Introduction to Brain Health and Leaky Brain

That Is True is a best selling author, a fantastic award winning international speaker, functional neurologist that specializes in complex brain disorders such as post-concussion syndrome and mystery brain symptoms.

The what better person to invite on today's talk and doctor to to talk about brain health? He has this fantastic passion for empowering health minded people with knowledge and insights and practical actions needed to heal their brains and really reclaim their lives naturally.

So obviously, we're on the same wavelength, and by getting to the root cause of diseases through advanced brain testing and sitar technologies, he's really has a step by step clinic improvement approach for healing the brain.

So, and you can also find him at W1 dot brain save and.com. So when I talk about something called leaky brain similar to leaky gut, except it's a little bit different and why the blood brain barrier actually matters and the hidden dangers of this leaky brain and how we can fix this naturally.

So welcome, doctor, to to the forum. Welcome to the forum. So happy to, get some time with you. What you do is so important. I feel like we're on the same mission.

And so I'm going to kind of dive right into it. So, you know, one of the things that really scare people is that whenever there's anything that has to do with mental health or brain health, there's sort of this sense of feeling of hopelessness, right?

But there's this concept that I like to use as well as you called a leaky brain, that I would like for you to kind of discuss. And then we're going to go back and forth about what it is, and then we'll take it from there. Sounds good.

Yeah, absolutely. And you actually bring up a great point, you know, before we dive into the leaky brain, that's when patients or clients reach out to work with me.

That's one of the number one questions on their mind is if they're struggling with the brain health issue, whether it's like memory loss, cognitive decline, concussion.

The number one question is, can my brain even heal? Is there hope? You know. So I definitely you know, I'm glad you mentioned that because through the miracle of neurologist visiting that I've witnessed time and time again for over 15 years, in practice, the brain can heal, you know, and in the past, I think a lot of people, including doctors, used to think that the brain was like this mystery black box.

So we didn't understand anything about the brain. But in fact, just like, you know, we know a lot about the brain when it's healthy and we know the different factors that influence it towards sickness and disease.

So with that understanding, there is a lot of hope. And yeah, so that being said, one of the biggest things that I have discovered in my research and actually in my journey to heal my brain, one of the biggest things when it comes to brain health is what we call the blood brain barrier, aka when when there's a breakdown in that leaky brain, then this is a concept that, I think it's maybe oversimplified when we talk about leaky brain.

You know, the brain's not a faucet where you, you have the things turned on. All of a sudden it leaks. It's a lot more complex than that. And one of the things to really understand is that when we talk about this concept of leaky brain is that we may make it sound kind of scary in the next couple minutes, but that means there's always something to do about it.

So make sure you stay tuned to the end of this to understand what we can actually do about leaky brain.

What the Blood-Brain Barrier Does

But in your definition of what exactly is leaky brain, why should we even care? And what is it? What is the blood brain barrier even matter in the first place?

Yeah, those are all great questions, and I'll unpack it one by one. So first things first is leaky brain. What it is, is our brains and bodies. We have these different barriers.

And I would imagine some people are, if not many watching this right now have heard of the gut barrier, right. That protects our gut and our body from the external environment, believe it or not.

Well, in addition to the gut fear, we have all these other barriers like the lung barrier. We have skin barrier. And for our conversation, the most important barrier is what we call the blood brain barrier.

And what the blood brain barrier is. It's a single cell layer that protects our brain from our actual internal world. What do I mean by that? Within our bodies, within our blood vessels and coursing through our veins and arteries, we have a bunch of substances.

Some things good, some things bad. The good things are things like oxygen and nutrients and the bad things are things like toxins or viruses, pathogens, bacteria, even our own immune molecules.

Those things can be negative and have a negative impact on the brain and nervous system. So what the blood brain barrier does, it protects our brain, our most precious and sacred organ, from those forces.

So that's when it's working. So the blood brain barrier is, simply put, it's a barrier that protects our brain from our internal environment, from some damaging forces.

That's when it's working. Right. And so the thing is, like I said, the blood brain barrier is actually really fragile, though, because it's made up of a very, thin cell layer, what we call endothelial cells.

There's also other cells we call astrocytes parasites and a basement membrane. In addition to that, there's what we call tight junctions. So again, without getting too technical, you think about the blood brain barrier.

