive. Thankfully, I have insurance, but I think about this often, as well as more recently with the crazy skyrocketing price of insulin. It's ridiculous!

Alie: What is causing this insulin surge? What's the deal?

Aside: Wooo boy! Ohhhhh boy howdy. We're gonna get to the cost of insulin in next week's part two, but you can start right now just practicing screaming with rage, if ya like. Okay but at this moment, back to the pump.

Dr. N: Oh, my god. So many things. So, just real quick with the pump. Who's a good candidate for the pump? If you're type 1, you have to demonstrate that you still… The pump is not autopilot. You still need to be cognizant of how to take care of yourself and how to troubleshoot. And it's also a machine, which can have its own issues, which I've dealt with as well. So if you've proven to your endocrinologist or your diabetologist that you have a good sense of your disease, you know how to handle it, and you know what to do in case of emergencies and troubleshoot, and you really want to try and fine tune, then that would be a good thing for you.

A CGM, on the other hand, I think every diabetic should have. Prior to a CGM, it kind of feels like you're flying an airplane with a blindfold on. You test your blood sugar and that's one point in time. You don't know if that's 100 and it's going up or going down. You have no idea. So the only way to combat that is you test your blood sugar 12 times a day and connect the dots, which is a pain in the ass. It sucks!

Alie: Does it hurt to prick your finger?

Dr. N: No. I mean, I don't think so. I think anything you do every day for X amount of years, you just kind of adapt to. But even when I first was diagnosed, pricking your finger is, like, nothing. It's a walk in the park.

Alie: What advice would you give someone who's just been diagnosed?

Dr. N: Ooh, that's a good question. I think it's important to recognize that it sucks. I think, you know, oftentimes when bad stuff happens to people, people who have experience with it are like, "Oh, it's not that bad," or whatever. I think it's okay to kinda get down on their level and be like, "You know, this sucks." But just because it sucks doesn't mean that your life is over and doesn't mean that you need to alter everything in your life. It means you're going to have to make some changes and you're going to have to adapt. But it's adaptable and doable.

Aside: So, it's adaptable, and it's doable. Especially with all the diabetologists and the charities working to further outreach and research. And for each episode, we donate to a cause of the Ologist's choosing, and for part one of Diabetology, Dr. Natter chose an organization called Beyond Type One. And Beyond Type One is uniting global diabetes community and providing solutions to improve lives today. It was founded in 2015 and they focus on education, advocacy, and the path to a cure. And their site is awesome, it has everything from equipment information, to diet info to DADs, aka Diabetic Alert Dogs, and it was a great resource as I was researching this episode. It has wonderful links for patients and for newly diagnosed folks. So that's BeyondType1.org. That donation was made possible by sponsors of the show, which you may hear about now.

[*Ad Break*]

Okay, so where were we? Yes, we were talking about cyborg pancreases…

Alie: Do you think we are going to get robo-internal-pancreases? Or is it too many moving parts?

Dr. N: I think that there's two flavors of cure. I think if we can get stem cells… the concern would be if it was an autoimmune process that killed off your own cells, then putting your own cells back in will also have the same issues. So I think if we could somehow hermetically seal them in, like, a Trojan horse and then we can implant them in the omentum or the liver, those beta cells will then kind of act as their own free-roaming, endocrine-pancreas. And I think that would be a potential cure. The other way would be a mechanical cure, which I think we are very close to doing.

Alie: And you have kind of a mechanical pancreas, it's just external.

Dr. N: That's exactly right. And I think that the mechanical cure will be an external one, but the thing that we really didn't dive into too much is that there is a gas pedal and there's a brake. The gas pedal is insulin; insulin is going to drop your blood sugar down. But right now, I don't have a brake. And the brake that our body has physiologically is something called glucagon. So, I mentioned that there is the beta cells for insulin, but the alpha cells make glucagon. It's another hormone, and that hormone, just to put very simply, goes over to the liver, knocks on the door, and goes, "Hey, liver! Let's get some sugar!" And so it breaks down the glycogen and pours out some sugar. [*clip from Def Leppard song Pour Some Sugar on Me: "Can't get enough!"*]

It's the 'yin to the yang' kind of deal. So a pump that has a dual chamber with some glucagon, and some insulin, and the closed loop system with the CGM would essentially be that system.

