Episode 260: Why the 21st Century Is at War With Your Spine With Ty Carzoli

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Katie: Hello, and welcome to the Wellness Mama Podcast. I'm Katie from wellnessmama.com and I'm here today with a friend I met recently and I cannot wait to jump into this conversation. I'm here with Dr. Ty Carzoli who has conducted research at Florida State in cardiovascular and muscle physiology. He has a Masters in sports and health science and a doctor of chiropractor degree. He specializes in a really cool form of upper cervical work that I'm probably gonna butcher the name but I think it's called orthospinology, which we'll talk about today. And we're also gonna delve into some of his other areas of specialty, a lot of which will really apply to a lot of you listening. So Ty welcome and thanks for being here.

Ty: Katie thanks so much for having me on. You nailed the name by the way orthospinology. And I'm honored to share the mike with you and I absolutely love the mission you're on to help empower people to take control of their health through education and understanding. My sister's a mother of four. She absolutely loves you and your work and she lost it when I told her I was coming on your podcast. So thanks for having me.

Katie: Oh, my gosh, of course. I knew when we met at an event that I had to have you on because geeked out on all kinds of alternative health and spine science for hours and it was amazing. I can't wait to share you with the audience. So to start for a little bit of background can you explain how you got into this field in the first place?

Ty: Yeah, absolutely. So I come from a large medical family. My father is a neonatologist. So he specializes in helping with babies that have any birth complications, premature babies, anything that could kind of make them a high risk pregnancy. And he started his practice when I was really young and so some of my earliest memories were actually spending the night at the hospital with him, getting to hangout out in the nursery, staying in the on-call room, and be around and exposed to that environment. And it was really awesome to see him help people in these extreme times of crisis, you know. There's probably few things scarier than something going wrong with a newborn infant. So I think that really inspired me to go into health care and help people through the medium of health.

You know, the more you learn about health-versed disease you kind of realize that in our health care system... I think we have the best emergency medicine in the world really bar none. But I think one of the issues that we've gotten so good at treating emergencies that we tend to treat everything like an emergency. And I think 8 or 9 of the top 10 killers are considered chronic disease, which is somewhat synonymous with lifestyle disease and that's really synonymous with preventable disease, at least modifiable in many cases. And so, you know, it's interesting to think that a lot of these things that are killing people in our country are in some way preventable through lifestyle changes. And sometimes there's limitations. They might not have access to certain things or might not have the knowledge of certain things. But that's why I think patient education and equipping people with the tools to navigate their health on their own can really, really open up the door to kind of a health Renaissance really.

Katie: Yeah, I love that. I think that's such an important point and you're so right. You're not gonna be able to go into an ER and get help for a chronic disease. And I think there was an article that came out this week even that said that the estimate was I think 11 million people died in 2017 based on food and lifestyle-based diseases and factors. And so I think you're right. This is a growing problem and I loved your approach when we spoke before because you're so much about getting the control back in the patient's hand and being their advocate and their partner. But not taking over their care giving them the power back, which I think is such an important mindset shift.

Ty: Absolutely. Absolutely. It's crucial and it's really remarkable to see how people perseverate and kind of can catastrophize when they're, you know, titled with these diagnoses that they don't always understand very well, and they don't understand what that means or what the prognosis should be. And it's a shame because I think if people had a little bit more understanding of their health and some of these associated conditions that can go wrong, I think they'd feel a lot more empowered to get back to their old life.

Katie: Yeah, absolutely, and that's a great springboard. So let's start there because I feel like when we spoke before you have really good perspective on a whole lot of different just different alternative therapies and problems that people are coming into you with. So can you walk us through some of these things that people may not necessarily understand about your area of expertise specifically?

Ty: Yeah, certainly. So like you said I'm an upper cervical specialist chiropractor. So I still analyze and treat the entire spine but I spend most of my time and attention up of the very top of the neck. So the occiput atlas and C2 or axis. So atlas axis. That's C1 and C2. They've got a couple of different names. I'll try to just keep using the name atlas throughout this. But that area is really, really vitally important and complex and I think it deserves a specific and specialized practitioner because of that. The atlas bone has no disc above or below it. And the disc really, among other things, it functions to kind of absorb and cushion and dissipate shock. This is also the most mobile joint in the entire spine. So between it being a poor shock absorber and hyper-mobile that's really the recipe for susceptibility to injury by displacement. And it can be a big problem because when that misaligns there's sort of a handful of things go wrong. And I like to classify them as sort of hardware problems and software problems. And what I mean by that are those orthopedic issues, those muscular skeletal issues and those neurological issues.

And before we go any further because I usually have a model that I think I can show patients while I explain this. So I'll do my best to sort of describe to you what that might look like. So just imagine if the head were a basketball and place like a ring-shaped kind of disc under it. Now it's a little differently shaped than that but that will work for this analogy and then put a smaller ball under that and that would be your C2. So if you can kind of imagine that atlas, that middle ring-shaped structure, that can move in a series of different ways. And those balls could kind of move on each other's surface in a way that can interfere with both the mechanical function of that area and the neurological function. You can imagine if that bone slides out a place it's not gonna do so like a little Jenga block. It's gonna bring everything south of that along for the ride.

