Introduction to Nitric Oxide

Welcome to the conquering Chronic Inflammation Summit. I'm your host, Dr. David Jockers. And today we are going to dive into the world of nitric oxide.

Nitric oxide plays a critical role in circulation circulatory health. By opening up and dilating the endothelial lining. It helps with lymphatic function and helps with our ability to think sharply and quickly.

And to have a healthy brain as we age plays a very important role with our libido and our hormonal health and so much more. And when there's breakdown in nitric oxide production, we are going to end up with a wide range of symptoms.

We're going to go through that in this interview. And I've brought on a guest, the world leading expert in nitric oxide. This is Beth Shirley. She is a registered pharmacist and certified clinical nutritionist.

Since 2009, has worked in close collaboration with some of the world's leading thought leaders in the field of nitric oxide research, and she's currently the Executive Director of the Berkeley Life Scientific Advisory Board.

Berkeley Life creates a great, nitric oxide supporting product that you can check out as well. And so, without further ado, let's go into this interview with Beth.

Well, hey, Beth, great to connect with you here. And, really, you know, my my audience has been asking a lot of questions when it comes to nitric oxide.

It's, something that more and more research has been going into this nitric oxide pathway in the body. And let's let's really explore that in great detail.

Let's start by just kind of breaking down what nitric oxide is in the body. And it's it's important roles. Sure. Thanks for having me.

What Nitric Oxide Does in the Body

So nitric oxide is just a molecule of nitrogen and a molecule of oxygen. But this molecule touches every single physiological process. Every single one of them governs circulation and micro circulation, which allows all your nutrients, your glucose, oxygen to get to the cells.

And just as importantly, the the taking away of the debris. So important for learning memory, our kidneys that filter everything, our eyes, it gets all our hormones started.

I. Hypothalamus needs nitric oxide in order to make gonadotropin releasing hormone, which then goes on to make your FSA junior LH. It's important for our immune system, one of our first defenses against pathogens.

It's important for healthy lungs. It's important for sex with which most people kind of kind of, you know, know about that part of nitric oxide. Yeah, I would say that's probably the most well known is its impact, particularly on erectile function.

And that's because, you know, there's a part of it that has it plays a role in improving the endothelial lining, the blood vessels. So you have that better circulation.

But most people don't know things like immune function and its role as kind of a messenger to help stimulate production of certain hormones. Right, right.

Neurotransmitters. It's it touches every everything. So you've got to have healthy circulation, micro circulation. All the exchange takes place down on that micro capillary level.

So that's got to be open and functioning in order for these cells to be fed. Cells can't be more than two cells away from a micro functioning micro capillary.

And if they they are then they're not going to be fed their nutrients. And so that's that's one of the things now that's such so critical in today's post viral post jab world because the spike protein is actually depleting the nitric oxide even more.

And nitric oxide governs platelet activation and aggregation, clotting. So you're depleting this nitric oxide even more. And so you're increasing this little micro clot.

Yeah. So therefore you're not creating good balance in the blood volume creating more viscous thicker blood because you've got more platelet aggregation going on.

Right. Yeah. And in those little micro capillaries, they're only big enough for like one red blood cell to get through at a time. So if they're clotting up they're not getting through.

And you've got this little, you know, clot set up. Yeah yeah yeah for sure. And so let's talk about some of the nitric oxide synthase enzymes. Right. There's three main enzymes.

Can you kind of break those down in the roles of each of those. Sure there's not one is neuronal loss. And this plays a big role in the central nervous system.

So then there's no loss to illness inducible loss. This Noss gets upregulated by inflammatory reactions infections. And then there's Inos nice three. And that's really all nice.

And this nice lines. All of those blood vessels. So the the nice and the Inos these nice. They they produce the nitric oxide in spurts. Unlike the anus.

That kind of gets upregulated under inflammatory conditions. And that just can produce, you know, large quantities of nitric oxide. However, to be able to make this nitric oxide, these nos enzymes have to be coupled.

So nos enzyme is a dimer. And it's held together by th4 tetrahedra byopteron.

Nitric Oxide Synthase and Uncoupling

So under oxidative stress or inflammatory conditions a lot of times that Bh4 is oxidized to be H2. So the nos becomes uncoupled. So when nos is uncoupled it's a superoxide producer not a nitric oxide producer.

So in some of these instances where they say that, you know, the Nos is being stimulated well, is it coupled and is it really producing nitric oxide or is it producing more superoxide and making more oxidative stress and causing more inflammation like that one.

