Opening on belief alignment and the podcast intro

trying to find the incongruences between stated beliefs and competing beliefs, and trying bring congruence into the way that we iterate the future and the we feel so that it matches what we believe.

You might call that repentance, change, identifying You know, those, errors in the way that we are approaching the world and approaching our interactions with sufficient humility so that, we can recognize where those incongruencies live and spending some time thinking about, oh, I felt a flash of fill in blank, jealousy, irritation, anger, because of some interaction and stop to think, why did I feel that?

You know, what really was the underlying chain of iterative thoughts that my prefrontal cortex invented? What was outcome that made me respond almost unconsciously in this way?

What if aging isn't about slowing down, but leveling up? I'm Dr. Isaac Jones. This is the Longevity Leaders Podcast. I am Dr Isaac jones and welcome to the longevity leaders podcast.

i'm here with Dr Kyle Bills, who is The Dean of Research at Norda College of Osteopathic Medicine. We are going to talk about a lot of really exciting breakthroughs that he has discovered and how we can help you maximize your brain function.

Dr. Kyle Bills' background and path into neuroscience

your focus and really how you can also mitigate migraines and things of that nature. So Kyle, thank you so much for being on this podcast with me. Absolutely my pleasure.

Excited to be here and yeah, this is going to fun. Absolutely. Now we were chatting just a little bit beforehand and you are a busy man. I mean, you're a Dean.

You're doing all this research. Some of the research is now being picked up by all these mainstream media sources. So why don't you share a bit about your background?

What got you so excited about the breakthroughs that you were now seeing in science? And we'll talk about some of those breakthrough a litte bit later.

Yeah, absolutely. My background is a little bit eclectic in the sense that I started as an undergraduate student in exercise physiology, worked in a pharmacology lab, doing research with a wonderful PharmD, taught me all kinds of stuff about research.

And then I chose to go to chiropractic school and he was not that pleased actually when I made that initial choice. But I choose that because of really the philosophical framework of trying to understand really how the body could optimize health and really trying to move away from just find disease state, eradicate disease, state to how do we look at the in terms of what are those barriers to it expressing its optimal health, and how we identify those and then how to we help someone move towards removing those barrier and allowing their body to kind of express health.

And so that was very attractive to me. So I went and studied chiropractic. at Parker university. That's great. Was Brizio Mancini there while you were there?

He was, he was the president while I was there. Absolutely. He's a good friend of mine. Yeah. And then I did my internships at the Dallas VA medical center in their department of physical medicine and rehab, and then went and studied in industrial disability.

Wow. Became a qualified medical evaluator in the state of California and studied manipulation under anesthesia. Had a few practices out there in The Bay Area and then went back and did a PhD in neuroscience.

My dissertation was on neuromodulation and trying to alter dopamine levels in brain. I did post-doc that was funded by the National Institutes of Health.

and focused again on kind of neuropsychopharmacology and neurochemistry in my postdoc. And that kind led to some of the work that helped us understand how we could modulate some these neurotransmitters non-invasively in the brain.

Since then, we've kind moved into chronic migraine research and we run the Chronic Migraine Research Center here at the med school. There's so much to talk about.

Oh my gosh.

Brain complexity, neuroplasticity, and dopamine prediction errors

But one thing I want to ask you to start is What is like, just having studied the brain in such amazing detail, having gone to chiropractic school, getting your PhD in neurology, what is it that is mind blowing to you?

Like maybe it's a factor. It's, a figure of the way that the body's been created and how just remarkable it is. I love that question actually. That's wonderful.

A couple of things that I think have really been profound to me. One is you realize as you try to study so complex as the brain, first off that one little structure within the is as complex.

As the cardiovascular system. And so you realized really quickly that the more you learn, the More you realise we know nothing. And it's gonna take, I mean, we don't even possess the adequate technology to fully understand what's happening within, you know, between our ears.

One thing that struck me was some concepts so basic as someone saying that they're feeling joy or they are feeling sad. The best we can do is describe mechanistically which nerves fire and what neurotransmitters get released and receptors get activated.

But if you try to take it any deeper than that and you say, well, Well, so what about that receptor getting activated? Why does that produce joy? And the honest response is, I have no idea.

We don't know. And that's I think a really important point of humility to recognize whenever we talk about the brain is I've become more and more wary of anybody that thinks that they've got it all figured out.