So I kind of say, you know, if you have an atlas misalignment there's a chance you have a full spine misalignment. And I think my favorite patient case to illustrate that point, we have a patient that survived a plane crash 20 years ago and came in here for right-sided knee pain totally unaware that she had a cartoonishly misaligned cervical spine. And naturally as we're working on her neck she's wondering, you know, "What the heck are you doing, man? My knee hurts. Like, can't you work on my knee?" And sure enough after a couple corrections on her neck we got about 65% structural resolution there, meaning she was about 65% closer to straight up and down. And that made the stress on her knee a lot more normal and not a very asymmetrical strain she'd been enduring for years. So that's a cool one because now she's since hiked to Mount Everest Base Camp. I think she did a month in the Grand Canyon. She's done the Cross Fit games. She's just, you know, at her most active lifestyle yet. And what brought her in here was the knee pain and she thought she had a knee problem.

Katie: Well, and I bet so many people end up with a diagnosis related to their knee or even, like, surgery probably at times right that go back to spine or some other part of the body?

Ty: All the time, you know, and it's tough because again with emergency medicine if somebody has a wound to their leg it's probably gonna hurt right there where that wound is. But with these more chronic things there's often a disconnect. You know, I like to tell patients "If you step on a dog's tail it barks out of its mouth, right?" So we have to realize that the body is obviously, very intimately connected and that these kind of upstream problems can cause downstream consequences.

So now alongside those structural issues it's important to know or familiarize yourself with something called Wolff's Law. So Dr. Wolff was a scientists that found that your bone adapts in accordance with the stresses placed on it. So this is why astronauts coming back from space have very brittle bones. Their bone marrow density has decreased and their muscle mass is wasted. This is also why as we become inactive as we age and our muscles waste as we age, we often see bone mineral density decrease. So similarly this is why athletes have very dense bones, right? They're either lifting weights or grappling with other athletes but they're doing these things that stimulate their body to create denser bones and stronger bones. But not only will the bone quality change in that way, the bone shape itself will change. So what can happen is if anything moves your body off its normal axis of pressure.

So imagine if you have a misalignment and it's probably easiest to think of this forward head posture, right? And you can probably picture maybe an elderly person with their head kind of pushed forward and their butt sort of tucked under. I mean, that's exactly what that tends to look like. And so what's happened there is that the axis of pressure of their body mass has moved off of its normal place, right? So in this case it's typically moved forward and as the head comes forward, well, the butt is gonna have to kind of tuck under it to bring that center mass back. But what's happening is all that tissue that is picking up the strain is now being stressed in a very atypical way. And so what will happen is in the case of forward-head posture is especially the front of the discs will take on an abnormal amount of load. The structures on the back of the spine and neck will be strained in a very unhealthy way. There can be soft tissue changes. The soft tissue corollary to Wolff's Law is something called Davis' Law. And so we know when soft tissue is strained for long enough it also starts to make changes to itself to adapt to those stresses.

So those are the types of things we wanna prevent because on a longer timeline that leads to degeneration and the associated consequences of that, which interfere heavily with nervous system function and mobility. And I would argue that the mobility of your spine is one of the most important things for driving a healthy brain. The stimulation that we get through movement for our brain is crucially important to keep our brain plastic, adaptive, and kind of malleable and responsive. And, you know, we sort of mistakenly say or think that we become inactive as we age. And I would maybe argue that it's probably more evidence that as we become inactive we really accelerate aging and that activity and that physical movement really keeps us healthy.

Katie: That makes sense. So in your opinion what are like some of those ideal forms of movement and amount of movement because I feel like in any area of health but especially, like, diet and exercise people have so much confusion because there are so many differing opinions. So what's your take on the best ways for people to move?

Ty: That's a fantastic question. I will tell you what I tell all of my patients is that I think yoga is a second best thing you can do for your spine, chiropractic obviously, being the first in my opinion. But I think really what people should consider when they approach their training and exercise is just remember that your goal is to kind of stress your body with a spectrum of different physical stressors. You wanna be adaptive to all sorts of things. Now if you're a competitive athlete you need to be very specific in your training, but if your goal is just health and wellness and to keep your brain and body as healthy as you can for as long as you can, I think you should focus on a spectrum of different physical stresses, yoga being a fantastic one. I am a big advocate of resistance training or lifting weights. I think that muscle mass is one of the most protective things someone can have as they age.

So I really encourage people to do that. I am not such a big advocate of some of the traditional aerobic endurance type stuff. You know, again, if you're competing then go for it, but if you're doing it just to be healthy I think that you can get a lot of similar adaptations through means that are lower impact or in many cases keep your spine in a healthier position during the exercise. I'm kind of thinking about road bikes right now that unfortunately to generate a lot of power you sort of have to put your spine in a slightly compromised position. So I tend to steer people away from the really high-mileage things unless it's something they're really passionate about and point them towards lifting weights and Yoga. I think those are some of the most important things from a physical standpoint that we can do for our health.

Katie: Yeah, that makes sense. And I've read a lot about that as well as far as, I mean, cardio has benefits for the heart. And you wanna like make sure you're moving but as far as for the bones and alignment and stuff it makes complete sense that things like yoga and weight lifting would be the way to go. And another thing, speaking of the structure and the spine, that we talked about in person, and I love for you to go deep on is you mentioned you have, this, like very mobile but also kind of you gotta be careful with the neck and the upper cervical. And I mentioned that I hate when they like crack my neck like at the chiropractic office on my neck. I kind of avoid it because I kind of hate that. And you had a great point on this. So can you talk us through your thoughts on that?