Because superoxide is one of the most powerful free radicals that we produce, it creates a lot of destruction in the body. And so if it's uncoupled, it's the, the, I guess the inducible nitric oxide is uncoupled, then it's going to ramp up the amount of superoxide production.

The overall amount of oxidative stress at the body is encountering right. All of the nos if it becomes uncoupled. At any one of them. Yeah. So superoxide generator right.

Which then causes inflammation. Right. Right. And so you said that first one is the neuronal knots. Right. Plays a role with the nervous system. And you've got the inducible.

And he said that goes up when there's chronic stress infection, or other things, maybe toxins that are helping to drive up inflammation. Is that correct? Right.

Yeah. And then the third one is the endothelial knots, which plays a role. That's the one that we think of when we think of dilating the blood vessels.

And it also plays a role in lymphatic function as well. Correct. I right lines all those lymphatic tissue. So when you're nitric oxide deficient your lips not moving either.

Yeah. Most people don't don't remember that part to yeah. Yeah yeah. So there's a lot of toxins. And if you're nitric oxide deficient not only are you not clearing them, you know through your kidneys, through your your blood, you're not clearing them through your lance either.

Yeah. That's so important to know because lymphatic function is is critical when it comes to overall health. And so for a lot of people, when they're under stress, you're talking about how that will drive up that inducible, nos expression.

Can you can you kind of go through that pathway again? Well, actually stress uncouples the nos enzyme. okay. Okay. So it's an uncoupling. Yeah. Yeah. So stress increase is oxidative stress.

So it's uncoupling that that nos enzyme. So that's why when we're stressed we get sick easier because that I'm not is uncoupled. And making your nitric oxide to attack the pathogens.

When we're stressed we have more cardiovascular complications, more high blood pressure, more strokes, more emissions. Because it's uncoupling that in us.

Okay. And is that the same thing that infections and toxins are doing. Are they uncoupling it as well. Yes they are, they are. And so a lot of like a lot of times when you, you read all these studies and they talk about how, all of these toxins and the, these infections that are in there are stimulating nice and particular I offs.

And they talk about a molecule that's called peroxide nitrite. Right. So proxy nitrite is a molecule of nitric oxide. And superoxide. However. And then they they blame all this tissue damage on this peroxide nitrate molecule.

However, you know, they can't even measure peroxide nitrite. They they are measuring a molecule called nitro tyrosine. And they are just assuming that peroxide nitrate was there.

But there's other molecules that can nitrous cetirizine. So the nitric oxide scavenges the superoxide. There's only a free free radicals can scavenge another free radical.

However Craxi nitride is o n o o. Nitrate is in O three. So in fact there's studies showing that 90 to 95% of the nitrogen right. I summarizes to, you know, nitrate, which is inert.

Symptoms, Causes, and Testing

So there's other it's I think it's from the increased oxidative stress and the inflammation that's causing these issues, not necessarily from the increase of nitric oxide.

Yeah. So that's important to know because basically the the inflammatory process is going to uncouple the nitric oxide, which is then going to cause more oxidative stress to build up in the system to like a vicious cycle.

Yeah. Yes. Yeah. Yeah. And what are some signs that like what are some, some signs and symptoms that somebody may have that could clue them in that they are not coupling their nitrate and producing nitric oxide at adequate levels.

Any kind of, any kind of chronic issue. Your notes will be in coupled age by the time you're 40. That nose is only

functioning about 50%. By the time we're 60, it's only functioning about 15%.

lack of exercise, EMF. And we're swimming in the sea of the mouth increases oxidative stress. Uncouple that nice medications, antibiotics as all antifungals that are used a lot for for mold issues.

And like the SSRI and antidepressants birth control pills. So that's why they don't like women over the age of 35. You know, taking the birth control pills, and especially if you're a smoker.

NSAIDs, your ibuprofen, naproxen and PPIs, epis interfere with the production of nitric oxide through both pathways, through that nice enzyme and the nitrate to nitrate to nitric oxide path.

Stress big one stress. couples that nice enzyme genetic snips. You know, you might have some nice snips. Any snips in in like the oxidative stress pathway.

If you've got any more snaps, you are by definition nitric oxide deficient. And that's about 40% of us, because when you get some more far snips, you're not able to, to make that buffer adequately.

And remember that buffer is what couples at nice. So that's why supporting the nitrate and I try to nitric oxide pathway is so critical. Because not only are you increasing nitric oxide through that pathway, the nitrate help.

They increase the production of an enzyme that makes sure before. So you're helping to re coupled that nice. let's talk about that pathway nitrates or something we get from our diet something that we can consume in different foods.

Can you break down that that pathway in the different foods, for example, that are high in nitrates. Where we consume the nitrates that get absorbed, they circulate around, they get concentrated in the salivary glands.