You're like, no, that probably not where we're headed here. The other thing for me personally is I have found absolute beauty and wonder, and it has brought me closer to God.

watching the architecture of the brain and how it was designed to interact and grow and learn and adapt. For me, that's been a testament of divinity. And it's, I think to a large extent, improved the way that I see people and see them in light of there's dividity within them and potential to be something great and the room for growth and expression of I think amazing wonder is off the charts.

And that depth of that has really grown for me. The more I've studied the brain and tried to understand the way that it works, it's actually brought me closer to God.

Wow, that's amazing. Just on that, the brains neuroplasticity and ability to adapt to create new belief systems and new habits and ways of being in the way that you interact with the world and people around you is that, that's the core thing that kind of blows your mind, right?

Like if you look at the actual details of the, the the brain is, is adaptable. Absolutely. And, you know, specifically some of those systems that are designed.

to cue when we're supposed to change are, I think, remarkable reflections of this. There's a lot of them. I mean, way too many to talk about in a short amount of time.

But for example, when when place confidence in faith in something that's unchanging and we make predictions based upon something of that nature, we have systems that are designed to reinforce and produce growth and and produced adaptation.

but when they're done in that context of something, that that stature and nature We find that it produces a thriving that is really quite unparalleled.

The dopamine system is particularly attuned. I mean, here's a good example. If you make a bad prediction, let's say you get up and you give a presentation in front of a group.

This is a pretty common experience, right? You get and say, okay, I'm going to present on this topic. If it goes well, you'll get a release of dopamine that will help to cue to your brain that, okay, here were the circumstances that led to this positive outcome.

Let's reinforce this behavior, right? Now, if you get up and you give this presentation, it's goes terribly. And you're just horribly embarrassed in front of this group of people.

You also get release a dopamine or alterations in dopamine dynamics, but the the influence and profundity of how that changes the brain. The arithmetic of this, this won't be perfect, but the arithmetic is roughly, you know, give or take 10 to 1, 10 really good experiences to counteract one really quite negative one.

And so in a very real way for someone to progress and to grow and move and achieve and become something better than they were, We were designed to interact in a circumstance where there's a semblance of unchangingness, an assemblance, of firmness and a foundation on which you can build something un-changing that can be kind of this North Star to which, you look and make predictions.

I mean, there there are countless examples where if you choose to see those things, they're very, very reinforcing. Interesting. So, what I'm hearing is that if you have that belief in something that is unchanging like God, like a creator, that there's an even more powerful dopamine system that brings you, you know, more joy and fulfillment, if would versus if didn't have had.

Is that accurate? Certainly the dynamics of making predictions based upon something that's certain and unchanging is going to bring about more positive changes within the brain.

Well, give me an example. Okay, so yeah, lovely example, let's say Okay, let's use this one. There is a movement in addiction recovery, right? Where you say, well, we're going to have you exercise.

Well, exercise has been shown to positively modulate those systems that are actually going help somebody heal faster. So that's a very positive thing to do, by the way.

And so if you base your predictions and your progression on a certain relationship or the fact that I can exercise on an irregular basis, that's positive and that is good.

Those are good things to do. But what's going to happen if all of a sudden you can't do that? You break your leg and you cannot get to the gym? Or what happens if a dear loved one passes away?

And that was the anchor on which you've based how you are developing your growth and the predictions that come in front of you.

Migraines, anxiety, and competing core beliefs

So this is a simplistic sense of it that maybe is little superficial in terms of neurocircuitry, but it really does, I think, illustrate this underlying truth, which is when we make those predictions based upon something that's immutable and unchanging, we have a foundation on what growth can occur over a lifetime as opposed to making those prediction and being anchored in those things that are quite changeable.

and our brain in the dynamics of the way that this system works, they were designed to interact with unchanging systems. They're designed to react to changeable systems because we absolutely will react a change able system.

So please, you got to not misinterpret my point there is because of course we were meant to interact with all varieties of change-able things. But some of the most positive and steady progression occurs when there's an anchoring to the unchangeable.

Oh, that's very interesting. Very interesting! Well, I think that there's an epidemic happening right now. People that are not, you know, focused, they have anxiety, depression, headaches are plaguing a lot of people, chronic headaches, brain fog.

