EPISODE 283

The Truth About Enhancing Your Physical & Mental Stamina – With Guest Alex Hutchinson

Shawn Stevenson: Welcome to *The Model Health Show.* This is fitness and nutrition expert, Shawn Stevenson, and I'm so grateful for you tuning in with me today.

This is a really important episode because we're talking about a topic that has just been weighing heavy on my mind lately, and I'm so interested in this topic, and it's the topic of human perseverance. It's the topic of our ability to endure.

Listen, we're exposed to so much today. We've got so much stress going on around us, and oftentimes when we think about stress, we think about it in the context of just maybe work-related stress. Like, "Are you stressed out?" "Yeah, I'm stressed with work."

Maybe we talk about it in context of relationships, but what I like to point people to is this concept called your overall stress load. So this is pouring into your physiology all the different stressors that your body is experiencing, your mind is experiencing.

So we do have that work-related stress, we do have relationship stress, but we also have emotional mental stressors that go outside of that paradigm.

Maybe it's a struggle with something going on with something you're trying to accomplish, you know? Some barrier you come up against with your goals.

We also have workout stress, alright? So exercise stress. That's something that's in the category that we tend to think about like it's just good for us, right? Exercise is good for us. No, it's actually a stressor.

It can be good for you, it's in this category of things called hormetic stressors, but the change, the real value comes in the recovery from the stress. Because the exercise itself breaks you down, it's catabolic, the rebuilding process is how you come back better.

Your body doesn't like to feel like it can't handle that stimuli that it's supposed to, so it comes back better. And I also give the example for people whenever I can of right now if you and I were just standing there, and we're like, "We're going to do a workout," right?

So we're at the door of the gym, standing there about to do an incredible workout, we're just looking at the weights, we haven't even started yet. We're actually in better shape standing there looking at the weights than after we finish working out.

We're in better shape before the workout. How does that even make sense? Because we tend to think of, "I just did a great workout, I'm in better shape now."

No, if we leave that gym, go get our blood work done, go get a hormone panel done, we can probably get diagnosed with some kind of an illness, alright? Core body temperature is going to be elevated, cortisol is going to be nuts, your blood sugar is going to be dysregulated, all kinds of stuff is going to going on. All kinds of stuff are going to be going on.

Alright? It might not look too pretty, but all that we did was a great workout. You don't have insulin resistance, but it might look like that. Alright?

So keep that in mind. It's a stimuli for us to get better, it's a stressor that enables us to get better, but the recovery part is where the real magic happens, alright?

So that goes into your overall stress load. We've got diet stress, alright? Your diet can be a stressor, it can go into your overall stress load in a big way, right?

If you're eating like wild caught salmon, and broccoli, stuff like that, MCT oil; like those kinds of things we know that these are more natural based foods. Like things that have more of a reality, right? Something that's based in reality, if we've got like some broccoli, some kale, right?

Some walnut butter, right? Those are more based in reality. Lucky Charms are not based in reality, right? You taste the rainbow, you're going to be tasting a big stressor, you understand?

So all that's coming into play, and so a lot of people are experiencing massive diet stress that their body is undertaking, alright?

We also have spiritual stress, right? That goes into your overall stress load. So what does that mean? This is just basically this feeling tone maybe that you're not really in alignment, right? You don't feel like you're on your purpose, you're not feeling like you are carrying a sense of significance that you matter. You're feeling a little cut adrift and not really connected.

You know, so we can all go through those phases as well, and that goes into that overall stress load.

So identifying and talking about stress is not just one thing, and so our ability to endure these things, because we go through all of it, right?

Whether it's in the context of running a race, or whether it's in the context of living our life, and that's why I wanted to bring on somebody who's really become a master instructor in this subject matter in this incredible new book called, 'Endure.'

And so we're going to dive into that today, and also I want you to retain the perspective that this isn't just about performing well in endurance sports, alright?

There's going to be a lot of examples that we're covering today that parallel with endurance-based sports, but this isn't just for that. This is in other types of training as well, and also again, this is talking about endurance in our day-to-day lives as well.

So I want you to keep that in mind because, like a nice majority of people as well, I have a little allergy towards running long races, alright? So like once it's like over a mile, I start having an allergic reaction, and I start breaking out in unhappiness basically, you know?

So it's just not my cup of tea. Now real talk, sometimes you just feel like going for a long run, and it is what it is, but generally that's not what I do, so this isn't just about that.

However, there are people right now listening, and also maybe this is something you're interested in, who are training for marathons, who are looking at ultra-endurance performance-based events, who are doing Ironmans who just want to be able to go longer and stronger, right?

And so all of this is going to apply to that as well. And so I want you to keep that in mind as we dive into the information today, and look at how we can apply this in the different areas of our lives, and not just that one lane of endurance sports, because this applies to so much.

And this information in and of itself is just really important for us to know as human beings walking around here on this planet with this fascinating body and mind that we all have, but we don't get the owner's manual, right?

So we're going to kind of start to open that book up, take a peek inside, and see what's going on in our internal regions, alright?

So listen, we can't have a conversation about boosting endurance without talking about cordyceps, alright? A study published in 'Medicine and Science in Sports and Exercise' tested thirty healthy athletes for six weeks to record the effects of cordyceps on their performance.

The group that added cordyceps to their daily regimen had twice the oxygen intake of the control group, and oxygen is essential in supplying nutrients to your muscles, and preventing fatigue, and preventing the build-up of lactate, alright? We're going to talk about that today as well.

And another study done by the same group showed a 9%- so how does this translate? Right? Okay, so what are the results?

Showed a 9% increase in aerobic activity from taking cordyceps. Seriously, alright? Cordyceps, this isn't new. This has been around for literally thousands of years. Thousands of years, and now today we just finally have the modalities of testing to affirm what our ancestors already knew, which cordyceps is awesome for improving your stamina.

And so what do we need to know about utilizing cordyceps? We just go Googling and go get random company X cordyceps, and expect it to work for us? Absolutely not, alright?

The cordyceps that you need to use, if cordyceps is the primary thing that you're looking for, Four Sigmatic, alright? Four Sigmatic because they do a dual-extraction, so they're doing a hot water extract and an alcohol extract to actually get the nutrients out of the mushrooms, out of the cordyceps medicinal mushroom, that you're actually looking for.

You're not missing any of the sweet spots, you're not missing any of the bases. All of the bases are covered because many companies, they're just doing one extraction method, and so we're leaving things out that you simply can't get out of the mushroom if you're not doing both. Alright?

So it's dual-extracted, they have these really simple easy to use instant packs, literally just add it to hot water, and you're good to go. Alright?

You don't have to open a bunch of capsules, that kind of thing, trying to put it in a smoothie or whatever, make a drink, nope. I've been utilizing Four Sigmatic, it's literally been like a couple years now, and I- like every day I'm utilizing Four Sigmatic products, alright?

So whether it's the mushroom coffee with chaga and cordyceps, yes it does exist. Whether it's the chaga itself, whether it's cordyceps, whether it's rishi, lion's mane; so many great things that you can choose from.

I've talked about many of them but today I want you to keep your eyes on cordyceps, right? This is something that's clinically proven to boost your stamina, to boost your endurance, and there are very few things that are natural, that have been around for a long time, that can help your body to do that without any weird side effects or weird crashes, alright?

So pop over, check them out. Go to www.FourSigmatic.com/model. That's www.FourSigmatic.com/model, guess what? You get 15% off, alright? 15% off. Pop

over there, check them out. I promise you're going to fall in love, alright? Www.FourSigmatic.com/model and now let's get to the iTunes review of the week.

ITunes Review: Another five-star review titled, 'I appreciate you immensely,' by Jake Morris.

'Dear Shawn, my girlfriend and I are currently writing our five-star reviews of your podcast together. She introduced your show to me months ago, and I look forward to listening to it every week.

Your story and optimistic approach to life are truly inspiring, and I love the holistic perspective you give to wellness. You are a great example of expertise and humility. I get so much value out of each and every one of your episodes. Thank you so much.'