It's like a wall protecting our brain from these external internal forces. And the thing because it is so thin, it's susceptible to damage. Right. And what happens is if you have a breakdown of the blood brain barrier, a.k.a.

leaky brain, all heck can break loose because like I mentioned, the brain is our most precious and sacred organ, and there's certain substances that should just be found within our nervous system.

And if those things get through and there's a breach of that barrier aka you have a leaky brain. Substances like toxins and pathogens, viruses, bacterias, even undigested food particles, believe it or not, can enter our nervous system, right?

As well as our brain, and trigger a massive inflammatory response that can be varied, destructive for our brain and nervous system, leading to many, many different types of brain symptoms.

Things like brain fog, things like what we call neuro fatigue, where your brain just feels really tired easily when you stress it cognitively. As an example, and in addition to that, with, breach of the blood brain barrier aka leaky brain, it's actually been shown to be one of the biggest underlying like root causes for serious neurological diseases.

When people have a leaky brain that's not healed or fixed, you can actually that becomes the gateway for things like Alzheimer's, dementia, Parkinson's, Ms.

the list goes on and on. And chronic traumatic encephalopathy, which is the end stage of an untreated concussion. But again, a lot of what the research points to is because there is actually a leaky brain.

And so I've found that that's one of the most important things that needs to be addressed when we're not only trying to prevent serious neurological diseases, but also to address any symptoms already surfacing for a person.

Well, that's amazing. And and this concept is actually what provides hope, for doctors like us.

Causes and Symptoms of Leaky Brain

Because this means that there's a lot of things that are controllable within the environment for the brain healing rather than just sort of this mystical black box.

Right. And so even though it sounds a bit scary, there's a lot of things that that we can do. Now, here's, here's something that's very interesting. So on another part of the forum, we have a biological Dennis that actually came on, actually spoke about like the leaky brain concept, actually a lot of it can start in like the oral microbiome or in the sinuses and stuff like that in dental collections.

And there's specific organisms that's related to cognitive decline and brain health issues from the oral cavity. And so, can you kind of speak to how that kind of represents the leaky brain model? Absolutely.

Yeah. I'm glad you brought that up, because in my research, what I have identified is not only in my clinical experience, but also in the research itself.

There is multiple root causes or causes for a leaky brain. Right. And what you're discussing here, I haven't seen that particular episode yet, but we're talking about inflammatory or infectious conditions can actually harm the blood brain barrier.

There's actually a substance we call lipopolysaccharide, which is an endotoxin released by certain types of bacteria that's been shown to be damaging to the blood brain barrier.

But in addition to that, in part of my history, things like physical trauma, like concussion, right. Everyone's talking about concussion these days and rightfully so.

Right. Because those things are serious. So physical trauma can cause a leaky brain. You can have inflammatory or infectious processes. Toxins can lead to leaky brain, but also poor sleep.

So the list goes on and on. Right? In addition to that, even mental emotional stress has been shown to cause or contribute to a leaky brain. It's by way of activation of those specific mechanisms, but activation of what we call mast cells, and the release of substances that can actually cause damage to your blood brain barrier as a consequence of stress.

So, yeah, the list goes on. And that's why, you know, but actually, one other thing I want to mention before we move on, even the normal aging process can increase your risk for leaky brain.

That's why I found it's so important to number one, identify if you even have a leaky brain. And then number two, do whatever you can to help either heal it or strengthen and fortify it.

As we continue to get older, right. As is what typically happens right now, this is this is something that it's you can't really just come to your doctor, say, I want to get tested for leaky brain.

So how would one know whether or not they have they have this leaky brain phenomenon. Yeah. Great question. And in my practice, what I've actually designed, I've designed different ways, low tech ways, as well as more high tech ways of identifying the different.

And one of the lowest tech ways I do it is through self-assessment quizzes like. So I have a quiz actually, that you can take to identify your risk factor for leaky brain.

Do you have a low, medium, or high risk in addition to that? The good news is, I mean in the sense that we can this can help us identify if leaky brain is an issue.

There are certain clues that, like different symptoms that point to a potential leaky brain, and a lot of it really boils down to what we call brain inflammation or inflammation.

Because when you have a leaky brain, what ends up happening develops this vicious cycle where if you have a leakiness of your brain, then things normally that shouldn't get in could get in and cause what we call brain inflammation or neuroinflammation.

But then from there, the brain inflammation could continue to damage the blood brain barrier. So certain clues that you might have a leaky brain, things like brain fog or brain fatigue or you have memory slips, maybe even anxiety.