Salivary glands release the nitrate. We've got good bacteria, on the back of our tongue in the crypts that can reduce that nitrate to nitrite. We swallow the nitrite in the acidic environment of the stomach.

Some of that nitrate gets reduced further to nitric oxide. Here's your protection against E coli H pylori. But most of the nitrite gets absorbed in acts like a nitric oxide donor molecule.

So different tissue can take that nitrite and make nitric oxide on a as needed basis. Like when you're exercising those myoglobin in the muscles can reduce.

And I try to nitric oxide to increase that circulation. There. The electron transport chain and reduce nitrite to nitric oxide on a as needed basis, like under hypoxic conditions to help open up those little micro capillaries in order to allow oxygen to get to the cells.

So what are the main foods that we're consuming with nitrates? arugula as a high nitrate without any oxalate issues. Right. Low oxalate. Yep. Right. But spinach does, celery beets.

Factoid butter lettuce. A lot of those dark green leafy vegetables are high in nitrates. But arugula is kind of the magic one because you don't have to worry about any any oxalate issues.

There, because a lot of people that do have some chronic issues, they're not clearing those oxalates easily. Yeah, it makes a lot of sense. And so when we're looking at it, we're eating foods like that.

And then our bacteria on our tongue, are helping break down the nitrate to nitrate compound. And then the nitrate goes into our stomach. We gotta have good stomach acid.

And that acidity helps with the conversion into nitric oxide. Right. So that that's why those PBS, the PPIs interfere with that. Nitrate to nitrate to nitric oxide pathway.

Yeah, those are proton pump inhibitors. And they block your ability to produce stomach acid. but they also increase the production of a molecule called a DMA, asymmetric dimethyl arginine, which inhibits that nice enzyme.

So those, those drugs, those are one of the first things that get people off of when they were first put on the market. They like insurance only paid for like a six week supply.

And now they've been on the market for a couple of decades. They're over the counter. People have been taking them for years and years, causing all kinds of issues.

Yeah. And let's talk about like people take, for example, a lot of people use mouthwash and different things like that. How does that impact the bacteria in our mouth that are helping us with this nitrate to nitrate conversion?

So anything that interferes with your microbiome, any antiseptic mouthwash, some fluoride toothpaste, fluoride is antibacterial. If you're using some whitening toothpaste, the hydrogen peroxide.

Antibacterial. So anything that's interfering with your microbiome can interfere with that reduction of nitrate to nitrite. So and if you've got dysbiosis of your gut, you know, all of our microbiomes are connected.

You know, if you've got dysbiosis of the gut, you know, there might be some dysbiosis of your oral microbiome. However, the beautiful thing about nitrate supplementation is with continued nitrate supplementation, you are rebuilding your microbiome, the gut, the mouth, the skin, the brain, the urinary tract, everywhere there's a microbiome.

Nitrate helps build up that. Yeah, it's good to know. So we obviously we want to be eating those foods. And then let's talk about there's different ways of boosting nitric oxide.

maybe from a supplement perspective there's a lot of nitric oxide products out there that have the amino acid L-arginine in them. And then of course, there's other products.

Dietary Nitrates and the Mouth-Stomach Pathway

like I know Berkeley Life has, I know, I know, I have a particular product that has nitrates, potassium nitrate in it. and so it's kind of like the direct nitrate form.

What's the different pathways there for forming nitric oxide through the L-arginine pathway and then also through the nitrate pathway. When you're giving arginine or citrulline, which makes arginine out of and you've got somebody with a chronic issue and they've got uncoupled not there's no way you can make more nitric oxide.

But most of the studies using arginine showing an increase of nitric oxide, were done on young male fit athletes whose noses coupled and c arginine has multiple pathways that can go down.

It's not just your nose enzyme. So if it can't go to that not enzyme because it's uncoupled, then you're going to be increasing your ad for that molecule, asymmetric dimer arginine that's connected to all cause mortality.

You can be increasing your ammonia. You can be increasing your urea. All of these things that we don't necessarily want to increase. So citrulline is a little better choice than arginine.

However, you're still trying to make a dysfunctional, uncoupled not enzyme work. You know, and it's just not going to, so supporting that nitrate to nitrate to nitric oxide pathway is the way to go.

And, and with your product to that's got a roguelite in it. Yeah. Not be. And it also has a little bit of activated folate. And that remember I talked about if you had any empty snips you're by definition nitric oxide deficient because you're not making your before.

So it's got a little bit of that activated for light to help you make you be H4 to help. Re couple that not decreasing

oxidative stress and inflammation.