Shawn Stevenson: That's so awesome, thank you so much for leaving me that review. I appreciate you immensely. That's so cool. Thank you, thank you, thank you. And everybody, thank you for heading over to iTunes and leaving a review for the show. It really, really does mean a lot. I just can't thank you enough.

And if you've yet to do so, please pop over and leave a review. I truly, truly do appreciate that. And on that note, let's get to our special guest and our topic of the day.

Our guest today is Alex Hutchinson, and he is a Toronto-based science journalist with 'Outside Magazine,' and the author of the New York Times bestseller, 'Endure: Mind, Body, and the Curiously Elastic Limits of Human Performance.'

Before becoming a journalist, he worked as a post-doctoral physicist for the National Security Agency, and competed as a long-distance runner for the Canadian national team. And I'd like to welcome to *The Model Health Show*, Mr. Alex Hutchinson. How are you doing today, Alex?

Alex Hutchinson: Good, thanks so much for having me, Shawn.

Shawn Stevenson: It's totally my pleasure. Very, very excited to talk to you, and as I told you before the show, I've had your book for a little while now, and I finally got to dive into it a few weeks ago, and it is one of the most fascinating books I've read in recent history.

And having read hundreds of hundreds of books, that says a lot. This book is so well done, and it just really speaks to my man brain, and I'm just excited to talk to you.

Alex Hutchinson: Thanks so much, and it's great to hear someone who agrees with my mom.

Shawn Stevenson: That's what's most important. That is the goal. Alright and speaking of which, I want to talk about your origin story, alright? I want to go back. So was baby Alex like super interested in running a long time, or like where did this whole thing kind of get caught on fire? And of course I want to talk about that 401 story that you kept bumping up against as well.

Alex Hutchinson: Yeah so I am one of those kids who was running around ever since I was a young kid. I joined my elementary school's cross-country team when I was in grade three.

And it's interesting, we were chatting just before the show started about the kids. I've got a two-year-old and a four-year-old, and it is funny that I can sit there in the kitchen and watch my kids doing laps around the ground floor.

I mean kids have energy, but definitely different people have different proclivities, and I always liked to run.

In terms of where this book came from, like you said, I had a kind of funny experience as a college runner. I was a 1500-meter runner, so middle distance runner. 1500 is a little bit shorter than a mile, eighteen seconds shorter than a mile. And I had always wanted to break four minutes for the 1500, and I ran 4:02 in high school, and so I thought it was just a matter of time.

But I got stuck for about four years. I was running 4:02, 4:01, over, and over, and over again. So by the time I was a junior in college, my best time was 4:01, and after four years of running essentially the same time, I concluded that I'd basically hit my- pretty close to my physical limits.

I knew I could run under 4:00, I knew I could run 3:59.9 on like the perfect day with a tail wind with a horoscope with everything going right for me, but I figured there wasn't much more in the tank because I'd been spending four years.

So I really had this sense of physical limits, and what ended up happening is there was a tiny little meet in a town called Sherbrooke in Canada, and this was in 1996, and I remember it very, very clearly.

Basically what happened is I went through the first lap, and the time keeper was calling out splits to let us know how fast we were going, and the splits he called out- he called out twenty-seven seconds for the first 200 meters, which is about five seconds faster than I needed to go for what I wanted to do, which was break four minutes.

And that's a lot at that level, it's very, very fast. And so I had this split between part of my brain saying, "Oh my God, you are in big trouble, Alex." And another part of my brain saying, "Oh, it actually feels pretty good."

And same thing happened second lap, the split was fast but I felt remarkably good, and after that I just kind of decided, "Something is going on, Alex. This is your day, don't waste it. Put your head down and run, get to the finish line, take advantage of this day," and I ended up- that's what I did, and I ended up running 3:52, which was a nine-second personal best after this four years of just fractions of a second.

And you know, after the race, I was debriefing with some friends who had timed the race for me so that I could record it in my training log and analyze it obsessively. And you know, there was a difference. It turned out that I thought we had gone out in twenty-seven, and my friend was like, "No, it was thirty, thirty-one." And so the time keeper, for reasons that I don't know, either he started his watch three seconds late, or there as a translation problem because this was in a French part of Canada, but he tricked me.

He was calling out times that were three seconds faster than I was really running, and in tricking me he sort of convinced me that I was having the day of my life, and as a result, I did. And the real thing here is not just that I had a good day, but it's that flipped the switch in my mind that stayed switched.

I never again struggled to break four minutes, and in fact in my next race I ran 3:49, and in the race after that I ran 3:44 and qualified for the Canadian Olympic trials.

So it was this dramatic moment that it changed for me how I thought about limits, that I could never then cross a line in a race and tell myself, "Oh that's everything you had today, Alex."

Because I'd had this experience of thinking that I was at my physical limits, and then discovering that there was a lot more. So I think that really- when I sat down to write a book about endurance and I had to ask myself, "First of all, does anyone else care? And second of all, why do I care about this so much?"

And that's what led me back to that story. I was like I think that's the moment where I really started to wonder how are our limits defined?

Shawn Stevenson: Wow, I literally got the chills when you said that you qualified for the Canadian Olympic team, you know? I read the story, of course, but hearing you say it, it just is mind-boggling how you can make such a jump, and then all of a sudden kind of live there.

And not just live there, but even go on to surpass that in such a small amount of time. And then that eventually kind of led you into this area of looking at all of the pieces going on behind the scenes because it is- there are quite a few pieces that lead up to stories like this.

But there's also a big connection to even the average person in how we live our lives and dealing with the ability to endure, whether it's something- a mentally trying time or a physically trying time, and how those meld together.

So let's talk about that a little bit, actually. I'd love to talk about mental fatigue because it's one of the early things in the book that you cover, and how being mentally fatigued can in fact influence how much physical effort you can endure. So let's talk a little bit about that.

Alex Hutchinson: Yeah, this was one of the things that surprised me. Half of the time it surprised me, but it's like one of those things you know intuitively, but then it's like, "Oh, you can actually kind of prove that."

So it's like if I put in a long day at work, a stressful day, let's say I'm on deadline writing stories, I know intuitively that if I go out and meet some friends to do a run or a workout, I'm going to maybe struggle a little bit with that workout.

But it turns out in the last few years there's been some research showing that you can actually quantify this. You can have someone sit in front of a computer and spend ninety minutes doing a very simple task.

Like let's say you've got numbers and letters flashing on your screen, and you have to just press a button depending on what number or letter comes up.

Like my four-year-old could do the task, but it just takes some focus.

After ninety minutes, then you get on the bike and you do an exercise test. What's really fascinating is that your perception of how hard you have to pedal is higher- your effort is higher right from the start.

You get on that bike and you're like, "Man, this is five out of ten," whereas if you haven't done that ninety minutes of mentally fatiguing task you're thinking it's four out of ten.

So as a result you're able- if you're mentally fatigued, you reach exhaustion earlier, you have to give up sooner.

So it's not just a kind of gut feeling, it's this real physiological effect where your mind's state affects your body, and so I think this is a really under-appreciated thing.

If you want to reach peak performance, whether you're running a marathon or whether you're giving a presentation at work, or writing an exam, we all understand that if you're running a marathon you don't go out and do a whole bunch of training the week before the race.

You have to back off, you have to taper your training. But I think we don't really appreciate the importance of being mentally fresh for a performance, for allowing your mind to recover, giving yourself a break so that when you're stepping into an exam you haven't been studying until 2:00 AM the night before.

Because you may learn some new facts, but your reaction times, and your ability to understand the question is going to be compromised because you're going to be mentally fatigued.

So to me that's a really fascinating area that this isn't just kind of like a gut feeling, this is really repeatable that mental fatigue compromises physical performance and mental performance.

Shawn Stevenson: Yes, and you covered- because one of the things that first jumps to mind when we're thinking about our ability to endure if we're doing high intensity interval training, or long runs, is that it's our muscles that give out, it's our ability to process oxygen efficiently, those kinds of things.

And you talk about it - oh my goodness in depth, we're going to get to it, and I can't wait to talk about it - but this mental area is so huge and you go back and forth in the book talking about it.