Many patients I work with have what we call post-concussion syndrome, where they had a head injury months or years ago, but they still continue to have symptoms that could be a clue that they actually have a leaky brain.

Another thing I find that's a clue that someone might have a leaky brain is if they have some type of brain symptom that they're struggling with, whether it's those things I just described, like brain fog or brain fatigue or memories, memory slips or anxiety.

Right? Or headaches even. But they they find themselves kind of on this up and down roller coaster, meaning they might feel kind of good one day, and then maybe they don't sleep well, or they eat some food that they have a sensitivity to and boom, immediately they have this symptom flare up.

How to Identify Leaky Brain

That's a big clue that either they do have a leaky brain, or their blood brain barrier already is pretty fragile and under a lot of stress. So those are some clues.

But in addition to that, there actually are new technologies available where you can objectively test for leaky brain. So there's different simple blood tests that you can do to identify different types of proteins that normally are found.

Remember I mentioned really briefly a second ago or a few minutes ago? Astrocytes. Astrocytes are part of our nervous system. We call they're part of our brain cells.

We call glial cells. Really important for detoxification and communication within your nervous system. Now, astrocytes are part of the cells that make up your blood brain barrier.

Found within the astrocytes is different types of proteins that should just be in the astrocytes. But research has shown that with things like, concussion or trauma or even stress or toxins, you can have damage to the astrocytes by releasing its contents into the blood.

And from there, we can actually capture that in a simple blood test. So yeah. And there's just awful and used to be all kinds of breakthroughs that we can use to identify leaky brain.

But as a clinician, being in practice for so many years already and actually struggling with brain health challenges in the past myself, there is a lot that we can uncover and identify through self-assessment quizzes or just having a conversation with our patients right?

Just as you know, but in addition to on top of that, the great news is there's some simple technologies, a simple blood test, that you can do to identify your risk factor for leaky brain as well.

Well that's amazing. So let's let's mention mentioned your journey for a second. How did you even get into like functional neurology? This is not it's very hard to find a neurologist.

How do you even get in this in the first place? Yeah. Great question. So part of my journey actually began over 20 years ago when I was in a really bad car accident that nearly took my life.

I was hit by a car, and I was actually on a scooter, and I was hit by a car on my scooter, and I flew off of it. Thank God I survived, but I ended up with broken ribs, dislocated shoulder, chronic pain, and a concussion.

And I tried everything I could. I searched within conventional medicine to try to find answers like, you know, everything that I knew to be medicine or health care.

And I was shocked that there weren't any. So I actually decided to go outside the box. I went back to school. I had a post-doc in clinical neurology. I got a master's in nutrition.

I studied acupuncture, functional medicine, chiropractic, anything that I could get my hands on to figure this out. And I'm so glad that I did, because along the way, I tinkered with my own brain.

I experimented with a lot of the things that I found in the cutting edge research that's out there, but I had to piece it together myself. And when I did, when I applied those things to my own life, I was finally able to heal from my concussion.

But the thing is, you know, one of the biggest discoveries I made along the way was leaky brain. Right? I discovered that a big part of the reason why wasn't healing and why I had that fallout.

My life literally fell apart, like I hit rock bottom. And I realized this because I had an untreated, leaky brain. And so when I discovered that it was it was shocking to me, though, because I realized that most people don't know about leaky brain, including many well-educated doctors.

And so shocked. So I actually made it a mission to educate the world about leaky brain and how its impacts on our brain health are just significant and tremendous, as well as the correlation between a leaky brain and the developed ment of serious neurological diseases.

So yeah, that's how I got into this. I went through it myself and I luckily, you know, thank God I was able to heal my own brain. And now, you know, I feel like I cracked the code in some ways, you know, and I've been blessed to be able to share that with many, many people throughout the years. Yes.

And even on this interview as well. So once again, I want to appreciate it from then on. But what a powerful story. You know, my, my journey actually started with concussions much earlier on and ended up with a really terrible one with a lot of retrograde amnesia myself.

And so, there's definitely some synergies in our parts. And one of the things that I understood about the brain actually came from my mother. She's an acupuncturist and Chinese medicine doctor.

Doctor's Personal Recovery Journey

And so a lot of the way that she was treating like post is a consequence of that post-concussion syndrome. It was to improve like the energy slow the lymphatic drainage from the brain.