Ty: Yeah, and before I do I actually just wanted to respond and say, you know, I did not mean to omit any sort of are aerobic training. But I think that you can get a lot of similar adaptations from sprint training or interval training that you can get from some of those aerobic style trainings. So I would maybe steer people toward those types of things if they still wanted to get their heart rate up and make those cardiovascular adaptations. But to answer your other question yeah, and I'm glad you brought that up. I think this is probably the least exciting point but a lot of people don't realize that there's tons of chiropractors that are not doing any twisting and cracking style adjusting. You know, we don't do any of that here and we're not alone in that. There are tons of people moving away from it. And, you know, it is even that style of adjusting is fairly safe. But I would make a case that if someone is adjusting and they don't have objective evidence for the state or position of the spine, well, the existing scientific literature seems to point toward what's called motion and static palpation or using your hands to assess spinal position. The existing literature doesn't shine a very favorable light on the efficacy of that.

So, you know, the people that do that aren't here to defend themselves and I don't wanna spend too much time harping on that. But we'll suffice it to say go explore the literature yourself if you're curious about that. And kind of know that this is what I would recommend for certainly myself and my loved ones, is that they need some objective criteria to guide what treatments the spine will receive. And in the case of what we do here and most other cervical doctors will do a digital X-ray to render kind of specialty images that show exactly how this upper cervical region is misaligned and how that can affect the brain stem.

So how do we adjust you might be wondering. So there's a series of different things you can do. We use a large table mounted instrument. Unfortunately, it sounds very esoteric to describe. It's something that tends to make a lot more sense when you see it. But we can orient this thing to get pretty much any vector or force in a sort of dome over the patient's head as they lay on their side. So we would take these digital X-rays, figure out exactly how they have misaligned three dimensionally, and then we would plug that into this machine,

which would then line up a very, very specific corrective vector of force, and then apply a really gentle impulse that's usually between an eighth of an inch and a quarter of an inch right over what's called the transverse process of the atlas.

So if you kind of gently put your finger right behind your jaw you might feel a bone kind of behind your ear. It's sort of right in that window that we have to get do this adjustment. So it's very, very precise, it's very calculated, and it's very, very gentle. So it's a far cry from what people are used to or expecting when they think of chiropractic and usually patients set up off the table after I do it and the first thing they say is, "Was that it?" because it is very gentle. And you're not alone in having some concerns about that other style of adjusting. I know it can be sort of unsettling and off-putting for people. So it's important to people know they do have lots of other options.

Katie: Good to know and what are most people coming in to you for or do you just see, like, a huge range of patients?

Ty: I'm glad you asked that. No, you know, we see... And it's kind of a shame that the example I gave earlier was a more mechanical pain-based one because that's probably only 20% of our patients that have neck pain, back pain, knee pain type stuff. The vast majority of people coming in to see us are coming to get help with things like post-concussion syndrome, migraines, and headaches, vertigo, dizziness, disequilibrium, including Meniere's, brain fog, trigeminal neuralgia, occipital neuralgia. We get some seizures patients, some tremors patients, occasionally patients with ticks, torticollis, infrequently but sometimes with GI stuff. That's not stuff I am a specialist in so that's more like if they've been everywhere else and then they come in here sometimes they get some results there. We see a lot of patients with Ehlers-Danlos syndrome, which is a rare and not well-understood connective tissue disorder that affects the collagen protein folding. We see people with TMJ, eustachian tubes issues, and then like you said, of course, neck pain, back pain, some of those more orthopedic issues.

Katie: So you just said several buzzwords that I hear from a lot of readers about. And I'm obviously not a doctor or a chiropractor. I'm not qualified to do any of this, but I would love to if you don't mind go a little deeper on a couple of specific issues. Specifically, recently I've heard from a lot of people struggling with migraines that are resistant to a lot of stuff they try and also people with post-concussive syndrome, including a friend of mine. So I'd love if you can kind of walk us through your approach to those.

Ty: Yeah. You know what? I will and before we get too deep in physiology, if I can I'm gonna hop up on a soapbox really quick and I want to say a couple things just sort of to help people understand health care and especially the alternative health care professions. And I'm doing air quotes when I say that. So we have to remember science is an approach to problem-solving and it's almost to discern fact from fallacy. So good science and a command of it should be pretty emotionally neutral. And it's perfectly okay and normal for scientists to disagree and it's common for there to be some gaps in between clinical practice and scientific exploration. This is sort of an unfortunate but seemingly unavoidable truth. So we have to do our best to navigate those gaps thoughtfully as best and always best to serve the patient, you know, and those types of missteps are not something I'm immune to. So I'll do my best to keep things accurate and digestible for everyone but there's also some things people should understand is that, you know, we should approach

science, its findings, and our understanding of them with humility and a healthy skepticism. It's good to challenge these theories and try to neither be too dogmatic nor defensive. I'll do my best not to put my foot on my mouth on that and I certainly have my own biases and I try to expose them as we go.