Because some researchers agree that this is- and they're very, very dogmatic about it. This is a physical issue with how much the human body can achieve.

And so there's this other camp that is very adamant about this concept called the central governor theory. So let's talk about- first of all, what is that?

Alex Hutchinson: Yeah, so the central governor is this idea that was proposed by a South African scientist back in the 1990's, a guy named Tim Noakes, and what he argued is that basically throughout the twentieth century, scientists had spent all this time trying to understand the human limits, thinking of the human body like a machine.

That if we can understand- it's like a car, you know? If you know how much gas is in the tank, if you know what the temperature of the radiator is, and air pressure in the tires, you know if the car is going to be able to keep going.

And we can think of the body in the same way. How much fuel is in the body, how efficient is the engine, and you can learn a lot about human performance that way.

But what Tim Noakes sort of started arguing in the 1990's is that doesn't really explain. It's kind of like a car without a driver. You have to incorporate the brain into that.

In any race, you also have to consider the brain, and what he argued is like you were saying, you don't slow down in a race because your heart is about to explode, or you don't slow down because your legs are physically unable to keep going.

If you release a lion into the crowd at mile twenty of a marathon, you're going to see a lot of people sprinting even though they're really tired. Their muscles are still capable of going. Instead it's our brain that decides we shouldn't go.

And so what Noakes said is we've kind of evolved to have a central governor, which is not a structure in the brain, but it's just a kind of behavior that we instinctively never let ourselves get to the limit.

And you know, maybe back in the Savannah 50,000 years ago, it would have been a bad idea to just keep chasing the antelope until you keel over and you literally can't go anymore.

So we get these stronger and stronger feelings saying, "I really need to stop," and so there's always some reserve being held.

And so Noakes' argument- Noakes was the guy who really brought into the mainstream this idea that we don't fail because our bodies fail. We fail because our brains are trying to protect us from failure.

Shawn Stevenson: That's really interesting. One of the examples you gave- and by the way, you went around the world, you were going to these different events, to different labs, and really seeing a lot of this stuff firsthand, which is really one of those things that shows up deeply in the book itself.

But there was a woman you talked about in the story who had a brain surgery, and she ended up losing something really interesting, and started to run much later in life. So can you share a little bit about that?

Alex Hutchinson: Yeah, this is a woman named Diane Van Deren. A really fascinating story, also a little bit sad, but really instructive.

She lives in Colorado, she's an ultra-marathoner, and she is one of the world's greatest ultra-marathoners. But she didn't start running or didn't start competing at least until after having brain surgery when she was thirty-seven.

She had really serious epilepsy that was starting to really interfere with her life, and so she had a chunk of her brain about the size of a golf ball removed, and there's always collateral damage in that sort of brain surgery. You have a piece of brain removed, you're going to lose some other faculties.

And so she had some damage to her ability to keep track of time and distance, and so you'd think this would be a disaster for a long-distance runner, right? Like you

don't know what your pace is, you don't know how far you've come, you don't know how far you can go.

But it actually turns out that this is what made her into a great ultra-marathoner. She discovered that she had this gift for ultra-marathons after her surgery.

She started running fifteen milers, then she started running multi-day races, then a few years ago in her early fifties she set a new record for this trail across North Carolina. It was something like twenty-two days, she was running twenty-one, twenty-two hours a day for more than three weeks.

Shawn Stevenson: That's crazy.

Alex Hutchinson: The crazy thing was that yeah, so it's not that she didn't hurt, I mean these efforts were extremely painful for her, but most of us were constantly thinking, "Oh my God, how far have we come? How far do we still have to go? We have to make sure we have enough energy."

She had a compromised- so her central governor in a sense, her ability to monitor how far she'd come and how far she still had to go was compromised.

At one point she said something like, "Look I could be out running for two weeks and if someone said, 'Hey, we're going to do a run tomorrow, a race starting tomorrow,' I'd be like, 'Hey let's go.'" Because she's not burdened by this knowledge or fear of what's in the past and what's in the future. She's just living in the present moment.

Now no one chooses that, but it's sort of an example of why great performers often try and cultivate that ability to live in the present moment and not to be kind of weighed down by what has already happened and what will happen.

If you can live in that present moment, it seems to be a way of kind of turning down the settings of that central governor.

Shawn Stevenson: Wow, and when I said earlier that she lost something interesting, it was she lost that ability to track time and distance, and it put her- it gave her the strange advantage.

And like you said, she still experienced pain, but because of not being able to process accurately the time and distance, it changes the overall experience.

That's crazy, like that's a part of your brain that's making that happen. And man, that just blows my mind.

You also talked about- is it Marcora in the book?

Alex Hutchinson: Yes, Samuele Marcora.

Shawn Stevenson: And so you mentioned him with several different studies, but one that was really- that jumped out at me, was testing people's endurance when exposing them to those subliminal messages with basically those smiley faces or sad faces. You've got to share that story.

Alex Hutchinson: Yeah, so to me this was maybe one of the most kind of amazing demonstrations of like yeah, the brain matters, and it's not just a placebo effect.

So what happened in this study, he had cyclists doing a time to exhaustion test, so they had to pedal at a certain rate until they can't continue anymore.

And on a screen in front of them he was flashing pictures of smiley faces or frowning faces, but they only showed up for sixteen milliseconds at a time, which is like ten times shorter than a blink.

So the cyclists didn't- you didn't even know there were pictures showing up. He checked this after the study. He was like, "Did you see anything? Notice anything?" No, no one knew anything was going on.

Nonetheless they were perceiving it unconsciously and when they were showing smiling faces, they actually managed to pedal for 12% longer than when they were showing frowning faces.

And so a couple things about this. One is that this isn't- you can't explain this a way of like, 'Well they expected to go faster, it was a placebo effect, they're suggestable.'

They didn't even know there was anything going on. So this is a clear example, and it didn't change anything about their lactate levels, it didn't' change anything about their heart rate, their VO2 max.

So it's just by manipulating what was going on in the brain that they changed. And so how does this happen? It's a good question, but the basic explanation I think is that - and what Samuele Marcora the researcher would say - is seeing a smiling face evokes feeling of kind of ease or comfort compared to a frowning face, and so it subtly alters how the brain is interpreting the signals from the rest of your body.

So you haven't changed your lactate levels, you haven't changed your heart rate, but you've changed a little bit how your brain perceives the sort of seriousness of those signals.

And so this is kind of a hint at some of the ways that we can then take charge of this, and think about, 'Okay if smiling faces make a difference, what do the words that I'm saying to myself- what does my internal monologue do to the way my brain interprets the signals from the environment from the rest of my body?'

Shawn Stevenson: Oh my goodness. You know what? Again, this is a clear indication that we cannot omit our minds from the equation when we're performing.

But let's jump back and actually look at some of those physical attributes that you talk about in the book. You of course talk about VO2 max, but what I want you to start with first is this concept- because you know, this is what I was taught literally in a college classroom, about lactic acid, right? That being the problem with you being able to perform. So let's talk about that first.

Alex Hutchinson: Yeah, lactic acid has a long history, and I had a lot of fun kind of tracing- because I'm like you, I grew up being taught that if I'm running hard it's the lactic acid in my muscles that's burning up the muscles, it's slowing you down, and it's just sizzling in there.

You know, it goes back to the early 1800's. There's great stories of like some Swedish scientist detecting lactic acid for the first time in hunted stags, and the harder they had run before death, the more lactic acid they had.

The modern truth is first of all, we don't have lactic acid in our blood. We have lactate which is an ion that's related to lactic acid.

When you take it out of the blood and measure it, it turns into lactic acid, so that's why people thought there was lactic acid, but in your body it's something called lactate.

And it is true that when you exercise hard, particularly when you exercise anaerobically, when you're doing efforts that last between one and ten minutes say, you'll have huge levels of lactate in your blood. It's a byproduct of exercising when you can't get enough oxygen to your muscles.

So when you're going into sort of oxygen debt, then you produce a lot of lactate.

The mistake though is to think that because when you exercise hard you produce a lot of lactate, it must be the lactate that's causing you to slow down.