So that's a hallmark of like Chinese medicine. Open the meridians allow detoxification to occur, which when I went through medical school I thought I was just done with bunch of you has to be honest with you, right?

But then I quickly learned that is like what's creating a lot of success right now. So we talked about, you know, leaky brain Instagrams of things coming in like invaders or toxins and stuff like that.

But there's some normal physiologic things that can also create this leaky brain phenomenon. And one thing I kind of want you to touch on is blood flow.

So a lot of people have a lack of blood flow to that particular barrier. 1 in 4 humans have some sort of upper airway resistance or sleep apnea, gigaton of touch.

And how that really affects the leaky brain barrier as well. Huge. Yeah, that's such a great question. And, you know, it's not all these serious diseases or traumas that can create a leaky brain.

What's actually fascinating before I dive into that, you're those astrocytes I talked about earlier, but your brain and body have a wisdom. Those astrocytes can actually change the tightness of the barrier itself.

So in some situations, the astrocytes can actually cause an opening of the blood brain barrier. So yeah, it's really just wild stuff. I mean, this yeah, I'm I'm super passionate about researching it.

But yeah, you make a great point. So in certain situations for example, exercise can actually create a little bit of leakiness of the brain like what we call blood brain barrier permeability.

So things such as exercise. Right. So it's not like the the wall is just always shut tight. Right. And it's not in the brain. And it's wisdom does actually do that.

But the thing is again, it's like if it stays open, that's where it becomes a problem. And so you mentioned one very common cause I see clinically is chronic hypoxia, where you're not getting it's not like you're not giving any oxygen to the brain.

As most of us know out there that oxygen is crucial for brain health and survival. Like after, what, four minutes of without oxygen, you can end up with permanent brain damage.

So point is, oxygen is that important? Luckily, most of us don't have what we call anoxia where you don't have any oxygen. But there are many people out there who actually have what we call hypoxia, where they have suboptimal levels of oxygen.

And one thing I see in my practice very often, actually, in addition to things like you kind of mentioned, like upper respiratory, blocks or, you know, issues with lung function is actually in balance of the autonomic nervous system.

The fight or flight response. Right. So what we have is the autonomic nervous system. We have a sympathetic and we have a parasympathetic branch. And one of the things that the autonomic nervous system does is it controls blood flow.

So one common thing I see in my practice actually, I have to say like 99% of the patients when they fly in to see me and I do these tests, they have a half of their body is stuck in the fight or flight response.

What do I mean? Yeah, like the autonomic nervous system. It controls things like blood flow. It controls things like pupil or dilation or constriction, like the size of your pupils.

It controls your blood pressure. It controls, your, you know, pulse. And many times in my practice, and if I'm working with a patient, maybe they have a chronic brain symptom like brain fog or anxiety.

Maybe they've had a concussion. When I do an examination, I can't tell you, like 95, 99% of the time, I find that one side of their body has less blood flow than the other.

And I have this little device we call a pulse oximeter. We can actually measure the oxygen saturation, how much oxygen is flowing on one side versus the other.

Most doctors that even measure this, they just measure one side because they're just looking for overall oxygenation or their pulse. But what I found is when you measure both sides, not only are we looking for absolute oxygenation, but many times I find consistently one side has less oxygen than the other.

And so for some of you out there watching who don't have that technology, you can actually sometimes seat yourself. Like many times I see my patients, one side of their body is colder than the other, right?

Yeah. Right side might be colder than the left.

Blood Flow, Oxygen, and Stress Effects

And many times if you actually measure blood pressure on that right side, it'll be higher here without getting too caught up in the details. One common thing that I see causing hypoxia or, you know, suboptimal oxygen and then triggering leaky brain is not enough blood flow when a person is stuck in a stress response.

But again, the good news is there's things we can do to help modulate that. By activating what we call the vagus nerve. But yeah, that's a topic for another day.

Yeah. Amazing. So, and part of this is, you know, getting proper sleep too. So a lot of people with chronic pain issues tend to not have enough time at night time to regenerate, their brain because they don't necessarily go into deep sleep as much as other people.

Those people sleep apnea who are untreated. Same thing and within low oxygen states as well. But let's help on something a little bit different that most people think is benign, which is chronic allergies.

Let's talk about how chronic allergies and how does that correlate to brain function, the leaky brain as well. Yeah. Great question. And there's so many ways we can explore this.