You see a lot of children now, it used to be just in adults, but now it's like children are struggling with a of these challenges. And it is sad because, you know, I was sharing with you before this podcast interview, my story is that I had ADHD, dyslexia, I was in special needs and it took a chiropractor, naturopath and a functional medicine practitioner to completely transform my internal physiology, my neurology.

my, my vitality to then overcome that and start getting straight A's in class and get out of special needs and, get academic scholarships and. Get on the Dean's list and then get on national Dean lists and graduate summa cum laude from a doctorate program, which if you told me while I was in special need being made fun of by my friends, I would never believe that I could have done that.

But the focus this chiropractor had was optimizing my neurology. This naturopath had, was to balance the energies in my body and to focus on the gut microbiome.

The focus of the functional medicine practitioner was get me off of, you know, this diet, get on that diet. Change this lifestyle strategy. Get on XYZ supplements, minerals and vitamins, and then get rid of the heavy metals that were bioaccumulated in my body.

everyone has kind of a different signature or fingerprint of why they're struggling with what they are struggling. But what are you seeing, Kyle, you know, as a PhD and as doctor and somebody that researches in lab but also understands the challenges that are happening in today's day and age, what do you see as the underlying reasons why we're seeing such an epidemic of people that can't concentrate, of People that are dealing with a lot of these neurodevelopmental issues, as well as psycho, you know, neurological challenges.

Yeah, well, that's a broad question, I suppose, in some sense, depending on which particular aspect and condition we zeroed in, and I think there could be a multitude of answers to that.

Maybe I'll Let me use an example of one, perhaps, because we research in chronic migraine quite a bit, a condition that is very comorbid with chronic my migraines.

And I'll be specific in the distinction between episodic and chronic for a minute. Chronic migrain is greater than 15 days per month. So very severe. Very severe migrane is so that the comorbitity with generalized anxiety disorder is a very high.

or for a variety of reasons. You can say, well, having 20 days of migraine a month is going to make anyone anxious. And that's undoubtedly true. But then there's, we've also done large scale testing and a study where we're actually about to submit for peer review, where you've done hundreds and hundreds of neurocognitive profiling, neuropsyche valves on individuals with chronic migraines.

There is a very, very specific neuro cognitive profile that emerges that certainly lends itself towards anxious personality. What is that? What's the gist of it?

So interestingly, what you find is the general cognitive profile of a chronic migraine individual is their IQ is higher than average. So that's an important starting point.

They have higher-than-average levels of deductive reasoning ability. And when the migraine has become chronified is where we've really focused a lot of the study.

So again, there's a little nuance to kind of distinguish between pre-post, but here in the, in a chronic state, we still have higher than average deductive reasoning ability and you have a higher-than-average spatial short-term memory and spatial awareness.

So you've got someone who's very aware of everything that's happening around them all the time, with very high levels of the ability to infer and deduce about the meanings of those interactions and the things that they're noticing.

And then you have a reduced, largest reduction in two cognitive domains. The first is verbal short-term memory. So their ability to actually remember specifically verbal cues that are coming.

And so a lot of visual cues and just awareness of what's happening with inferences that aren't necessarily based on what they're hearing, but what their seeing and feeling.

Then you a lowered response inhibition. Now, response inhibition is that part of the brain that allows you to decide that something should just be let go.

It's the part that shuts down rumination and overthinking and cycling of part the of brain responsible for letting you iterate potential futures in your mind.

So, where is it located? You've got a variety of spots, but the anterior cingulate, there's portions of entorhinal cortex and their interactions with prefrontal cortex, which is the area where you're going to, let's say you lay down at night and you've had some interaction with an individual that maybe wasn't your favorite and.

You start reliving it in your mind and say, well, they said this and I should have said. And then they probably would have this. Then, and then you can live the lifetime in that part of your in 30 minutes, just laying awake in bed on your own.

Right. and your body can respond as if you really lived these experiences. Hmm. Some of them end triumphantly, but unfortunately, when there's lowered response inhibition, too many of the end, you know, drunk, dead alone in a ditch and everybody's left me and I'm all by myself and, the world would be better off without me.

Unfortunately, to many end in that iterative future. But that processing is, very, very common when migraine has become chronified. And I suppose that was a really long answer to when you dig in and we've worked with other wonderful researchers and professionals on aspects of analyzing that through things like cognitive behavioral therapy.