And so the way you can answer that question or the way you can explore that question is to say, "Well if lactate is the problem, what happens if I inject lactate into my thumb? Am I going to feel the same thing that I feel when I sprint four hundred meters?"

And so if you inject lactate into someone's body, they don't feel the lactate burn, and so you could say, "Well maybe it's another metabolite. Maybe it's the protons, or maybe it's the ATP that occurs in your muscles during hard exercise."

So you inject those into your thumb, and this is what some researchers at the University of Utah did a few years ago, again no sensation.

But when they injected all three, when they injected lactate, protons, and ATP, which are all metabolites that are produced during hard exercise, when they injected those into the thumbs of these volunteers, all of a sudden they felt like they were doing intense exercise in their thumb even though they were just sitting there.

And the more they injected, the more it felt like they were reaching exhaustion.

So what that tells you is that none of those- lactate on its own isn't doing anything, so it's not physically changing anything in your muscles, but when all three of those are present it's sending a signal to the brain.

You have nerve signals that are sensitive to the presence of those particular metabolites, and so during hard exercise when you get that signal it tells your brain that you should feel- and so it sends a signal to your brain that your brain interprets as fatigue, and discomfort, and that forces you to slow down.

And the extra twist, not to sort of go too deep down the rabbit hole, the extra twist is you can block those signals. You can inject a block into your spine so that you don't feel those signals.

You can be cycling on the bike, and you can still move your legs, but all those signals from your legs to your brain are blocked. And you think, "Well man, what a dream come true. You should be able to just set world records like that because you're going to feel no pain."

But what actually happens is if you inject that spinal block, the cyclists start really hard because they feel like a million bucks, and then they start to fade, and they crash and burn, and they actually don't cycle any faster than they would without the spinal block.

What that tells us, that a little bit of pain is actually essential to performance, to pacing yourself. You have to be able to feel what's going on in your body.

If you can't feel the discomfort, then you can't pace yourself, and you end up going too hard and reaching actual physical limits to the point where your muscles actually can't go.

So to me, the message there is kind of redefining our relationship with discomfort, that it's an important source of information. You have to- if you're pushing hard, you have to know you're pushing hard, you can't just numb yourself so that you're unaware of your effort.

Shawn Stevenson: Yeah, man that's a powerful insight about life in general, you know? And being willing to experience the discomfort because it's a guidance system in a way, you know?

And if we numb it, if we're ignoring it, it's going to end up hurting us in some aspect, you know? And seeing somebody run themselves to the ground because they're not paying attention to that feedback, you know?

There are so many valuable lessons that parallel life in general in the book, which is so cool, and by the way when you started talking about the thumbs, I started thinking about video game players. And what's the guy's name? Sam? The engineer here telling me about- and I just saw his picture, I'm like, "Who is that?"

And I just started laughing. His name is Billy Mitchell, right? Billy Mitchell, Sam? So Billy Mitchell was this guy who was like a world champion video game player, right? But now there's all this information, and even back then he's kind of been blacklisted because he cheated in Donkey Kong. Alright?

He found some way to game the system. And I was like, "Are you serious?" Because when I saw his picture, I thought he looked kind of comical like the guy Peter Dinklage who plays the guy who cheated in the video game on this movie called *Pixels* by Adam Sandler, which is- when you watch it the second time it's better.

It's one of those like, "Maybe I need to give it another chance," you know?

But I used to be a huge fan of Adam Sandler movies, but then he just kind of went downhill. But anyways, *Pixels* was really cool, and playing video games was something I was fascinated with growing up as well.

But this translates to everywhere in our body, you know? Where we have receptors for pain. It's really, really interesting.

By the way, I just want to throw this little fun fact out there, our brain itself doesn't actually have any pain receptors. So when we think that we're having a headache, it's actually the surrounding area, right? From your skull, right? It's not your brain itself.

So shout-out to the brain for not having pain receptors.

Alright now I would love to talk about VO2 max, alright? So can you describe what that is and how that plays into this concept of endurance?

Alex Hutchinson: Yeah, VO2 max is kind of the Holy Grail for a lot of endurance athletes. Everyone wants to get their VO2 max higher and get their VO2 max tested.

The basic concept is this; VO2 max is the fastest rate that you can bring oxygen out of the air into your lungs, get it into your bloodstream, get it to your muscles, and use it to help fuel your aerobic metabolism, to help make your muscles go.

So the faster you can bring oxygen to your muscles, the quicker the pace you can sustain over a long period of time. The problem is as you start pushing harder, your usage of oxygen goes up, up, up, up, up, and then it hits a plateau.

You reach a point where no matter how hard you work, you can't get oxygen to come any faster. The pipes just can't carry any more, and that's your VO2 max, your maximum ability to carry oxygen.

And it was discovered in the 1920's, and it kind of defined the twentieth century of physiology because it felt like- this seemed like a really kind of absolute empirical quantification of endurance.

You could say, "Well let's look at the VO2 max of different people, and then we can tell you who's going to be a better athlete."

And of course, very soon they realized other factors mattered like VO2 max is like how quickly can you pump gas into the engine, but you also need to know how efficient the engine is, so in running that's something called running economy. It tells you basically your gas mileage as a runner.

And there's various other factors so you can refine it, but VO2 max is kind of the center of this idea that if we understand how all the parts of the body move, or how all the parts of the machine fit together, we can calculate what each person's ultimate limits are.

And so there's been a backlash I would say in the last ten, fifteen years, accompanying this idea of the central governor, moving away from the idea that, "Oh actually if you go to the Olympics and you test the VO2 max of everyone in the Olympic marathon, you're not going to be able to tell who wins," which is definitely true.

So then the backlash says, "Well if the VO2 max is useless it doesn't tell us anything," and that's not true either because VO2 max does tell us a lot, it just doesn't tell us everything.

And so this is one of those areas where, as in so many areas of life unfortunately, where debates tend to get kind of polarized or go swing from one extreme to the other. "Like it's all about VO2 max," "No, VO2 max is useless." It's like no, VO2 max is useful in context but it doesn't tell you everything.

It tells you something because the body sure is important. Like no amount of mental strength is going to take me to the Olympics and allow me to set a world record. You also have to have the VO2 max. So you have to kind of integrate the two.

So VO2 max, yeah it was over-valued, then it was under-valued, and I'm here to say it should be somewhere in the middle.

Shawn Stevenson: Oh perfect. Perfect. And so this is something that people can actually increase?

Alex Hutchinson: Yeah, it's not easy to increase, and it doesn't increase indefinitely, but I mean you can double it if you go from being sedentary to training hard for a number of years.

Like an elite athlete might have a VO2 max- an elite endurance athlete might have a VO2 max in the seventies or eighties. There's a few people in the nineties; very, very few.

You have people in the thirties or forties if they're just sedentary middle-aged adults, and a fit adult - not an athlete but just a fit adult - might be in the fifties.

So there's a wide range. You've got people three times, and there's a lower threshold, especially when you talk about older adults, when you talk about people getting into their sixties, seventies, eighties.

If you get below- I don't remember the exact threshold, but roughly if you're getting into around twenty or eighteen, that's the point where you don't have enough aerobic power to get around your apartment and do things on your own.

You don't have the ability to get to the door, get to the fridge, to bend over, pick things up. So VO2 max is not just an important parameter for athletes, it's an important parameter for healthy independent living, and so it's important- again it's not everything, but it's a pretty useful parameter to tell you where you're at in terms of your overall fitness.

Shawn Stevenson: Wow, man that just made me think about that movie *WALL-E,* right? Isn't that that movie where humans just stop moving around? He's like- man that was crazy, and it's just like one of those things that wow, that can be a strange possibility. You know?

But the great news we have, work like yours, and what we're doing to really get the information out there in how important movement is, not just for the sake of the physical appearance, but literally just being able to do basic functions and live our lives with freedom. You know? It's kind of important, so wow, that's really, really great insight.

I want to talk to you about the role that oxygen plays into all of this, but we're going to do that right after this quick break, so sit tight, we'll be right back.

Alright we are back and we're talking with the author of the bestselling book, New York Times bestseller, 'Endure,' and it's Mr. Alex Hutchinson. And before the break we were talking and just kind of leading into this conversation about oxygen, right?