But one of the big things is when we talk about allergies, it's a state. There's some type of inflammation happening in the body which could then impact the brain.

And like I said earlier, when it comes to the blood brain barrier, one thing that can cause a leaky brain is when you have a release of an activation of what we call mast cells, they're part of your immune system.

But when you mast cells release their contents, things like histamine that in and of itself can cause a leaky brain. And so when we talk about allergies, there's different types of allergies like environmental allergies, food allergies.

But the point is, if you have allergies, we know, I mean, even without doing any like fancy tests or even not knowing your specific situation, we can conclude that there's some level of inflammation and probably histamine release coursing through your blood vessels again in your blood, and then that can impact the leaky brain as well, you know?

But again, that's the thing when whenever I look at leaky brain, there's a lot of different things that we can do about it. One of the big ones is decreasing inflammation.

So that might be, for some people addressing the root cause for their allergies. Right. And so the key to this is it really needs to be personalized for each individual person.

Absolutely. Yes. Definitely personalized for each individual. But also, have people not ignore the warning signs as well because even if people do take antihistamines, will that causes worsening brain fog.

It's a big risk factor because you're just not addressing the root cause. What's going on? If you have allergies to dairy, for example, and you take antihistamines to ward off the symptoms, then you can try to consume it.

That doesn't prevent any of the brain fog or anything like that in the mast cell responses. So those are really important things to understand. And I think that, you know, as people are kind of listening to this and taking check of their body, it's really important to have a really guided way of looking and quantifying.

Can you tell us the website that we can actually get, the tests from, the questionnaire from that you're talking

about? Yeah, absolutely. So, yeah, just like you said, the first step is to really identify what it is, what's going on with you.

And if you even have a leaky brain. So I put together a free quiz that you can take to assess your risk for leaky brain. It's simple leaky brain quiz.com.

So if you go to that website leaky Brain quiz.com, there's a simple questionnaire. You fill out a few questions, answer a few questions, and that will give you at least a baseline assessment of your risk for leaky brain.

What are the most common ways you think that we can actually fix a leaky brain, or is it even fixable to begin with? Yeah. And that's you know, I'm glad you asked that because I think that's very in our conversation, people watching might be like, oh my goodness, do I have a leaky brain?

Yeah, it could sound very scary. The interesting thing is though, like I mentioned earlier, even when you exercise a lot, you can actually cause a little bit of a leakiness of your brain, but that's part of the normal processes of daily life, right?

And the great news is many times that leakiness that permeability that can start to close all by itself. But the problem is when it gets stuck in the open position, like I said, leading to all the different things that we mentioned.

So the good news is there's some simple, natural things that you can do to actually heal a leaky brain. And so I'll be sharing with you my top three. So the first one, number one is actually exercise.

So there's research shows that exercise helps actually heal a leaky brain.

Allergies, Inflammation, and Root Causes

And it doesn't have to be anything like extraordinary just different things that increase blood flow and oxygenation to your brain. So but the key with exercise is obviously not overdo it.

Because just like I said, if you overdo exercise, you can actually cause a leaky brain. But the good news is, if you're pretty healthy overall, those things can start to heal on its own.

But if you're finding that anything that we're talking about on this conversation here you resonate with, then one thing you can do if you do have a leaky brain is exercise.

And the second thing that I found to be really effective and natural way of healing leaky brain is by increasing your intake of what we call polyphenol.

So polyphenols are, so polyphenols are plant compounds found all throughout nature. And they're found in a lot of different fruits and vegetables, especially the ones that have the bright colors.

So things such as, curcumin found in turmeric, the, the curry spice. In addition to that, there's a polyphenol we called taro still being found in high levels in blueberries.

Many people have probably heard of resveratrol, one of my favorite polyphenols that found in red wine as well as red grapes. And we also have EGCg found in green tea.

All those plant compounds have been shown in to research to not only help heal a leaky brain, but if you don't have a leaky brain and you don't want to develop one in the future to actually fortify and protect your blood brain barrier from different stressors.

So that's my second tip in terms of healing or strengthening, blood brain barrier or leaky brain is increasing your intake of polyphenols. And finally, number three, and this kind of refers to what you had spoken about earlier, like, when we talk about sleep and the blood brain barrier.

But the third thing is actually not related to sleep. Sleep is important for the blood brain barrier, but it's actually cleaning up your diet. Many different food particles, food compounds, and food proteins.