What you find is that there's generally an untethering and an unmooring from purpose And you have this interesting dynamic that arises where someone's, what their core beliefs are, are stated about what it means to be a good person or what the purpose of life is and why am I doing this and what indicates that I'm doing well and a And then you have this separate set of competing core beliefs that are living out in the prefrontal cortex that more things like, well, my worth is actually dictated by what other people think of me.

And it's not really enough that I'm trying to be a good person, that i'm serving others and that, I am kind and doing these things that they would state are actually the things.

That dictate whether you are doing a job. But they're living the experience of, well, it's actually dictated by what other people think of me. And so this incongruency in competing core belief and core beliefs seems to be at much of the root in the demographic we've studied, at least of that tension that produces that anxiety with their social interactions and their Interesting made worse by social media and the consumption of it and variety of factors like that.

And so, right. Yeah, I was just going to say that there's probably a massive increase in anxiety around people that are consuming a lot of these things because oftentimes social Media pulls us away from purpose.

It pulls into a place of distortion. When you look at kind of the meta program of distorting reality of what, you know, start seeing other people as more beautiful than yourself.

And you start looking at like, oh, wow, I don't have this or I. Look like that or whatever. and you. Falling into the comparison trap, but it's interesting how there's a psychological personality and even IQ element attached to people with migraines.

So if you get a lot of migraine and your listening, You're probably like Einstein. My mom would get chronic migraines, so I assume her IQ is pretty high.

She was a very smart person, is a… very… smart… person. Yeah, and you know, it's always important to caveat when you do large-scale, you, know hundreds and hundreds of studies, there's a statistically significant average effect.

It doesn't mean that every individual, you know, there's diversity among individuals, even if we find a group mean, that gives you the percent likelihood that any given individual falls within the category I've described, right?

Even though those are averages among the But you know, it's interesting your comment there because almost to a person, if you sit down and in the interviews that we'll go through to understand the dynamics of the anxiety.

Almost to person. If you ask someone, okay, well, tell me what it means to be a good successful person? You'll get a very similar answer across the board.

And it'll be things like, Well, that you're kind. And you serve others and you're forgiving. And when you make a mistake, you own it and, and your striving to be better.

You know, it's this, very, these threads that just run very tightly through what, what these stated beliefs are about what it means to good and whether you should see yourself as, as being successful.

But then you'll walk through, okay, give me an example of, of a situation that produced anxiety for you. And they'll describe an interaction with an individual where the interaction implied that someone was displeased with them in some way.

And then what they will say is, well, they're actually reacting as if their self-worth and their sense of success is dependent on these external changeable factors, these other people and what the think of them.

As opposed to those immutable characteristics of I can control whether I'm patient. I Can control? Whether I love someone I? Can Control whether i serve someone i can Control the level of my selfishness You know these are these internal factors that are within my my control And and those are the stated beliefs of the individuals But the lived beliefs and the outcomes of their emotions Betray a competing core belief that it's actually Just what other people think of me Wow, that's so deep.

That is so, deep and so profound.

Identity, trauma, and reframing unconscious responses

It's, it's seriously, you know, this is where you get into the kind of unconscious element of human nature where maybe there was a past trauma and they believe and, they, have a stated belief that is, is one way.

And then their actions and their thoughts are completely different because there's been some sort of a pass issue where they decided, You know? Hey, This is.

This is who I am. I went through this course that was all about letting go of the past and forgiving people and it was really powerful. And I can remember there are different things that you would do and you'd write down different people that would hurt you.

And I had no idea how much of my childhood and the neurological like development around certain traumatic experiences impacted the belief about myself even today.

and so when I was digging in, one of the things that occurred to me is I. Was bullied a lot like my, my parents came from split families. They got married, but they brought their families in with my family and then my older brothers or my you know, would beat me up and bully me a little bit here and there.

which was challenging, you know. I look at my kids' upbringing and the lack of blood that comes out of their face and their bodies and how much blood I, it's like, how is it that my kid's don't bleed like every day like I did?

But it, like black eyes that flop over your eyes and stuff that I was just like this is just childhood. You get black guys, and you go to the hospital a bunch of times.

Yeah, it's not the childhood that my kids have, but I've had to go into the past and recognize that these are some of the beliefs that little Isaac developed about myself.

And then I asked myself like, look, there are four questions in the neuro-linguistic programming course that I took called Strategic Brain that kind of helps you flip the story or the narrative.