This is our most important nutrient. We can survive for weeks without food, days without water, potentially depending on the circumstances which he talks about in the book, and only minutes without oxygen, alright? It's very, very vital.

So Alex, how does oxygen play into this whole equation with endurance?

Alex Hutchinson: Yeah, this is really one of the most surprising and interesting things for me because as an endurance athlete, as a runner you think about oxygen all the time in the sense that you're panting, right? And you feel like oxygen is a limiting factor.

So I really wanted to explore, "Okay, where does oxygen really become an absolute limit, you know? You're panting, but when are you actually running out of oxygen?"

So that led me to free divers, because they're the best breath holders in the world. They're the ones who can actually not just pant but they can stop breathing for a long time.

Shawn Stevenson: Can you share what free diving is really quickly?

Alex Hutchinson: Yeah, yeah so free diving is basically another way to call breath diving. It's just you, a string bikini or speedo, and you dive under the water and you hold your breath, and you can stay down there.

And if you're me, you can stay down there for ten to fifteen seconds, but if you're a trained free diver you can do amazing things. You can dive down all by yourself, no tricks, no nothing, 300- I think the record is 102 meters which is like 335 feet or something below the surface on a single breath, and then make it back.

And you know, there's a lot of crazy things going on at that point, there's wild pressures, you have to be careful you don't collapse your lungs, but the key thing is you have to not breathe.

And so I mean free diving is cool, but one of the things free divers do, it's kind of the equivalent of the sort of Homerun Derby in baseball where you say, "Let's just take one skill and see- one aspect of this skill and see how far we can take it."

So for them, that's just breath holding. So they say forget about the diving part, let's just sit in a swimming pool, put our face under water, and see who can hold their breath for the longest.

And you know, this was the single most surprising thing for me that a human being can do that, can hold their breath for eleven minutes and thirty-five seconds. And this is not- like David Blaine did seventeen minutes, but he was breathing pure oxygen before the breath hold, that's a bit of a trick.

You can do that, but this is with no trickery, just like waltz up, hold your breath eleven minutes.

And so that really forces you to re-evaluate why is it that I can only hold my breath for ninety seconds? And it's not because the free divers are- they're not like nine feet tall with lungs the size of a swimming pool, they're just ordinary people.

What they've learned to do is ignore the warning systems in their body, and go right to their actual limits.

So for most of us, if I try and hold my breath, I will reach a point where my breathing muscles are literally contracting involuntarily, they're forcing me to breathe. But that's not because I'm out of oxygen, that's actually triggered by carbon dioxide levels in my blood that have risen to a certain point.

And but I can't resist it, so that's the end of my breath hold. Free divers have learned they can't turn off that warning system, but they can- they've learned to not breathe even though their breathing muscles are contracting.

And I had a chance a few months ago actually to talk to a guy named Brandon Hendrickson who set the American record for breath holding last year. He held it for eight minutes and thirty-five seconds.

And what he told me is he gets these involuntary breathing contractions, and during his record breath hold, that started at around four minutes- a little bit after four minutes. Between four and five minutes. That's the point at which his carbon dioxide warning system was flashing.

And he's able to just ignore that, he went all the way to eight minutes and thirty-five seconds, and that's the point at which he's actually out of oxygen. These guys can hold their breath- they've disabled the warning system, they can hold their breath until they actually lose consciousness, which is of course dangerous if you're under water.

It's a factor of two between the warning system going off when your body thinks you're at a limit at four minutes, and then at eight minutes that's when you actually hit the limit.

Shawn Stevenson: Wow.

Alex Hutchinson: So to me, that's the real kind of- a great illustration of the difference between a warning sign and a stop sign, is there's this huge safety margin that most of us aren't able to access.

Shawn Stevenson: And even our environment itself is a player in when these warning systems are going off and how they are, because you talked about something called the mammalian dive reflex, so talk about that.

Alex Hutchinson: This is amazing. Basically- I don't want to get to gruesome here, but there was a study back in the 1890's where they basically drowned ducks to see how long they could last.

Shawn Stevenson: Sufferin succotash.

Alex Hutchinson: Yeah, this was not a study that anyone would do now, and in all seriousness, I don't mean to joke about it. But they found that if you basically strangled a duck in the open air versus under water, the duck would last like eight minutes without air out of the water, and like twenty-three minutes under water.

So there was something about being in water that allowed the duck to last without oxygen for longer. And it turns out we're the same, and in fact all mammals have similar responses.

That's why when they do these breath holding contests, they do them in a swimming pool, not just to prevent cheating because you can't breathe when you're under water, but also because when you put your face in water, a bunch of things happen.

Your heart rate immediately slows down and there's various other things. In fact your spleen stores red blood cells, and after awhile it starts to squeeze extra red blood-oxygen carrying red blood cells out into your circulation to give more oxygen to your heart and brain.

And so one of the interesting things to me is that you know the kind of cliché of you're feeling kind of panicked or something like that, you splash cold water on your face.

In a sense, that may be triggering the mammalian dive reflex a little bit in slowing down your heart rate. So that's why putting some cold water on your face is going to calm you down, because it's tapping into this deep, deep, deep evolutionary response of when your face feels water you know that you're going to not need oxygen so your body automatically starts to calm itself down.

Shawn Stevenson: Okay, so this is just again one area, we're looking at oxygen. You cover so much in the book, and there are so many things I want to ask you about, but I definitely want to talk about muscles because this is just- this is one of the things that we just tend to immediately think about in performance, especially when it has to do with sports.

You shared a story of a man who actually- it was a very descriptive story, essentially lifting a car off of a person, which I thought was really fascinating in and of itself.

Can you share that story and why you put it in the book?

Alex Hutchinson: Yeah, and you know in a sense this was one story that's representative of so many stories, that you look around in the news and you'll find that at least once a year there's a story of someone, like their loved one gets pinned under a car, and they save the loved one by lifting it off.

In this case it was a guy in Tucson, Arizona. A teenager on a bike was pinned under a Camaro, and he just went and lifted the Camaro until someone else could pull this kid out from under the car.

You're like, "Well a Camaro weighs typically about 3,000 pounds." And the record for deadlifting is in the neighborhood of 1,100 pounds depending on which record you're looking at. I think the highest one is actually from the 1983 World's Strongest Man competition, it was lifting 1,100 pounds of cheddar cheese with a kind of bendy bar.

So whatever, it's in the neighborhood of 1,100 pounds.

Shawn Stevenson: Got any cheese?

Alex Hutchinson: They had a lot of cheese in that competition. But there's a big difference between 1,100 pounds and 3,000 pounds, and you can start to get rid of some of that difference and say, "Well he didn't lift the whole car above his head, he lifted the front end of the car, so there's leverage, he's lifting half the car, it depends where the wheels are, depends what the weight distribution of the car is," yada, yada, yada.

You're still not going to get it down to 1,100 pounds, or least it's tough. So the question is, is there such a thing as hysterical strength, which is this idea that when a mother sees her baby in distress, all of a sudden she's able to leap over tall buildings.

This debate's been around forever, and there's all these examples, like the example that I gave from Tucson in the book, I included that because it had a bunch of eyewitnesses.

Like there's people who saw what was going on, and the guy who did the lift, it's like later that evening he's driving home and he suddenly noticed he broke like eight of his teeth while he was clenching his jaw.

So clearly something crazy happened here. There's this fight or flight response, but how big is it, and does it really exist? And so I tried to dig into the literature as much as I could, but of course you don't have lab experiments where you put babies under cars and see if people can lift them off.

Shawn Stevenson: Right.

Alex Hutchinson: It just doesn't happen. But one of the ways to try and test it is using electric shocks. And so once people realized you could make muscles contract with electric shocks they were like, "Well let's see how strong- let's turn up the voltage and see how strong people get when we zap their muscles with electricity."

And for a long time the conclusion was it's definitely true. Man, people are way strong- like if I try and lift something versus if you use electricity to force me to contract my muscles, you can get a way stronger contraction.