Aside: And remember: CGM stands for 'continuous glucose monitor.' I gotchu.

Alie: And can a CGM be a CGGM? Like glucose and glucagon monitor? Can it monitor both glucagon and glucose?

Dr. N: Ooh… So, glucose would be the piece that you want to measure, because both glucagon and insulin are what's going to be affecting the glucose.

Alie: Oh, got it. So then it would be more the pump that had two, uh… nozzles?

Dr. N: That's exactly right. It'd be a double nozzle.

Alie: [*laughs*] Okay! Oh, my god! [*"Wait a minute! There's two sets of nozzles!"*]

Are there any good movies or TV shows about diabetes?

Dr. N: Oh, are there good movies? Umm…

Alie: Other than, "Shelby, drink your juice"? I'm trying to think of other diabetics that I've seen.

Dr. N: [*laughs*] Oh, there was! My sister, who's a bit older than me, used to be a big *Babysitter's Club* fan.

Alie: Oh, my god. Claudia. No… uhh…

Aside: Of course I looked this up. The *Babysitter's Club* character with type 1 diabetes was named… [*drumroll*] Ready for this? Stacy McGill! So, congratulations if you've been in your car, alone, screaming, [*as if over a phone*] "It was Stacy! It was Stacy! C'mon, Ward!" Okay, Stacy. Yes. Sorry.

Dr. N: There was an episode that my sister made me watch with her because there was a diabetic. It was like a Christmas episode, and she's eating all them cookies, and then she goes into – oh, it's such a good segue – she goes into something called DKA. Should we dive?

Alie: Yeah!

Dr. N: We're taking a dive. Oh my goodness.

Alie: Something ketoacidosis?

Dr. N: Oh, boom! Crushing it. What's the 'D'? I mean, we're talking about it.

Alie: Uhh, diabetic ketoacidosis? Arrghhh!

Dr. N: You're brilliant. See, you are a doctor, Dr. Ward [*laughs*]

Alie: Pretty much. All I need is a lab coat and a really good insurance policy. The best malpractice insurance and I'm just ready to go.

Dr. N: You're golden.

Alie: So what is diabetic ketoacidosis?

Dr. N: This is what I was in when I was diagnosed, and often this is what happens with type 1s. If you have type 1 diabetes, you have no insulin in your system. With no insulin in your system, like we spoke about before, all that sugar, all that glucose, can't get out of your bloodstream and it can't get into your cells. Your cells are dying in a sea of plenty. They're like, "Yo! Where's all that delicious, sweet, sweet sugar?"

Alie: Oh no, and it's all around them.

Dr. N: It's all around them. It sucks.

Alie: And so what does that do to your tissue?

Dr. N: So your tissue is like, "Yo, we need to get some energy now!" So they go to alternate forms of energy. And that's breaking down your adipose, or your fat tissue, and sometimes your muscle as well. When you break down fat tissue, it's called beta oxidation. And you can get some energy from that. You actually get things called ketones, which can be used as sources of energy, and the major ketones you get are things like beta hydroxybutyrate and acetoacetate and acetone.

So, your brain and neurons and your heart can use ketones for energy and so on. But the problem with ketones is that, if there's absolutely no insulin around, then these ketone bodies build up in the blood, and they're super acidic. And your blood is super finicky and it wants to remain very, very, very neutral, like 7.3, 7.4 pH., so your pH starts to drop precipitously, and you become acidemic and then acidotic, and then you get very sick – coma, brain swelling, death kinda deal. That's DKA.

Alie: Why does that not happen on the keto diet?

Dr. N: So on the keto diet, you go into something called ketosis. So you're getting more ketones and you're kinda shunting that as your fuel source, but you still have insulin around in your body. And so those ketone bodies don't build up to the point where they're dropping your blood pH.

Alie: Okay so, on the keto diet, can you survive without glucose in your blood and glycogen in your liver and muscles?

Dr. N: You need some glucose, but you're getting some glucose. I think it's almost impossible to eat a diet that has, like, zero-zero glucose. Like, plants and stuff have a little bit of glucose. Your body is able to kind of shunt to different sources and so on, but I really don't think it's the best way to go. I think it does help with epilepsy to some degree. The mechanism, I don't think is that well understood, but it has to do with the idea of neurons utilizing ketones instead of glucose as their source. And so it does something with the excitability of the cells.