So any explanation I give here is one that hopefully a year from now I'll be able to give you a better, more well-rounded, more updated explanation. And maybe I'll even say, "You know what? I disagree with something I thought was true then." So with that all in mind hopefully kind of painting a picture of where you're a little bit better. And what I'm getting at with that is some of these things are not perfectly well understood. Some of them we have really, really sound hypotheses for what happened or what is going on. But not everything has been as scientifically validated or vetted as we would have liked. And that's probably true of everyone in these alternatives health care professions is that we'd all desperately love more research, more scientific inquiry and investigation into what we're doing. But the reality is science has to be funded by someone. And if there's not a clear financial incentive to dump what can be hundreds of thousands of dollars into research then some of those things won't get funded. So there are some issues where these things have been tested and true and routinely proven effective in clinical practice. But we don't have the randomized control trials that everyone would love to back them up.

So hopefully that kind of paints a picture and I'll get of my soapbox on that. But the kind of working model right now, there's a few different things that are important to understand. So your spinal cord functions essentially as the information highway for the body. There's, of course, the cranial nerves. But a lot of the signaling to and from the brain goes through the spinal cord. And like any highway, this can kind of get jammed and I think this bone on a nerve model is somewhat outdated. It maybe lends itself to an easy analogy but it's not perfectly accurate. So in any event though these different misalignment's can cause issues with the timing of signals that are sent in the nervous system. And I want you to think of the nervous system a bit like you may think of an intersection, okay? So an intersection doesn't have a terribly complicated spectrum of signal types and similarly for any given neuron there is maybe a handful of different neurotransmitters that that neuron may release. Now so it's not that there's a, like I said, this crazy spectrum of signal types. It's that the cadence for the timing of those signals is crucially important. So back to that intersection. If the lights in an intersection are mistimed we can't really safely use an intersection anymore. So a lot of this involves a hopeful resolution of cadence problems within the nervous system that allow more normal function. So the upper cervical area is the most densely loaded in the entire body with something called a proprioceptor. Have you heard that term?

Katie: I've heard it but I don't know much about it.

Ty: Okay, perfect. So proprioceptors are sensory neurons. They're everywhere in your body. They're sensitive to mechanical stimulation so under your skin. They are sensitive to how gravity is pushing on you and affecting you. They are why our brain is typically and hopefully keenly aware of where we are in space. This is why if you close your eyes you could probably find your nose and even if someone moved your hand you could still find your nose, right? And that's because you are sensing how gravity is affecting you constantly. So when you have a misalignment in that upper cervical region the thinking is that that alters and interferes with some of this proprioceptor input. So like I mentioned that is the most densely loaded with those types of neurons. And those neurons are constantly sending signals up to the brain to the vestibular system and to the kind of integrating centers between those two to help your brain know where you are in space. Now you can imagine

though if there's a misalignment in that area, well, some of these joints are then getting sort of crunched down on more than others. Some are maybe getting stretched. There's a rotation component. Basically, that disc, that ring-shaped vertebrae, the atlas that I described earlier, that can misalign sort of three dimensionally. So and again it's sort of sliding around somewhat spherical surfaces. It will serve this analogy to think of it that way. So it's not so much that we can trace out exactly what's going on but just that there is aberrant input going into the nervous system to the brain. And the brain is doing its best to integrate these sometimes confusing and nonsensical signals, but it becomes a bit of a garbage out, garbage...or excuse me, garbage in, garbage out type situation. Does that all make some sense? Is that clear?

Katie: Yeah, definitely.

Ty: Okay. So those types of issues are why we see I think a lot of vertigo problems, dizziness. I'll get back to the post-concussion one in just a second but these migraines, these headaches, essentially if the brain is getting signals that don't make sense it's not gonna operate at its best and how that manifests itself, you know, can be a number of different ways. But suffice it to say that we want your brain getting the healthiest and most accurate signals from your body and you want it to send out the most healthy and accurate signals to the body. Now on the topic of post-concussion syndrome, and there is some really cool stuff coming out, a gentleman named Dr. Stuart Rosa is doing some studies with FONAR MRI. This is a type of video MRI where they're looking at the fluid movement of the cerebral spinal fluid, okay? So CSF, among other things, one of the main functions is to wash away cellular waste, metabolic waste, that builds up in the brain throughout the day, okay?

So every cell in your body all day long creates toxic waste and we're pretty brilliantly designed to metabolize, excrete, get rid of these things. And it really causes no issue for us when we do that. Now the issue here though when that atlas is misaligned what can happen is it would soft of occlude that opening at the base of the skull. It's called the frame and magnum. And it will slow or change...I should say it will alter the flow rate of that cerebral spinal fluid. So there's sort of two things that happen with that. One, there's a backup of these metabolic byproducts or a potential backup of these metabolic byproducts that could be toxic from a cellular perspective. And two, there's a pressure build up. So you know one of the main issues with concussions is there's a swelling, these pressure changes in the head. So you can imagine if the pressure valve at the base of the skull is twisted too tight, that person's going to have a very slow and laborious recovery. If they can get that adjusted and altered and restore some normalcy to that flow rate, well, then that person might have a much swifter and more complete recovery. Now that, depending on how acute the concussion, is they might still want to be under care with a vestibular specialist or a functional neurologist or some of these other groups who have specialized in these other things that compliment and really are an important total package for resolving those issues.