The problem is those tests were kind of misleading because it felt way stronger, but that's just because it was painful. And so finally in the 1950's they started to be able to isolate like single muscles and say, "Well let's check a maximum voluntary contraction versus electrically stimulated one."

And what they find is actually- as far as they can tell, there doesn't seem to be a lot of hidden capacity, that most people can recruit about 90%, 93%, 95% of their maximum strength.

And so then not to again disappear down the rabbit hole here, but there's studies of Soviet weight lifters where they suggest that actually most people only recruit 60% of their available strength.

In competition, which is sort of like seeing your baby under a car, but not quite, you can access more of that, maybe up to 90%.

In the end, the answer is- I hate to say it's sort of inconclusive except to say that for a given muscle, we can actually- it does appear that we can actually access a lot of pretty high fraction of the strength that's available.

But when we're talking about something like lifting a car, you're not just talking about one muscle, you're talking about like seventeen muscles working together. And when you talk about that sort of complex motion, the scientists I talked to, they said, "Well that's different and it's much easier to believe that when you're trying to do something like that voluntarily, you can get under normal circumstances, you might not really max out because you're getting all these muscles working together. And when you have this extreme moment of like nothing else matters other than lifting this car, you might be able to squeeze out that extra 10%, 15%, something like that.

So I think it's fair to say that like you're not going to double your strength in a moment of panic, but there is probably some sort of reserve that we can access under the craziest of circumstances.

Shawn Stevenson: That's so fascinating. And so again, this kind of concept of the central governor being able to keep us from maxing out. Like there's always a little bit of space there, and keeping that in mind, and even you talked about in the book,

even in the heat of competition, like it can bring out another percentage, another jump in your percentile just from that alone versus just training with yourself, or maybe with your coaches, practice, that kind of thing.

And so these are things that we kind of think about, we kind of know commonly, but we never really put down on paper like this, and that's why I really love this book.

So let's talk about muscles in the context of- so this is also like a very strong momentary situation where we have the example that we just talked about of lifting a car up.

What about in the context of running a really long way? What's going on there with the muscles? How are the muscles getting fed? How should they be fed? Let's talk about that.

Alex Hutchinson: Yeah, so this is- if you thought the waters were muddy when I talked about trying to lift a car up, it gets really complicated when you say, "What's holding you back if you're running like a hundred-mile race through the mountains or something like that?"

There is some pretty amazing research that they can do now where they can take people and you can test how much muscle strength they've lost by using electricity to stimulate and see how strong you can force their muscles to contract.

You can also then take magnetic pulses to their brain to make their muscles contract, and then that allows you to see, "Well how much of the fatigue that we're seeing is in the central nervous system rather than in the muscles itself?"

So you can kind of distinguish between the central fatigue that's in the brain, and peripheral fatigue that's in the muscles. And what's interesting is they find once you get out past a certain point in long efforts, the muscle fatigue actually doesn't get any worse.

If you run a hundred miles, or if you run two hundred miles, as far as your muscle is concerned at the end of those races, the level of muscle fatigue is pretty much the same. Because at that point, muscle fatigue is not the issue. When it's really long, it's the fatigue in the brain and the psychological battle that's the real challenge.

And so the longer the event gets, the more clearly it becomes that what matters isn't what your muscles can do, what matters is how hard your brain is willing to push yourself.

And so I think like you said before, I think this is one of those things that people have kind of sensed intuitively. If you talk to like ultra-marathoners, they're like, "Yeah it's a mental battle. It's all about being willing to suffer and learning to push myself."

And that sounds kind of like just sort of empty talk, but this is what the science says too, that it's not really your muscles holding you back when you're going for a twenty-hour race, or something like that.

Of course how tired your muscles are affects how- this is what we were saying before, it affects how your brain is feeling. So let's say you mentioned fueling, if you haven't been taking in enough food to fuel your long race, then your brain is going to have to work harder to push your muscles.

So it's not necessarily that your muscles fail, but it means that it makes the mental fatigue worse because you're having to work harder because your muscles aren't working as well as they should because they haven't gotten the fuel they need, or they haven't got the hydration that they need.

So it's like- in a sense it's all like a big circle. Like if your muscles aren't working, then your brain is more tired, and if your brain's more tired, then your muscles aren't going to work as well. It's all one system; the brain and the body are all functioning together, and if you mess up one part of that system, all the others are going to get messed up too.

Shawn Stevenson: Man, this is so interesting. You know, when we're talking about muscles, and their ability to perform, like you said there are so many different pieces, and I just want to point this out for folks, and I'll put this in the show notes.

Way back in the day I did really a master class on high intensity interval training. We talked about the different types of muscle fibers, we've got the fast twitch, slow twitch, we've got these intermediate muscle fibers, and just being able to pay attention to developing all of them in a sense, you know?

And like there's a lot of endurance athletes now who are incorporating sprints, like doing sprint drills, into their workouts because of the development of these different muscle fibers, and the different motor units, and all that cool stuff. So I'll put that in the show notes.

But also in the book, Alex dives in deeper in talking about how muscles play into this whole equation of endurance, so make sure again to check out the book.

This is probably the last thing I want to ask you about. There are so many things, but I want to talk about hydration. You know?

This is something I mentioned earlier, you can go weeks without food, days without water, and only minutes without oxygen. But water matters a lot, and especially in certain environments.

And you kicked off that chapter talking about there was a story of Pablo Valencia, and man, what a story. Can you share that story, and then we'll kind of dive in and talk about hydration.

Alex Hutchinson: Yeah, this was back in the- I think it was in the early 1900's in the Sonoran Desert, and a couple of prospectors were out looking for a hidden gold mine, and one of them, a guy named Pablo Valencia, he thought he had found a rich gold deposit and he wanted to go stake a claim.

And but they quickly realized they didn't have enough water, so Pablo sent his buddy back with the horses to get more water while he continued onto the claim, and they were supposed to meet back again like six hours later, or something, but they missed each other.

They couldn't find where they were supposed to meet, and eventually the friend was like, "Oh well I can't find him, I don't want to die," so he left and left Pablo Valencia for dead.

And basically cut a long story short, seven days later, Valencia comes crawling into the camp of another prospector, of a guy who was out camping in the desert, and one of the reasons I put this in the book, or used this particular example, is the description of the guy who found Valencia, of what he looked like after seven days in the desert without water.

Now he had eaten a few bugs, and he'd been drinking his own urine, that's for sure until he stopped, but it is absolutely gruesome of like his lips just pulled right back, and his gums basically disappeared, and his eyes- and you know, he's been crawling across the desert through like cactuses and stuff, so he's got all these cuts all over his legs, but none of them are bleeding, they're just like- because he's got no fluid in his body.

But he survived, and so this is one of those tales, it's really hard to figure out like- the question I was asking in a sense just to start out was, "I wonder what the longest anyone has survived without water is." And like I said, it depends on the conditions. Seven days in the desert is pretty crazy.

There's a story from Austria in the late seventies where some small-town cops forgot a guy in a prison cell in the basement of a sort of medieval castle, and they left him there for like eighteen days. He survived.

Their hypothesis, they don't really know, but their hypothesis is that the basement room was so gross and drafty, or moldy and mildewey that there was condensation on the walls, that he was able to lick the condensation off the walls, because otherwise he should have been dead for sure after eighteen days.

So anyway, like whatever the records are, those are amazing stories, but those are those stories we hear about, but we don't tell the stories of the 9,999 of the people in similar situations who just die, because that's the usual.

Shawn Stevenson: Right.

Alex Hutchinson: If you don't get water when you need water, it's not quite as urgent as oxygen, but if you don't get water, you're going to die. And then just as interestingly or even trickier is the question of like, "Okay short of death, I'm not at much risk of dying of lack of hydration here, but at what point does being slightly short of water start to cut into my performance?"

That's something we've all heard a lot about in the last few decades, and it turns out to be pretty controversial.

Shawn Stevenson: Yeah, you know I even- when I was in school, this was in high school, I had some people who were from the lineage, I guess they were like some leftover folks from the camp of like, "Don't consume any water or hydration while you're competing," right?