Aside: And so if you don't have insulin deficiencies, the keto diet won't throw you into ketoacidosis like it would someone with diabetes. And in terms of using the keto diet to control blood sugar, some folks with type 2 say it's allowed them to manage their glucose levels and use less insulin. Of course, do not use this episode to diagnose or treat a disease. Consult a doctor before making any changes. Do not sue us.

Alie: How do you think we can change our culture at large to avoid so many people getting type 2 diabetes? Obviously there's a lot of things a person can do individually to take responsibility for it and to try and look out for themselves, but in terms of an epidemic, what should people be doing at a higher level?

Dr. N: I think that's a really good question. It's a really important question, because it's really turning into such an issue. I think it has to be a multipronged approach. I think we have to change culture, which is a very difficult thing to do. And I think the idea of changing culture is really centered around food. I think food is a huge driving source and I think we need to make healthy food options more accessible. If you think about a single mom raising four kids, it's probably really easy and affordable to go to McDonald's and feed everyone. Also, in American culture, if you eat dinner, it's expected that your dinner is going to be filled with a lot of meats and carbs and sugars, and our portion sizes are crazy. I think that's huge. I think having access to healthcare is important. I think those two things in and of themselves would make a huge difference. And then outside of that, I think we need to be more active. I think we need to exercise.

Alie: How does a person stay active when they are doing something really hard, like raising a lot of kids, or going to medical school, or asking people about lizard dicks for too many hours a week? [*Mike laughs*] How do we prioritize exercise? I know I can fit it in my schedule, I know I can Tetris it in there. And I'm so bad at it lately!

Dr. N: It's hard. I mean, I'm gonna be a hypocrite, because I'm a resident, my schedule is awful. I mean, I *wish* I could talk about lizard dicks. [*laughs*]

Alie: You need more lizards in your clinic! [*both laugh*]

Dr. N: Yeah! I think the idea is, being active and exercising doesn't mean you have to carve out an hour and go to the gym. You can take the stairs instead of the elevator. You can park your car a little farther in the parking lot. You can take two stairs at a time instead of one step.

Even if you get 15 to 20 minutes a day of doing something like that, that counts and that makes a difference. It adds up.

Alie: Do you ever advise patients to get a Fitbit or get a step tracker and just try to hit a goal?

Dr. N: Yes. Usually what happens is they'll get it and they're very excited upfront and then it kinda peters out towards the end. But it is nice to have objective data. And then what I'll try to do is I'll bring them back. So I'll say, "Instead of seeing me in six months, come back in a month. Let's see how many steps you did, let's see how many pounds you lost." And then you kinda work with them and you kinda keep them honest. It's helpful.

Alie: How do you, as a doctor, approach something like, you know, physical fitness and things like that without making it into an emotionally shaming issue? You know what I mean? Because it's so hard to feel good about your body in a culture that celebrates, like, emaciated Instagram models. And so we're fed these two really different messages about how we should be stick thin and also you should feel good about your body at any size. It's a little confusing.

Dr. N: It's difficult, you're absolutely right. And I think from a physician point of view, when someone has disease or they're developing disease, that should be the motivating factor. It's not about, 'you don't look good.' It's about, 'I want you to lose this weight because I'm worried about your diabetes and your metabolic syndrome and your blood pressure.' And losing weight doesn't necessarily mean that you're gonna… I don't want someone to necessarily *look* different. I want them to feel better. So, I think if you package it like that and say it's about your health, it's not necessarily about the physique, I think that's important.

Alie: How do you, as a doctor and also a patient motivate yourself to do the things you know are good for you?

Dr. N: I struggle, Alie. I really do. The things I can control, I control. So I try really hard to be careful about what I eat. But I also think it's important that… you know, I believe in moderation. I think it's important that if you like ice cream, if you like French fries, you shouldn't deprive yourself of them *all* the time. I think it's okay, being diabetic or being hypertensive or overweight, to once in a while indulge yourself.

Alie: How once in a while? [*laughs*]

Dr. N: That's the balance, right? For instance, I try not to eat any red meat, but I'll have red meat maybe once a month, once every two months. That's not evidence based, I just made it up. And what I do is when I'm at the restaurant, when I'm out with my friends or whatever, and everyone is ordering steaks, I think back, "Okay, when was the last time I had steak? When was the last time I had red meat?" If it was recently, I'm like, "You know what? I'm going to go for the salad."