I wanna be clear. It's certainly not that I'm suggesting that people have, like, motor oil building up in the brain but we are really, really sensitive chemically to any changes in our body. And so the slightest alteration in the solution just about, in any tissue can change enzymatic functions. It can change how proteins behavior. It can change all sorts of different things. It can change how sensitive certain neurons to firing. And so you can see how this can be a bit of a quagmire to trace out, "Okay, well, here's exactly what's going wrong." And it's a little bit more of, "Well, here's sort of all the things going wrong," and it's hard to put your finger on exactly what is the most important or what's the most contributing. And then between, you know, two people it's

always a little different. So hopefully that paints a picture and people can realize that the goal is to restore normalcy to function, not necessarily intervene and improve on the natural process, just allow the natural process to function normally and optimally.

Katie: I got it. Do you feel like we're seeing an increase in these problems? Like, are we doing more things to inhibit this natural process or why do you think all of these things seem to be on the rise?

Ty: Yeah. No, that's a brilliant question and if we get to talking about evolutionary biology here in just a second, I will kind of expand on some of that more but, you know, the reality is...and I am certainly a bit of a naturalist. And my bias is absolutely that nature has done a pretty remarkable job getting us to where we are and I certainly think the human body is a lot more capable of healing than not. And I think tragically we've sort of been disempowered on our health in this country. And, again, that circles back to why I think patient education is so important.

So you know, the 21st Century is at war with your spine. You know we sit more than ever before. Some estimates put that at 12 hours a day for the average American. We stare down at our phones and computer screens that are way too low, way too much. And we're less active or physically challenged than we've been in the last several hundred thousand years. So, I mean, you think about it. We used to have to hunt for all of our food and now we can get it all through the window of our car from the cloud, right? So we've sort of disconnected with what would be natural stresses on the human body. And I think in the absence of those normal healthy stresses or I should say kind of historically natural healthy stresses, and then with the implementation of these things that are pretty terrible for your spine just sitting all day long looking down in these awkward positions and postures, it makes some sense why there might be a kind of a surging of these issues we're seeing at least those associated with the misalignment component. And, of course, all the things I mentioned are complicated in their own way. They all have multiple contributing factors. So this is not an island, you know, where we do often see complete resolution of many of those things. I wouldn't say or expect that to be the only thing going on. And it's important that we vet out what else might be going on for a patient to get them co-managed with the appropriate professionals.

Katie: Yeah, for sure. Okay. So you said evolutionary biology. Let's talk about that because you and I talked about this a little bit in person and I think you have a really, like, fascinating perspective on this as well. So walk us through your research and your theories on this.

Ty: Yeah, absolutely. So evolutionary biology is a pretty cool topic and we're gonna rewind a few billion years to get started here. So some of the first animals...and it's even funny to think of them as animals because they seem to us more like plants but sponges right? So these things you might see on a coral reef, the simplest ones are just sort of tube-shaped columns and their nervous system...they were actually sort of planted there. They couldn't really move, maybe sort of undulate a little bit in place in some instances. But for the most part these were not predatory hunters and at that time there wasn't too much to hunt anyway. So they sort of sit there and let debris and food stuff floating through the water catch into them and then it sort of metabolized from that point. But with that immobility their nervous system is what's called a nerve net, okay? So this is the simplest well, one of the simplest forms of a nervous system to my knowledge and there's no sort of special

congregation of nerves throughout. They're sort of evenly distributed and then they sort of, kind of like a web throughout this creature's body. And so they aren't terribly capable of complex neurological function.

So as you're moseying along through evolution, you know, one of the next things that came along are these spinal medira and they're kind of jellyfish-looking creatures, right? And so these have what's called a nerve ring or a nerve disc and so they have a slightly more centralized concentration of nerves in the middle. But it's still not terribly complicated and I think that's pretty fitting because if you look at a jellyfish, again, you've never been like "Oh, there's a creature of grace and elegance." And, you know, it's sort of just floating aimlessly through the water and can angulate itself and maybe push a foot or two in one direction but for the most part is really at the mercy of the current, right? And so as we continue on we think it's what's called cephalization. So this is where, you know, I think flatworms or something of that nature might have been one of the next steps there. So these little still very simple creatures but they actually have a head now and with that head comes concentration of nerves or neurons and eventually a brain that helps them utilize their special sense organs that have been developed as well as achieve increasingly complex types of movement, okay?

So, again, if we look at, you know, a flatworm it's still not something that's physically impressive in how it moves. But it certainly can direct itself better than the sponge or the jellyfish. And as we move along, you know, we move into I believe astrocytes with the sharks. Astrocytes are like fish. And so you move up and as the nervous system is getting more and more complex so too are or were the animals' abilities to move, to engage in different physical mediums, to explore different landscapes, you know. And then things came out of water and there's an explosion of life on land and then some things, some mammals, went back into water. You know, I think it's really amazing that flight evolved four times, you know. There's bats, mammals of all flight birds, obviously, and sex and pterodactyls. Don't sleep on pterodactyls, easy one to forget. And I don't actually know where they fit into all of this. But it's incredible to see that I think one of the main driving forces in evolution was the ability to navigate different mediums more effectively. And then you get to humans and, you know, we have some of the most complicated nervous systems and our movement is also some of the most complicated really in the animal kingdom.