And so again, it's pretty controversial, and there are people who set records not even that long ago by not consuming- was it the Boston Marathon I think? You mentioned?

Alex Hutchinson: Yeah, Boston didn't even allow water until I think the late seventies. I mean it was forbidden.

Shawn Stevenson: Bananas. But all that changed really around that time period, and there was the birthing of- because it's not just water, it's also electrolytes, right?

So there was the birthing of Gatorade as well. Oh by the way, I want to backtrack really quickly because you mentioned in the story with Pablo Valencia that he also didn't get heat stroke.

Alex Hutchinson: Yeah, and that's an interesting one. It remains controversial that whenever you hear, "It's going to be 110 degrees out there tomorrow, make sure you drink lots of water to avoid heat stroke."

Well look, it is important to drink lots of water, but actually the link between dehydration and heat stroke is really weaker than maybe Gatorade would like us to think.

You get heat stroke because you overheat, you get dehydrated because you don't have enough fluid. But getting dehydrated isn't necessarily what tends to lead to heat stroke.

Heat stroke is you've over-exerted yourself in the heat, and you can get heat stroke- in fact, it's more likely to get heat stroke if you're running a 10k where you're unlikely to get really dehydrated than if you're running a marathon when you are going to be dehydrated.

Because in the 10k you're running faster and harder so you're pushing- it's like you're running your engine hotter, so that's the kind of thing that tends to lead to heat stroke.

So all these things are kind of linked together, and for sure like again going back to not flipping from one extreme to the other, it's not that hydration isn't important but it's important to understand that being hydrated doesn't necessarily make you immune to heat stroke. Heat stroke is from getting hot.

Shawn Stevenson: Right, and also not immune to other issues. You mentioned a story of someone who actually died doing a long distance run from drinking too much, right? But it's too much water, and this is where I want to talk about the line between- by the way, that's called hyponatremia by the way, so hyponatremia.

Let's talk about that line between smart hydration and hyponatremia.

Alex Hutchinson: There are lots of people who like to blame everything on Gatorade. Once Gatorade realized you could make a lot of money by convincing people they need to drink all the time, all of a sudden hydration guidelines changed from you should never drink to you should always drink.

You should never ever let any- have any sweat loss without replacing it.

And so in the nineties, that's kind of the place where sports nutrition guidelines ended up which was like trying to replace all your sweat loss. Whether intentional or not, the message that a lot of people took away from that is you can never drink enough and it's always- if you're out there running, you should be just drinking at every water stop, and so on.

And that led to people drinking so much that they basically diluted their blood, and that can be occasionally fatal.

So then how do you draw the line between it's obviously bad to be dehydrated, it's obviously bad to be over-hydrated even though that's rare, what's the best way to figure out what the right level of hydration is?

Well one pretty good kind of heuristic that humans have been using for a few million years is drink when you're thirsty.

Shawn Stevenson: Interesting.

Alex Hutchinson: It's not perfect. Drink when you're thirsty is not perfect. Like our thirst- if you just drink when you're thirsty and you run a marathon, you're going to be dehydrated when you finish.

The question is, is it a serious level of dehydration? And the other question is, in a lot of ways I feel like we've lost the ability to pay attention to our bodily signals, so if you tell- in a lot of cases, if you tell someone drink when you're thirsty, they might not even notice when they're thirsty.

They may not be aware that that kind of low level feeling of, "I don't feel great," is a signal that they're thirsty. They might interpret that as, "I'm hungry," or, "I'm tired," or something like that.

So saying drink when you're thirsty isn't necessarily super helpful to a lot of people, but I think that's a good starting place.

Shawn Stevenson: Yes, absolutely.

Alex Hutchinson: To start listening. Now if you're out running a marathon and it's ninety degrees out, you should be proactive about drinking. You should make sure you start hydrated, and you should probably drink before you're like, "Man, I'm parched."

But you shouldn't feel compelled to just keep downing bottles of water every time. Like if you're not thirsty anymore, you're probably okay if you're not on a like five-day march in the Mojave Desert. Like there's times when dehydration is more serious than others.

But I guess the one thing I would really say is under 'normal' circumstances, let's say you're going out for a forty-five minute or a one hour run from your house through a populated area, it's no big deal if you get dehydrated a little bit.

Like dehydration doesn't kill you as long as you rehydrate when you get back. So I never carry a bottle when I run if I'm just running for an hour, or even ninety minutes, or whatever. And I'm not- I live in Toronto, I don't live in the Mojave Desert, so of course that's specific to my circumstances.

But you know, I would say thirst is pretty good, and don't sweat it if you're - pun intended.

Shawn Stevenson: Don't sweat it.

Alex Hutchinson: If you're a little bit dehydrated when you get back, but be smart if you're in extreme circumstances for sure.

Shawn Stevenson: I love it, great advice. And so I love that you mentioned how other factors can be in play here. You know hunger and even sleep, because it's all controlled- the hypothalamus is kind of this master gland in our brain, on top of regulating your thirst, your hunger, your body's just experience of being tired, and those signals can be a little bit confusing, you know?

So a lot of times when folks are generally just kind of dehydrated, they might feel like a hunger pain of some sort, and they feel like, "I've got to eat," which makes you more dehydrated, you know?

So just keep that in mind, keep it in context. Stress is going to influence how your hypothalamus is acting, but that's such great advice is drink when you're thirsty but also be proactive. You know the times when you probably need to get in some more hydration just to be careful, but we don't need to overdo it. That's just sillypants.

And so I want to ask you also in this context with drinking, we talk about- and this is just nuts here, drinking a sports drink, swishing it, spitting it out, and how that can improve your performance. What? Let's talk about that.

Alex Hutchinson: Yeah, this is amazing. I love this kind of example. These are some studies that started- they started coming out about ten, twelve years ago showing that yeah, you can take a sports drink, you can take a mouthful of it, swish it around spit it out, and it will enhance your performance.

And in theory, this is nuts because the whole point of a sports drink is that you're sending fuel to your muscles, you're sending some sugars and some carbohydrates to your muscles and you're going to use it as fuel.

If you spit it out, the fuel's not getting anywhere. So what's happening? Well basically you're telling your brain that fuel is on the way, and so your brain, going back to this idea of a central governor, your brain is holding you back a little bit. Your brain is being cautious.

Your brain is thinking, "Oh we're not out of fuel yet, but we're burning it up pretty quickly. I don't know how long we're going to keep going. We'd better kind of throttle things back to make sure we don't run out of fuel."

And then you send up the signal that more fuel is on the way, it detects fuel in the mouth and says, "Okay, alright more fuel is on the way." So it allows you- so this kind of- to me it's a really clear demonstration that your brain is holding you back, but it's also a really subtle calculation because first of all, I should say this isn't just a placebo effect where you think fuel is on the way because it doesn't work if you use an artificially sweetened drink, and it does work if you use a tasteless carbohydrate called maltodextrin.

So your brain is somehow sensing the energy content, not just the taste that's in your mouth.

The other thing that's cool to me is it doesn't work, but let's say you get up in the morning and you go for a one-hour run, then this rinsing and spitting will enhance your performance. But let's say you get up in the morning, eat a bowl of oatmeal, and then go for a one-hour run, it won't work because then you're not low on carbohydrates anymore.

So this trick that is tricking your brain into thinking more fuel is on the way, it's only relevant if your brain is aware that you're low on fuel.

So there's these subtle calculations going on in your brain of not only like how much fuel you have, but how quickly you're burning it, and how much more is on the way, how long you're going to keep going.

So this is I think a cool demonstration of the brain's role, it's also something that has practical applications. So you'll see these days a lot of marathoners, cyclists, triathletes, they get towards the end of a race, if you've been out there for four hours taking your watermelon gels or whatever, you're pretty sick of it by the end and you may be having stomach problems from trying to eat or drink and run.

And so you may think, "I don't want to take anymore fuel." Well you get to half an hour to go, you can say, "Okay I'm just going to rinse and spit. I can trick my body for a little bit. I'll get some of the benefits without risking stomach upset."

You can't do that right from the start of a race. You can't trick yourself indefinitely because at a certain point you are going to run out of fuel, but towards the end of a race, you can trick yourself and do that.