People have what we call food sensitivities, too. It's not the classical allergy which you call an immediate response, like the IGA reaction, but many people have undiagnosed food sensitivities.

It's what we call IgG or IGA reaction. So it's a delayed response. So to kind of contrast that, you know we hear about kids eating peanuts and then their, you know, their face swells up and they go to got to go to the E. R..

Those are classical food allergies. But this is different. What I'm talking about is when people eat some food, they don't have an immediate reaction.

It's not like boom, they immediately feel terrible. They have hives or they they have like some type of anaphylactic shock. It's where they eat a food that they're sensitive to.

And there's it can take up to 72 hours for this immune inflammatory response to happen. And therein lies the kind of danger and food sensitivities. Although most of them don't cause life threatening medical crises, these food sensitivities, especially if they go undiagnosed, can lead to chronic states of inflammation and also damage your blood brain barrier.

So the third simple, the third tip, the natural way to help heal your leaky brain is to avoid foods that can actually damage or damage your leaky brain.

So things the most common ones I see is gluten. Number one, found in substances like wheat and pasta and bread. And then the second one is actually dairy.

Natural Ways to Heal and Protect the Brain

So things found any, you know, milk products, cheese or butter. But in addition to that, you know what I've discovered in my research. And this goes back to what I was saying about sleep.

The reason why sleep is so important for our brain health, and the reason why sleep is so important for our, particularly our blood brain barrier, is because when we fall asleep at night, our brain triggers what we call the lymphatic system, which is our brains waste disposal.

So when you sleep at night, you know throughout the course of your day you're building up toxic plaques in your brain and all types of toxins just through the course of our normal day.

But the good news is, when you go to bed at night and you have deep, refreshing sleep, you activate the lymphatic system, which helps to clear out the toxins from your brain.

But get this what we found is one of the ways that the the toxins get cleared out from your brain is by way of these water channels found within your blood brain barrier, meaning there's these little water channels.

They help flush the toilet of your brain. The fancy term for them is aqua porn, for that's a very common water channel. What I've discovered in my research that are certain foods that if you have a sensitivity to, not only can your immune system cause inflammation against that food, it can actually trigger inflammation in your blood brain barrier, particularly that water channel.

So that's why step number three, the most important tip, like natural tip to help heal your brain is to avoid foods that can trigger inflammation. Amazing.

Interestingly enough, I just read this yesterday is there's something called aquaporins for antibodies now that can be measured where your body like attacks that actual channel causing a lot worse leaky brain process.

And one of the most common reasons are cause of injuries. So that's that's a brand new thing that just came out. I was reading about nerding out on. And so I'm so glad you kind of mentioned it.

You know, we could sit and talk for hours, but, let's talk about, like, your book. What's the name of your book? Is a is it out? One has come out and then, how to give people access that.

Yeah. So I'm super excited about this because I said after learning about Leaky brain, I made it my mission to educate the world about this because I found it is one of the most important things we can do to not only heal our brains now, but also to prevent future neurological diseases like Alzheimer's and dementia in the future.

So my second book's coming out at the beginning of next year, early next year, and it's called The Leaky Brain Fix, and I walk the reader through my five step program to heal leaky brain naturally and decrease your risk for serious neurological diseases like Alzheimer's, dementia, and many of the other ones that we had talked about today.

So I'm super excited. And it's actually available for preorder on Amazon today.

Books, Resources, and Closing Remarks

And what's the name of your first book? My first book is Brain Save, where I go deep into the world of concussion and I have a six week plan to help people jump start their healing, even from the safety and comfort of their own home.

It's a great stepping stone starting point for people who are struggling with post-concussion syndrome. But yeah, I'm super excited about Leaky Brain Fix and it'll be coming out early next year.

But you can get it on Amazon preorder today. Excellent. And so, at the time of this recording, it's, December of 2022. So we're actually listening, after that, that's probably already available.

And so I want to thank you so much for coming on. Like I said, we could talk for hours and I could just keep throwing you stuff. But, but for everyone listening, like, go get choose a book.

This is incredibly important information. And this concept of leaky brain that we just discussed about is globally recognized at this point. And it's not something that's really out there or it's not something that's very fruitful.

This is actual recognized thing that's part of clinical research and lab and bench work research right now, animal trials and human trials is it's a big deal.

So once again, thank you for coming on. Absolutely. Thanks for having me.