Yeah that makes sense. And then it's also got vitamin C in there. What's the role of vitamin C. Vitamin C the ultimate antioxidant as well as vitamin C.

Make sure that none of those nitrates or nitrites are making nitrosamines. because all it takes is, you know, just a little bit of antioxidants and nitrosamines will not be formed.

Right. So that helps with the coupling process. Right? Correct. Is vitamin C actually is the only molecule that can take three back to before so before when it uses that electronic goes down to be H3 and then oxidizes further to be H2.

But vitamin C is the only molecule that can take BH3 back to B4. Yeah super important there. And then also what is the role of magnesium and potassium in proper, nitric oxide function?

Well the potassium is from the potassium nitrate. Yeah. Yeah CM is really good for the heart. It's it's not too much magnesium our body's own relaxer.

So for stress tension high blood pressure headaches magnesium the miracle molecule to yeah. Play such an important role with all of that plays an important role with with proper endothelial function too.

Helps kind of relaxed the muscular component. So our body's own calcium channel blocker. yeah. Yeah. That's good. And so a lot of people out there again are taking the arginine.

They're, they're trying to take L-arginine to get the nitric oxide benefits. And what you were saying is, well, if you're under this sort of inflammation stress cycle of, uncoupling the night, the nitric oxide, or uncoupling the before, then you're not going to get any sort of benefit from taking that L-arginine.

And then there are a whole lot of other potential downstream negative effects that you might get from L-arginine. I know when I think about L-arginine, I think I know viruses, they they love L-arginine.

Exactly. And, this is why typically when somebody is on an antiviral diet, we try to reduce arginine in the diet, and increase lysine, because that helps to inhibit viral replication in the system.

And so for taking in more supplemental arginine maybe predisposing and hurting our immune system. Right. And having an arginine deficiency in our diets is is really rare.

Right. It's easy to get in the diet. The amount of arginine needed to bind to the Nash enzyme is really really low. and it's really rare for somebody to have an outright arginine deficiency.

Yeah. Super important to know. Yeah. Now what are the best ways to test. Like how could somebody test their nitric oxide levels. Are there any obviously other direct tests.

And are there indirect tests like even like markers like for example, things like homocysteine. Does that play a role? Does, erythrocyte sedimentation rate or the ESR?

Supplements, Arginine, and Supportive Nutrients

Does that play a role? And can that kind of give an indication banding on what those levels are of perhaps what's happening with this nitric oxide pathway?

Right. If you see a high homocysteine or a high CRP, you know, there's inflammation and oxidative stress. So you know, you're not making your nitric oxide because the mast will be in coupled.

If you're they we do have some some nitric oxide test strips. These are saliva test strips which are testing the nitrite

concentration of your saliva.

So this will show your body's ability to take that nitrate and and make it into nitrite. The immediate precursor to nitric oxide. So usually you can do you can eat your big a regular salad.

Or you know, take a couple capsules of a supplement and then about an hour later, hour and a half later, retest like test initially just to look to see where you are.

But an hour, an hour and a half later retest and you will be able to see your ability to start reducing that nitrate to nitrite. Yeah. So it's called a Gris reagent that's on the strip.

And this is the same kind of reagent they use in all the studies to look for, for nitrite. So that's a salivary test, right. Yeah. Where can people access that.

Probably on your website. Right. I don't believe we offer that off to, Oh. Maybe by the time we have this recording. Well, you have it. You will? Yeah. Take a look at that.

Well, Yeah, because it's great to have a simple home test that people can do, especially to look at a pre post. Now, you were talking about eating that big arugula salad.

So we want to make sure obviously that we're getting we're prioritizing these nitrates in the diet. So a lot of these good plant based foods but not getting too many oxalates.

You know that's why we mentioned the arugula as opposed to for example spinach or beet which would be higher in oxalates. And so not that you can't consume those at all, but try to limit your consumption and focus more on the arugula, which you said is number one source when it comes to getting the nitrates in the diet.

It's also what we use in the nitric oxide powder product as well. Isn't a regular based. Right. where we have the potassium nitrate, coming from that.

Correct. So we're getting so we're trying to get it from our diet. And then we want to make sure we're getting just electrolytes in general B vitamins. You had mentioned five methyl tetrahedra, folate which we have in the supplement which is basically the methylated form of folate.

And so again if somebody has for gene mutation then they want to get that pre methylated form. So you should be looking for that. You're taking supplements.

but also you know just in general trying to consume B vitamin rich foods which arugula happens to be one of those as well. Right. And a food that's rich in folate and active folate.