So our bipedalism and our ability to walk around on two legs was not really achievable without a lot of brainpower going toward balance-related things right? I mean, you can look at the research or the robots being made at the Boston's robotics lab and it's incredible to see. You know, some of the brightest minds in the world for a long time struggling with how do we get these things to maintain balance and it's remarkable. I don't know if you are familiar or if you've seen any videos on YouTube. You know, just a few years ago they have these things with four to six legs walking around very clumsily slipping on banana peels. And I most recently just saw some robot doing parkour. So I'm afraid that the rein of human kind might only have a decade left before some sort of Skynet take over. But in any event it's really impressive to see that that's where a lot of the brain power in robotics is going into balance-related things for these. And that's certainly where a lot of the evolutionary push was toward, like I said, increasingly complex forms of movement demanding an increasingly complex brain.

Now alongside that there is certainly other things that drove that. Changes in our diet likely played a role. Changes in our social structure played a role. So nothing that I've described is an isolated incident. And I certainly wanna be careful not to answer for evolution. It's not necessarily a thinking process. It's something

that we can kind of reflect on, back on, and see what happened and what guided what types of changes. So hopefully that kind of makes some sense and is interesting but you can see how our balance centers and those proprioceptors I described earlier are crucially important because those, among other sensory organs, help keep us upright. You know, I think it's a miracle that anyone can step off a curb, you know, look to their left, see some truck barreling down the road, do the math, instantly know how far away is that, how fast is it closing on me, is it accelerating. Can I safely get across the street? You know, they'll look to the other side, see another car, do the same calculation, all the while remembering and estimating, "Hey, the first car that I'm no longer looking at it, how close is that likely to have gotten? You know, we walk across the street and the winds blowing. We don't fall over. We step down. We're probably on our phone the whole time we're doing this. It's incredible to think of how much brain power is navigating or being dedicated to these things that we really take for granted. But they're really miraculous when you understand what all is coming together to make that a reality.

Katie: Yeah, absolutely. Wow.

Katie: And the other thing I want to make sure we talk about and jump around a little bit is chronic pain because I hear from a lot of people who are struggling with that. I've never experienced it myself. I've

experienced, like, the chronic the fatigue side with hashimoto's, although that's much better now, but I can only imagine what someone who has chronic pain is going through. And I guess the way I'm thinking it would be a very difficult thing. And I know that's something that you have researched and also worked with people on. So you can talk about chronic pain?

Ty: Yeah, I'd love to. This is a really, really interesting topic. So chronic pain and this is great because I know your listeners are familiar with the topic of neural plasticity. I know it comes up all the time with people you have on the show. So neuroplasticity, just to be brief, are these sort of plastic changes to the function of the nervous system. What that means is basically your experiences throughout life and the input your brain receives will guide and shape how your brain integrates and behaves with future input, okay? So neuroplasticity by itself is neither good nor bad. It just is. It means our brains adapt, okay? And so they can certainly adapt for the better or for the worse. And so when we have something like chronic pain you have to remember that let's just say someone has let's stick with knee pain, okay? So we don't feel pain in our knees. We sense pain in our knee. We feel pain in our brain, okay? And so if the tissue in question, even if it's healed, if we trigger something that lights up that pathway in our brain, well, we can feel pain whether or not we truly authentically sensed pain, okay?

And so you've probably heard of, like, phantom limb syndrome. That's probably the easiest example to give right, where somebody might have lost a limb and they then wake up in the night with that foot hurting or itching, right, and the foot's gone. So we know that the sensory organ right there in the foot is certainly not what's generating that sensation. Something in the brain is generating that. So when we have chronic pain you can imagine if somebody is woken up every day for 10 years with pain, well, those experiences are basically kind of solidifying that pain pathway and its hypersensitivity. So it's tricky because sometimes when you explain this to people there's this knee jerk reaction that it's like, "Oh, so you're telling me this is in my head?" Well, no, I'm telling you electrically speaking it is within your cranium, yes, but it's not that you're crazy, right? And so we have to understand that we've essentially trained the brain, you know. Like Pavlov's dogs, we've trained the brain to experience pain whether or not we're still authentically generating those pain signals from the sensory organs in question.

So it's a kind of the million dollar question is well how do we unwire that, right, or rewire it? And certainly this is where patient education plays a tremendously powerful role. People have to understand, "Hey, no, you have healthy tissue. You're healthy. We just have to get your body to remember that and to believe that." And so it's one of those things where sometimes you'll have someone say, "Oh, well, you know, okay, every time I wake up saying I'm not gonna feel pain anymore, well, I feel pain that day." And the issue is that we didn't say you have to say you're not feeling pain anymore. You have to subconsciously know and believe in the world that we're there subconsciously. No one believed that you are in fact free of pain or that the tissue is healthy.