The first one is what meaning do I choose to give this? Like you can actually reassign the meaning of whatever happened in the past. What learnings do want to take from it?

You know, the learning are vast oftentimes and you're like, wow, learning that learning, I'm journaling about all these learning. of when I was like six or seven years old.

And then the third question is, how can I integrate these learnings into my life? And the fourth question, is how I can share these with others? Because that's how you really lock it in neurologically is you share and you help other people with what you learned.

So I did that. Of course, through prayer and just letting some of the anger I had from people have stolen millions of dollars from my business in the past and things of that nature.

I've just been like, you know what? I'm in a state of complete peace and love towards a lot of these people. Somebody brought up this person's name and I felt my heart starting to race the other day and But do you think that that is a key element from a neurological perspective is like past unconditioned, you know, unconscious subconscious responses that we've had to external stimuli that developed a belief about ourselves that, we can state one thing.

We have our stated beliefs, but then we have, our subconscious or unconscious, mind that's running the show. Right? Yeah, for sure. So maybe if we shift that, so this is, we've had a very psychological conversation.

If we could even take that and say, okay, well, let's turn that into a neuroscientific conversation for a minute. Yeah. Let's do that. We've got, but exactly with what you just described, because I think yes, everything you said, yes.

I that's absolutely right. And so you've these systems that are designed to lock in context and help us make better

predictions. And one of the cues involved in that system is dopamine, as we've touched on this.

But that's system responsive to novelty and salience. Novelty in what? In salients. So potency. For example, we make predictions and if we encounter something that is unpredicted, then that's going to produce novelty.

Like, it's like, okay, well, that not what I expected to happen there or something. That's just particularly potent. And that can be through, you know, a surprise.

It can through just some emotionally intense experience, things like that. But all of those will produce this firing of this, this mesolimbic circuit it is called.

It fires to a variety of places. It has little tentacles that reach out towards everything from the limbic system, you know, through the hippocampus and the amygdala to the prefrontal cortex.

But in essence, it primes the system to change and to make a different prediction. And so, but it's very context dependent. So, for example, if someone has a very negative experience, that's very unpredicted and very, very potent, then they are very likely to lock in the context of that.

And it's quite protective, right? If someone has this horrible experience with someone and now their brain is going to say, you know what? You mispredicated that and it led to something that feels catastrophic.

And so you get this release that says, okay, lock in context, make a better prediction. And if that's so potent that we begin to make mal-predictions, we began to predict the danger in situations that don't warrant it, Well, to some extent, we might call that a post-traumatic stress disorder.

And then there's a wide spectrum of what that can look like. There's the diagnosable pathological version of that all the way down to, now I don't trust anyone that looks like this kind of a thing.

It can be quite subconscious. But bias processing is actually a very important part of life. The reason it doesn't take us 10 hours to get dressed in the morning or decide what to eat for dinner because bias-processing is critical to life, But it can go pathological and produce unwanted consequences.

But every time we experience some new encounter that's novel, salient, produces a release of dopamine in some way in that sense, it locks in a new context, meaning you can change.

And so the prefrontal cortex will take that context through hippocampus and amygdala, and that previous context produces this almost prescription lens that's unique to an individual through which the prefrontal cortex will gaze in order to predict the future.

And the task is to change that prescription lens so that it more approximates reality. We kind of jokingly teach neuro students at the beginning of their process of education that the brain is not recording reality, it's inventing reality does it through the lens of all of your messed up experiences.

And so don't be so sure that what you think is happening is reality. Be a little careful making final judgments about people and things. Maybe start with intermediate judgments and test your hypothesis and see if it holds up because those final judgements tend to be a bit challenging.

That's brilliant. And yeah, in my strategic brain courses, they said that the map isn't the terrain, right? The terrain is like the actual geographical land.

It could be like a plane in front of you or beautiful mountains or an ocean, but one person that sees you know, let's say the reality is a field. Another person sees a hill, another person see a mountain, right?

And like you said, the brain does not record reality. It is inventing reality based off of your past deletions, distortions generalizations and filters that you've developed.

I think that's brilliant. Now, I will say just from There's a clinician that we work with that has developed a really amazing system to help people reverse CRPS and her company is called Spiro Clinic.

And one of the things that she had said was, you know, having people consciously aware and have the prefrontal cortex, deduce like, okay, this is not actually what I want to believe is a powerful way to rewire the brain.