But in the morning, I try to eat eggs, some, like, avocado, something with a lot of protein and some fat to kinda keep me going. Maybe I'll have a Greek yogurt and some berries. Berries tend to be okay in terms of glycemic index for diabetics. Other fruits are a little bit more tricky. And then coffee. Lots of coffee. Numerous amounts of copious coffee. And then for lunch I'll have a salad, usually, if possible. And then maybe I'll have some fruit, an apple or

something for a snack. A handful of almonds, something like that. Another two or three coffees.

Alie: So what do you eat for dinner?

Dr. N: Oh, my god, dinner. What do I eat for dinner? For dinner, I eat a good amount of sushi, sometimes I have some grilled chicken and salad or quinoa, sweet potato, that kind of stuff. I try.

Alie: Have you ever done, like, a straight up diet? Like a Whole30 or a South Beach? Have you ever… Oh, you're like, "Nah."

Dr. N: Nah. It's just that I don't think those types of diets work, because I don't think they're sustainable. I think the best kind of diet is a diet that allows some moderation.

Alie: So a diet doesn't work, but...

Dr. N: Like, fad diets. Like a 'diet' in terms of like, you know generally what you want to stay away from and what you want to have and then recognize that there's some room for moderation. And moderation means both serving size and frequency of how often you have it.

Alie: Okay. Can I ask you some Patreon questions?

Dr. N: Hit me. Let's do it.

Alie: Okay, we're going to inject you with Patreon questions!

So ask nice doctors stupid questions and stay tuned for next week's episode, which has more of your questions about staying healthy, and affording insulin, and supporting people you love who have diabetes, how to avoid getting diabetes yourself.

To follow Dr. Natter in the meantime, he's Mike.Natter on Instagram, or Mike_Natter on Twitter. We are Ologies at both, and I'm @AlieWard on Instagram and Twitter. Links to Beyond Type One and the sponsors of this show are in the show notes and up at AlieWard.com/Ologies/Diabetology.

Ologies merch is available at OlogiesMerch.com and up at AlieWard.com. Thank you to sisters Shannon Feltus and Boni Dutch. They are hilarious, and they run all that merch, and they host a podcast called *You Are That*, which is so funny. Thank you to Erin and Hannah, who have adminned the Facebook group since the start. Emily White organizes all the transcripts and we are catching up fast. There are links to bleeped episodes and transcripts in the show notes.

Jarrett Sleeper of the mental health podcast *My Good Bad Brain* does assistant editing. And thanks, of course, to He Who Is Sweet and Not Insipid, Steven Ray Morris, for putting all the parts of the episode together and getting it out on time. Nick Thorburn wrote and performed the theme music; he's in a band called Islands. Listen to them.

And if you stick around until the end of the episode, you know I tell you a secret. Woo! This week, I'm gonna share a little hot tip for my fellow folks who have sleep procrastination, or fall asleep in their clothes a lot. At 8 p.m. – this is a new habit – I make myself get ready for bed, even if I have no intention of sleeping for, like, hours. That way, at like, 11:30, when I'm super tired, I don't have to splash cold water on my face, and have it run down my sleeves, and essentially look like a possum who's been attacked by a garden hose. So, baby steps, kids! Get ready for bed hours early. It helps

with the sleep procrastination. Okay, so next week, we get emotional, we have more living tips on how to avoid or afford the 'beetus, so meet me back here. Berbye!

[*Outro music*]

[*Wilford Brimley: "There are so many new ways for you to treat your diabeetus."*]

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Some links which may be of use:

Shockingly, Gwyneth is not drinking her pee

Don't drink your pee!

The Golden Fountain: pee won't help you

Army Field Manual: just go thirsty

CDC Diabetes fact sheet

Type 1.5 diabetes

Drink your juice, Shelby!

Types of Diabetes

Coxsackie and Type 1 Diabetes

Generalized Anxiety Disorder and blood sugar

Coxsackie New York and its cute viruses

Coxsackie, NY real estate: that $129K log cabin

Genetics of diabetes

Meat and diabetes

The truth about Stacey McGill of the Babysitters Club

Keto and diabetes

Red meat and diabetes

For comments and inquires on this or other transcripts, please contact OlogiteEmily@gmail.com