So a lot of the therapeutic targets of this involve kind of taking people just shy of maybe ranges of motion that elicit pain or just gently pushing that boundary and getting people more comfortable, and confident, and familiar with certain positions and realizing, "Oh, this doesn't cause pain." And then you kind of push the envelope a little bit more a little bit more and hopefully you can rewire those things. But in the absence of at least education first on how that works, I think there's gonna be a very low ceiling on how much better a lot of chronic pain patients can get, you know, and I'll give you just a couple examples. A good friend of mine is an all-American shot putter and a very, very big guy. He grew up on a farm. He was probably the biggest beast on

that farm. He's about 285 pounds and he's a lean guy. Now he had an injury in college where he herniated a disc and I think it was pretty poorly mismanaged by the medical staff he had access to and so now, you know, over 10 years later he will sometimes when working out he'll think he still feels that disc.

And it's funny because you can take him, you know... Again, the guy weighs 285 pounds. You can load 95 pounds on his back and he'll squat a little bit and he'll sometimes, you know, and say, "I think I feel it. You know, it's starting to bother me." And what's happening here is that his brain very much expects that pain because that squatting motion is what he associates with the original injury. So you can take the same guy and you can stress his back in a mechanically identical way that doesn't remind him of the pain and he will often not notice it at all. So is he crazy? No, absolutely not. He's just been conditioned very, very effectively for a very, very long time and now those neural circuits are firing without his permission, right, and without his want. But that's the gist of chronic pain is these neuroplastic changes, unfavorable neuroplastic changes, that are made that unfortunately don't seem to resolve by themselves because they really don't have too much reason to, you know.

And so I'll actually talk about a cool study, not a chronic pain study, but something that shows the expectation bias at its best. And there's recently a study conducted where they looked at I think 116 different people who performed a cardiovascular test like an aerobic endurance test. And they had done some genetic testing on everyone before this. They conducted the aerobic test. They measured both objective and subjective criteria for performance. And then these groups or these people were divided into roughly three groups. And there was a group that had a gene that was somewhat favorable for aerobic performance, a group that's pretty neutral, and a group that has a gene that's unfavorable for aerobic performance, okay? So they split the groups up into those thirds and then regardless of what they found genetically they told half the group, "Hey, you've got the gene to be really good at this," you know, the favorable gene and they told you the other half, "You've got the unfavorable gene." They retested everyone I think a week later and almost 100% across the board and I think almost all objective and subjective criteria either improved or decreased based on what the patient or the participant was told they had genetically. And, again, half those people were lied to or more.

So it's a really powerful finding because it shows that this expectation bias literally changed their objective and subjective performance. They ran, meaning how fast did they run? How much oxygen did they consume? How far did they run? How hot did they feel? Even how laborious did this feel? All those different things were recorded and based on what they expected to be true they performed accordingly. So it's, again, a really, really powerful study and the sort of knee jerk reaction people have when I tell them about this is. "You know, mind over matter or, you know, if you believe it you can achieve it. You can set your mind to anything." And whether or not that's true, that's not exactly what the study showed. What the study showed is if a scientist in a white lab coat standing in front of you saying, "Hey, I just did your blood work and you've got bad genes," well, you're gonna believe that and that will affect how you perform. So this is why I think it's crucially important that clinicians be very, very careful with the narrative they share with patients because that patient is going to own what you tell them, you know. And that patient is going to really, really internalize that and if you're not careful they're gonna catastrophize and they're gonna have this kiss of death diagnosis that really shouldn't be as stressful for them as it has become. And, again, that's often a function of just not understanding it well enough, the patient not understanding it well enough.

Katie: That's so fascinating and I've definitely heard the inverse of that as well. People who were told they had some, you know, like terminal illness and then when they died and did the autopsy they actually didn't. It was misdiagnosis that they believed that they were gonna die so they did. And I think that's, obviously, a very extreme case. But this is an area that I feel like I'm only starting to delve into the research on it. It's so fascinating. For years I was the type of like, "Oh, you know, I want to see the data, the, science, and just power through and, like, the emotions and what you believe don't really have a place." And I've come to realize so much in the last couple of years just how much they really, really do. But I think also your perspective on that was so good. It's not that just whatever you set your mind to you're gonna achieve. What this study actually looked at was when someone in authority tells you this and you believe them. So that's a really important key as well because I see studies like that used for just, like, this kind of more esoteric like, "Oh, if you believe it, it will happen," but you're right that's not exactly what this study said.

Ty: Exactly and you have to understand like, you know, are you telling yourself you believe that or do you authentically subconsciously believe that. Do you expect that to be true, you know, from a subconscious level and if not well, then I think that that's just wishful thinking to say, "Oh, it's all gonna resolve. I think so." And the power of positivity is a very, very real thing, so I certainly don't mean to undermine that. My point is just that if you wake up and say, "I'm not gonna have pain", well, sorry, the last 10 years of your experience is telling the rest of your brain that you are. So that's probably not gonna fool your brain, you know.

Katie: Yeah, but then it's a great springboard to go back to what you talked about earlier of but it is still possible to retrain the brain. Is just you have to have a little bit more of a long-term approach basically, right?