But she said that hypnotherapy has been very powerful in the kind of rewiring of our patient's brain as well. What do you think about that? I think there's a lot of mechanisms, right?

I Think at the core, maybe there is a, here's, a term that's used broadly that maybe resonates with a number of people. But I, think, you know, this, trying to find the incongruences between stated beliefs and competing beliefs, and trying, to bring congruence into the way that we iterate the future and the, way, that, we feel so that it matches what we believe.

You might call that repentance. change, identifying, you know, those, errors in the way that we are approaching the world and approaching our interactions with sufficient humility so that, we can recognize where those incongruencies live and spending some time thinking about, I felt a flash of fill in blank, jealousy, irritation, anger, because of some interaction and start to think, why did I feel that?

Neuroscience of change, humility, and congruence

What really was the underlying chain of iterative thoughts that my prefrontal cortex invented? What was that outcome that made me respond almost unconsciously in this way?

In order to have felt that, what must I believe about myself in the world and them? And forcing yourself to say, okay, well, you know, maybe forgive a touch of personalness here, but maybe for me, I say well my worth comes because of my relationship to God.

My core belief is that I'm a son of God and that is highly relevant to my identity. and the way that I approach the world, and there's a sense of immutability of that worth because of the relationship.

It requires things of me. If I have an interaction that produces a flash of anger because the someone responded to me, then it requires sufficient humility to say, time out.

What level of pride do I and what must I believe about my worth and my interaction with this individual in order to have produced this emotion? And the truth of it is, I must believe that my worth comes from them.

I'm dependent in some way on my performance and I am dictated by the outcomes of these situations, not based upon that fundamental identity I hold as a son of God.

And that requires then me to confront that and to say, okay, that's incorrect. Let me pause for a minute. I clearly felt that. And so I've clearly got a competing belief that it's living rent free in my head here.

So let me go back and try to reformulate. a better iterative thought and if that lens were true to my beliefs, what should I have thought? What would it have looked like?

And it doesn't instantly fix the problem, right? But it helps you reframe in some way and slowly over time helps to keep things at least aligned psychologically so that I can feel the confidence of congruence accompanied with the humility of recognizing the vast numbers of imperfections that Like the recognitions of the imperfections for me are part of humility that brings grace.

Wow, that is so powerful. I align with that. And I think a lot of people, they base their identity on, again, the external. If they add up, if they look a certain way, or if, you know, show up a way.

So I had a client in London, England, and she ran a hedge fund that she would make around 2% to 4% a year on

this multi-billion dollar hedge funds. You know, 24 to 50 million pounds a year.

And, and so she ended up buying a lot of stuff from Gucci and from Louis Vuitton and, uh, Hermes and she, she bought like a. Like she would buy a million dollars plus a, year of clothing and.

She would be asked to come to all these different, you know. Gallas and private events, of course, to spend more money. So she was telling me she's like, Isaac, She's.

The thing that I just started to realize was that everyone in that environment was living a masquerade and everyone was trying to talk about the next thing and how important it was to go on this trip.

And they were talking about this and that and what they bought and the new diamond ring. And, and she's like, it was so what I realized it is so empty, right?

Like, at the top, It was just so Empty. And there was this lack of like identity around who I actually am. From from from the perspective, I've very aligned perspective as you have is, is like look, we I believe that God loves me unconditionally.

That is part of my identity. I Believe that. God shows me grace and I don't have to essentially create perfection and to earn his love. He loves Me unconditionally and there's this identity that gets formed for me at least to elevate my level of excellence and my Level of You know, how I show up for other people, because I don't have this pressure of feeling like I'm behind, I am a failure, you know enough, i'm not worth it, not worthy.

A lot of the core beliefs, unfortunately, that a lot the doctors I've coached and trained over the years have ended up developing. So we went deep on this, Dr.

Karl. I want to bring us back up and just talk about how I absolutely love the research that you've figured out around the development of this seat that my kids and I use every day.

My wife, we've learned about this unbelievable science that, you know, unlocked and how dopamine surges through certain mechanisms that are non-pharmacological mechanisms.

that can help people in a number of different ways. And I'll just tell you, it's helped me. It's help my kids. They, and it helped my wife. My kids utilize this device right before they homeschool.