Shawn Stevenson: Wow so many cool, interesting insights in the book, and fun facts. Final thing I want to talk to you about is just let's get some like takeaway bullet points of how we can increase our endurance, right?

Besides putting the hours in, like let's not forget about that part of like actually putting in the hours, putting in the work to develop yourself, develop your VO2 max, develop your muscles. What are some of the insights we could take away from today and even in the book?

By the way again there are so many with being able to boost our endurance.

Alex Hutchinson: Yeah so first of all, I'll echo your point that number one is get out there and do the work. Like that's always the biggest bang for your buck. You can't fake it.

But in terms of some of the ways of expanding beyond those limits that you've got. So first of all we talked a little bit about mental fatigue, and I think it's really important if you- and again, this is if you've got a physical test like a competition, a race coming up, or if you've got a work thing, if you've got a test, if you've got a presentation, to incorporate a mental taper into that preparation.

To make sure that your mind is as fresh as your body when you step to the start line. I think that's really important.

The number one piece of advice that I took away from the book, and if I had a time machine to go back and tell my twenty-year-old self when I was competing as a track athlete, the number one thing I would tell myself is to pay attention to the inner monologue that is in your head when you're under stress.

Are you telling yourself, "I can't do this. This is too hard, I'm going to have to stop." And if you are, that's going to have effects on how your brain is interpreting the signals from the rest of your body.

Like what matters is not- you don't fail because your muscles can't go any farther, you fail because your brain interprets those signals from your muscles and your heart as being in a danger zone.

And your brain's interpretation is affected by the thoughts in your head. If you're telling yourself that you can't do it, then you're more likely to interpret those signals from your muscles and your heart as like, "Oh we've reached a point, we should stop."

So we all have internal monologues, but we don't necessarily think about them, and so the first thing is to become aware of it. What do you tell yourself in stressful situations? And if that's not helpful, if you're telling yourself, "I can't do this," then try and come up with alternatives.

And it's not an easy process to figure out. You have to think carefully about, "What could I tell myself that will make me feel better and more confident and enthusiastic like, "Keep pushing, you're ready for this, you've done the training."

And you've got to try those things out in training, in competition, figure out which ones work for you, and keep working on them until they become second nature so that next time you have an important competition or task or whatever, it's second nature that you're telling yourself, "Yeah I can do this. This is good, keep pushing."

And you're going to alter the relationship between what your body is doing and how your mind perceives it. And I should say, like the last thing I should say is I'm a skeptical guy.

We had sports psychologists working with us when I was in college twenty years ago, and we just thought it was garbage. We didn't really pay attention to it, like it just seemed like a bunch of hooey. All we cared about was VO2 max and stuff like that.

I've come back to this as a different guy because I've gone through and looked at the research and I realized in the last few years there's people who are studying things like- so what I've just been describing is called motivational self-talk.

You alter your self-talk, and people have done the studies, and they've measured it, and they've shown, "Yeah you give people motivational self-talk, they can push their bodies into a deeper place, but their perceived effort stays the same.

So they're basically by changing the words in their head, they're changing the relationship between what their body is doing and how their mind perceives it. And so to me, that's a super powerful lesson that is definitely not just about sports, but it's about all the endeavors we face in life that you can take control of that monologue.

Shawn Stevenson: Awesome. Alex, again I think you did a fantastic job in putting all of this information together and packaging it up for folks, and I'm just super pumped for you, and all the acclaim that the book is getting, and I know it's just getting started actually because it's going to reach a lot more people even through the show today.

And guys, make sure to go out, get yourself a copy of 'Endure' like ASAP. Alex, can you let people know where they can find the book and where they can connect with you online?

Alex Hutchinson: Yeah, for sure. So the book is available at your local bookstores, and also at Amazon and other bookstores. To connect with me, the simplest place is probably Twitter. My handle is @SweatScience and anytime I write a new article, which is a couple times a week, I'll post it there and if I come across other interesting stuff, that's where I post it.

I do have a website, www.AlexHutchinson.net where there's more background details and stuff like that. But Twitter is probably the place to go, and as is your local bookstore.

Shawn Stevenson: Perfect. Alex, one final question I'm going to throw in here. What is the model that you're here to set for other people with the way that you live your life personally?

Alex Hutchinson: That's an interesting question, and one thing I will say- first thing I'll say is that the model I'm setting, I'm hoping to set, is about a process, not about a result.

And so all this stuff I'm talking about, about changing the internal monologue and things like that. Believe me I've still got lots of negative thoughts, so I'm not speaking from the top of the mountain, so the model I'd like to think about is not about who you are, but about who you're trying to be, and how you're trying to get there.

And one of refusing- or not being held back by your mind, and just setting goals, and in a more general sense independent of the book, setting long-term goals and being patient about getting there, and not worrying about where I am tomorrow, but thinking about where I want to be in five years.

Shawn Stevenson: Alex Hutchinson, everybody. Thank you so much.

Alex Hutchinson: Thank you, Shawn.

Shawn Stevenson: Everybody, thank you so much for tuning into the show today. I hope you got a lot of value out of this. Listen, he just ended on something incredibly powerful, which is minding the process and not the result, because we're all in process.

We're all in a process of becoming. There's always another level whether it's physically, mentally, in your relationships, whatever the context might be, it's really about the process, you know?

Because we often find once we get to that result, once we get to that destination, the goal, that the bar keeps moving, right? It's a moving target. We never really arrive, so enjoying the process and really embracing that, and understanding it's not about perfection, right?

You hear this all the time, I've said it many times, it's not about perfection, it's about progress. And each day, just making it a mandate to even get 1% better, right?

Maybe it's in your physical fitness, maybe it's in your mental fortitude, you know? He talked about some putting people through these tests that kind of tire out their mind.

And by the way, I want to just point out one of the tips he gave was trying to keep yourself mentally fresh on the day that you're competing, or that you're really looking to give your best, right? I think that's really important.

And also listen, it's not just in the experience of the discomfort, but it's also how you perceive it, and I don't think that this can be stressed enough. I think this is one of the most important pieces to take away from this show.

We're all going to go through discomfort whether it's in training, whether it's in our life and mental and emotional experiences, we're all going to experience it.

But the more that we can train ourselves to label it differently or perceive it differently, right? When we're thinking about for example- somebody asked me when I spoke at an event recently.

You know, they're sitting next to me, this is after I came off stage and they were just like, "Man that was amazing. How do you do that? Like you didn't seem like you were nervous." Because they were sitting next to me before I went up on stage, too.

And they were just like, "I don't think I could do that. Aren't you anxious? Like aren't you nervous?" And I was like, "You know what?" I really thought about it. I was like, "Yeah, there are some feeling there, but I label it differently. It's excitement, right? I feel this excitement. I just want to give, I want to perform, I want to share value, right?"

It's very different from, "I'm nervous. I'm so nervous, right?" There's a different texture, and your brain is already linked up with this dialogue, right? And so really paying attention to that, and how we're perceiving information coming in, how we're labeling things, and really taking back control of our mind, because that's where the real battleground is going on, you know?

For the most part, muscles matter too, as Alex has talked about.

So take all of this into context, use this stuff to create the life that you truly deserve, because listen guys, this is just scratching the surface of what we have coming up for you. So we've got some incredible guests coming up, mind-blowing show topics, but make sure to get yourself a copy of 'Endure' because I just think it's an important part of our library, and understanding human persistence, right?

Understanding our ability to endure, to keep going to the next level. Alright? I appreciate you immensely. If you got a lot of value out of this, make sure to share it out with your friends on social media, Twitter, Facebook, Instagram, all that good stuff. You can tag me or of course tag Alex as well.

And I appreciate you immensely. Take care, have an amazing day, and I'll talk with you soon.

And for more after the show, make sure to head over to www.TheModelHealthShow.com. That's where you can find all of the show notes, you can find transcriptions, videos for each episode, and if you've got a comment you can leave me a comment there as well.

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And take care, I promise to keep giving you more powerful, empowering, great content to help you transform your life. Thanks for tuning in.