Ty: It seems that way now, yeah, and that's something that's being heavily investigated, and debated, and discussed. And I certainly don't have all the solutions but I think that in the absence of education, like I said, there's a very low ceiling on how much better someone can get. So I think we need to start there. I know there have been studies looking at this bio-psycho-social model of the pain. And is patient education alone enough? From what I've read no, it does not work in isolation. Some sort of manual therapy does seem to massively aid alongside patient education and exercise in the improvement or reduction of those chronic pain symptoms. And one other example on chronic pain that it's just sort of become a popular teaching point in the office, my own employee's grandmother-in-law was a lady that suffered from debilitating back pain for decades until she got dementia and she forgot she had back pain. And she never experienced or complained of her back pain again. So that's one kind of anecdotal thing. I don't know how many studies have looked at back pain and dementia. But I think it drives home this point that, you know, when we subconsciously expect there to be pain and in many cases identify with that pain or that condition, it will stay alive and well until we start to reframe that. And that's where I think, again, a lot of clinicians will serve their patients best spending a little more time there.

Katie: That's so fascinating but it makes sense because that would bypass those mechanisms in the brain. It's so interesting. Yeah, I hope they study that work.

Ty: Absolutely, yeah, and pain science is definitely a hot topic right now. There's a lot of really brilliant people looking at it. So a lot of it does seem to reaffirm some of what has been discovered in the last couple of decades but the treatments in that medium through which we can influence that is still being discussed.

Katie: Well, it's something to continue exploring. That's really, really interesting. And I cannot believe I just looked at the clock our time is flying by and there's a couple questions I'd love to ask at the end. So I would have to do around two one day because this went by so quickly.

Ty: I would love that.

Katie: And I think there's probably many more topics that we can springboard into based on questions from this episode.

Ty: That would be awesome, yeah. And I hope my rambling was coherent here. Like I told you, I've so many notes for different things I wanted to talk about. And we've sort of bounced around a little bit. So I really hope it's been clear enough for people to get the gist of it.

Katie: Yeah, I think so. And as we start to wrap up the two questions I love to ask at the end are first if there is, like, a single piece of advice that you could give and spread far and wide what it would be and why?

Ty: That is a fantastic question. And you know what I think it would be is to surround yourself with people smarter than you and argue with them. Okay, that's the best way to learn. I've been very, very blessed with a lot of brilliant mentors, both family mentors and academic mentors that have helped shape my understanding of these things. And I think until you are surrounding yourself with people who are authorities in certain topics you're gonna be limited in how much or the depth that you can learn something at. And, of course, you know when I say argue with them in this instance I don't mean, like, get in a Facebook fight with them. I mean, like a formal debate, you know, and with a healthy respect for maybe what you don't know and very much a willingness to change your position. I think that's a crucially important thing for all people clinicians, scientists, and patients alike. Yeah, that's where I would guide you to learn more.

Katie: That might be my favorite, like, one advice question answer that I've ever gotten because it's like when you said, "Argue with them," because you always hear like, "Always be the dumbest person in the room," or, "You are the sum of the five people you surround yourself with." But to argue with them that's so brilliant because then you're actually learning and hopefully challenging your own views as well, which I think is such a key. That's awesome. I love that.

Ty: Absolutely, yeah, and it's good to find people that disagree with you. You know, some of my best friends in health care we disagree on a lot of different things and we have great debates and we both come away from those discussion with a little bit more polished perspective of our position and, you know, the counterpoints.

Katie: That's awesome. And lastly is there a book or number of books that have really influenced your life and if so what are they?

Ty: That's, yeah, another great question I love books. I think one of my favorite books is "On The Shortness Of Life," by Seneca, a kind of ancient wisdom stoked philosophy book. It's an amazing read. It's a dense read. You can tell, you know, as conversation and voicing your opinions has become more and more convenient, I think people have become a lot less intentional with their words and that's tragic. But that was certainly written in a time where you had to be very, very purposeful with everything you put on paper. I don'know if they used paper then but however they recorded it. And actually one of my favorite books I've ever read, it's on evolutionary biology. It's called "Darwin's Blind Spot."

It is a book that takes Darwin's hypothesis that evolution is a survival of the fittest, and not that he actually necessarily said exactly and only that, but this book makes a case that we have almost more examples of survival of the most cooperative. So we have crazy, like, just the coolest examples of things down from fungi and bacterial relationships benefiting each other to this kind of global biosphere perspective of the whole Earth as an organ system. So some of it's a little bit more philosophical and some of it's more scientific but it's really amazing to see how animals and plants co-evolved with each other and how they've occupied these niches together. And I think it's, like, a very humbling book to read but it inspires you, like, the brilliance of nature. So I love those two books. Those are two I'd recommend to anyone.

Katie: Than you. And lastly, where can people find you if they wanna learn more or especially if they're in your area they want to come visit you?

Ty: Yeah, absolutely, you know, so I own Denver Upper Cervical Chiropractic. We have a lot of patients that travel in from other states for care so people can always come in for care if they would like to. I try to stay off social media. And so unfortunately, I don't have how much of a presence there but we might be starting a podcast, my brother and I, I presume. He's getting his PhD in neurophysiology right now where we interview scientists. So stand by for details on that. That might be a fun place to learn some cool novel studies and what's going on in different fields.

Katie: Awesome and Ty, thanks so much for your time today and for sharing your wisdom. This has been so fascinating.

Ty: Absolutely. Thank you so much for having me, Katie. I appreciate it.

Katie: And thanks to all of you for listening and sharing your valuable asset of your time with us today. And I hope that you'll join me again on the next episode of the Wellness Mama Podcast.

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