And so talk to me about NeuroNova. Talk to you about the science behind it. Why the heck does it work so well? And yeah, I'd love to learn a little bit about that.

Absolutely. So when I was a postdoc, we started running some experiments where we were doing surgical implants of spinal stimulator devices.

NeuroNova research, dopamine, and clinical applications

Wow. And then we could drop cannula down into the brain and extract fluid and we can put electrodes into brain where we record single and clusters of nerves simultaneously in real time.

I suppose the way to make the story a little shorter is we discovered through some of those experiments that if you stimulate the pathway in the spine, it's called the dorsal column.

if you stimulate that at a very specific frequency, there's actually a pathway that travels up through the brain and enters that mesolimbic dopamine system.

And it's a window. If you go too high in the frequency of stimulation, it stops. You go to low, same thing occurs. But if hit this certain frequency we could elevate dopamine levels within the Wow.

We published that mechanistic study back in 2019, actually, and that was a profound moment for us because that is a pathway that had not been described.

Activating that particular neural pathway had been previously shown to go to that system, so that paper we published, it led to some experimentation of, wait a minute, if we can elevate dopamine levels, Dopamine is involved in a lot of things here.

What does this mean? And so we tested in the context of alcohol addiction and opioid addiction, and published a series of papers showing that if we gave this stimulation simultaneous to the administration of some of these drugs, that we could block some the dependence-inducing effects of the drugs.

Or in case of withdrawal, we can alleviate some symptoms associated with withdrawal. And that led us then to say, well, how can we do this non-invasively?

And we knew the frequency of stimulation was around 80 hertz. And so with some great collaborators, we sat down and figured out a way that we could get this 80 Hertz stimulation deep enough into where those mechanically sensitive nerve endings live deep in the spine because it's too fast.

You can't just put it on your back. That frequency moves so quick that it won't penetrate deep to activate those nerves in a substantive way. And you can just stand on a plate that vibrates at 80 hertz because its moving too quick.

You don't get enough displacement. And so it required this kind of workaround approach of offset frequencies that combine in vivo to produce beat frequencies, that produce harmonics that can reach up to the right frequency to activate in the spine.

We tested those in anxiety and we submitted those data to the National Institutes of Health as a novel mechanism to treat the anxiety associated with opioid use disorder.

And the NIH funded our phase one clinical trial, the science was pretty strong that we had a mechanism do this and so they funded that trial. We did that trail in probably the arena that was the most anxious one we could find, which was immediately following acute medical detox from opiate use disorder.

Wow. The beginning of inpatient residential treatment. And so we tested this device that you referenced as a method to elevate those dopamine levels and treat the anxiety associated with withdrawal.

We had a sham-controlled device that produced a very almost identical experience, all done in the context of the standard of care. And we published that study just a couple of years back, demonstrating the efficacy of of intervention in context to of anxiety.

Mechanistically, it elevates dopamine levels, which is critical for focus. It's critical to falling asleep. It's relevant, obviously, in a variety of those kind of neuropsychiatric conditions, including generalized anxiety disorder.

We're waiting on some phase two funding where we'll do a multi-state, even larger trial. Right now, as a wellness device, it's being utilized in, I think, approaching 200 clinics to be an adjunct, to help with some of these wonderful therapies that are already occurring in wonderful clinics.

But we're pretty pumped. It's been going well. Wow. Congratulations. That's very exciting. You said it helped with anxiety. How much did it increase or decrease in anxiety and how much have you seen that it increases people's focus?

Yeah. And I'd love to, for you to touch on sleep, if you have any data around that. Yeah, we do. Yeah. So when this device was added into the standard of care, We got a little over a 50% increase in anxiety reduction over the Standard of Care when it was done in conjunction.

And we're seeing that hold now in a pretty eclectic and heterogeneous pool of users. Wow. That effect broadly is holding above 40% with now a significant amount of data that's coming in.

That's a pretty, we were pretty excited about that actually. That that's been pretty profound. One of the reasons we think it does this is because of some of those connections with the centers of brain that produce rumination.

Kind of subjectively reported that many, well, what they'll sense is kind of this almost let down where the thoughts calm. Interesting. And is that something that dopamine does?

It helps decrease rummination? it can. It's involved in circuits that do affect that. Absolutely. Yeah. Wow. Sleep latency is also a dopamine involved process.

And so we've got lots of wearable data now where we have been able to show. In fact, we published a case study several years back showing that we could improve sleep latency by activating these mechanically sensitive receptors at this frequency.

We've gotten quite a bit of data, now, demonstrating pretty significant improvements in deep sleep. Really? In addition to latency. How much, like, what are we talking, 5% increase or what?

A little better than that. I'm always a little cautious because that one we've not submitted for peer review yet. And so as a scientist, I am always cautious on throwing out numbers of things that we haven't allowed others to scrutinize.

But it looks good and we'll definitely be publishing some very specific numbers on what we're finding broadly with improvements in deep sleep. And you use it anytime you used it throughout the day or specifically right before you go to bed?

We've definitely noticed the effect when people use as they're preparing for bed, but also just using it any time throughout day in a continued way, 10 minutes a day.

Over the course of at least a couple of weeks, we're seeing that the the effects starts to hold. And we were prelim data is suggesting a durability after about four weeks of use.

Well, why is it important to use every day? What's happening there? It's a fabulous question. So there's several use cases. And so when it's used, we thought honestly that it was going to require a lot more use than that, to be frank.

I mean, altering neurocircuitry is no trivial matter, right? And trying to, especially non-pharmacologically and noninvasively. We first thought that was gonna require multiple sessions per day to do it.

But the data we have from the clinical trials suggests that 10 minutes a day is sufficient. And in the preclinical data, we found that we get an elevation of dopamine that peaks at about an hour and falls back down to baseline about two to three hours in.

And so the first few times that someone uses it, that's kind of subjectively that is the experience many will have is they'll notice this kind calming effect, a reduced rumination that occurs on the order of two or three to hours.

But as continued use goes, the effect starts to last longer. Really? And seems to become a little more long standing after about two weeks of at least five days a week use.

Now, that's, how long? Wake up to five hours? Meaning the effect? Yeah. We'll start to see some of the effects like improved sleep and decreased anxiety that starts to stay 24 hours a day.

When we hit the two week part in the clinical trials, we'll find that it becomes statistically significant at three weeks as measured by Hamilton A anxiety scores.

And then at four weeks, quite significant. Wow. This is so exciting. So powerful. If you use it twice a days, is that a

problem? We've not seen any adverse effects, but we've also not seeing that it's necessary, actually.

And we got the effect with one time per day use. So it doesn't seem to be that that's required to get the affect described in the clinical trial. Interesting.

Wow. So coming back to deep sleep, I don't want to push you too hard, but is it that you're starting to see and we'll let the scientists scrutinize it as you stated, But are you starting?

Is it like five to 10% give us a range like 10 to 20% improvement? What do you think it's going to end up being? Hypothetic like your hypothesis. All of the caveats in the world.

Okay. So it's been properly caveated that we have to reserve the right to change this number a little bit, but I think we'll probably land somewhere around a.

Little over 20%. Do you know how exciting that is for likes a biohacker longevity hacker, like myself and other friends.

Sleep, focus, and closing remarks on the device

Like we look for anything that can increase deep sleep for like a minute. Yeah. So yeah, so that's where we are. But again, you know, I'm properly caveated and we'll wait to put a flag in the ground until we've let others scrutinize the paper and then we're confident.

Yeah, yeah. No, no I like that. I liked that, Kyle. You've come across a very A humble scientist and somebody that is really looking to do a lot of really good in the world.

I think any psychiatrist, psychologist, longevity center, regenerative medicine center. Pediatric clinic, they need to get this, right? Like this is something that they should be, you know, integrating into their clinics.

So we'll have a link underneath the chat to, just to be able to explore this for yourself. But I just know for myself, I've been using it. I see an increased level of productivity, output, focus.

And then my wife was ready to throw a couple of my kids into public school or private school. and not homeschool them anymore. And it saved them from having to be thrown out of the house.

That's amazing. So their, their focus is a lot better, et cetera. Appreciate all of work you've done, Kyle. Any last thoughts around NeuroNova and what it can do or any kind of exciting things that we haven't talked about?

Well, I think we've covered some great ground in this interview. So I just maybe take a minute and just say thank you for the opportunity to come and talk science.

And I, think, we hit quite a few categories here, but this was wonderful. Thank you so much. Kyle, you're amazing. Really appreciate the work you've done.

I look forward to seeing what gets created over the years to, come with your research and your desire to create non-pharmacological interventions that will change people's lives.

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