Yep. Yep. And so we want to make sure we're doing that getting the vitamin C. So somebody might use lemon juice for example on their big salad. Right. Are you a fan of that. Yes.

Yeah. And most most of the the foods actually have, you know, their own antioxidants. Right, right. So they help just naturally with helping support that nitrate to nature to nitrate.

And then the nitric oxide pathway. and so we're consuming healthy foods like that or taking a supplement. what other lifestyle strategies can we be doing to help support the, the, nitric oxide pathway?

don't put your phone up to your air. turn off the Wi-Fi at night. This EMF is decimating our nitric oxide production. So this EMF stimulates this enzyme called nADPh oxidase.

So this nADPh oxidase only job is to make superoxide. So, remember, when you're making that superoxide increase in the oxidative stress, that nice. So, you know, just whatever you can do to, to cut down on some of that EMF because it's everywhere.

Yeah. One great thing is to get a switch for your Wi-Fi and be able to turn that off at night, like times when you really don't need it, not using it throughout the day, switch it off and then throughout the day, like you mentioned, you know, if you're using it, keep it away from your body.

Right. And try like glyphosate, glyphosate, uncouple that nice. Yeah. Glyphosate is is the herbicide that's pretty much in everything Roundup Ready, herbicide.

And so it's really hard to avoid. But the more you can go organic with the food you're consuming, getting water filtration, obviously not having your landscaping people, spraying roundup, those would probably be the biggest suggestions there for reducing glyphosate exposure.

Right. And get your exercise. Yeah. Exercise increases like the function of not enzyme because is kind of a sheer like thing on your blood vessels. So when we stress our body in our body and our cells any more oxygen to produce more ATP.

because because, you know, this individual is doing all this exercise, then the body will that that natural, that natural conversion nitrate tonight to nitric oxide takes place in the myoglobin.

And like you were talking about and then throughout the blood vessels as well. Right. And it's it, it supports Enos activity to. Yeah. Right. The endothelial function of it. Right.

Because we need to make sure that we're dilating those blood vessels to be able to get more red blood cells, more oxygen carrying capacity, and deliver more oxygen to the cells so it sensor intelligent adaptation that way.

Lifestyle Factors That Improve Nitric Oxide

So nitric oxide is so critical for for cognition too. you know, you've got to have that circulation up there in your brain. Like, even though the brain is only about 2% of our body weight, it consumes about 20% of our total oxygen.

so that means, like, those cells have to be fed and the debris has to be carried away. So by optimizing your nitric oxide, most people can actually start to feel their brain work better.

Absolutely. Got to have that oxygen, in the brain. Brain at those all those neurons definitely need that. So some of the big takeaways that I'm getting from this interview here is, number one, is that any sort of chronic inflammatory process, chronic symptoms that you're experiencing, there's going to be some level of breakdown in the production of nitric oxide.

And when we are don't produce nitric oxide effectively because of this uncoupling effect. So that buffer compound needs to be coupled when it's uncoupled due to toxins, stress, inflammation, infections, all the different things that we're being exposed to that are trying are moving us in that, that, that pathway emfs like you had mentioned, then, we end up with this uncoupling process, which then we produce superoxide, which drives up overall oxidative stress, and it becomes a vicious cycle because then that increases uncoupling, and continues the process of uncoupling, which continues a process of oxidation in the body.

So we've got to start by obviously getting all of that under control, trying to reduce our exposure to toxicity, reduce our exposure to emfs. And then of course, we want to make sure that our diet is rich in nitrates.

So things like a ruler like you had mentioned, and not too high in oxalate. So that's why we don't want too much spinach, too much beets. but arugula as a phenomenal source to get this.

So we want to consume that. We may also supplement with a supplemental source of nitrates, coming from like, for example, potassium nitrate and, arugula powder and things like that.

we have a great one, nitric oxide powder that, we work with Utah to help formulate. And, so we're taking that in. And then, of course, you know, continuing to reduce our exposure to all the different stressors that are going to

uncouple, and we also want to make sure that we are avoiding mouthwash, PPIs, different types of medications, antibiotics, I'm sure.

And so, different things are going to damage our natural gut and oral microbiome. so that way we can get the natural conversion of nitrates turned to nitrates that should be taking place in our mouth and in our gut.

and also trying to optimize our stomach acid production for when we eat food. You know, so many people are eating on the go, right? And so, we're eating and we're stressed at the same time.

We're not going to produce the stomach acid we need for proper digestion and also for proper conversion there of the nitrates to nitric oxide. So we want to make sure we're doing all of those things.

And also obviously making sure that outside of meal times that we're getting some exercise in, so we get that intelligent adaptation to, drive up. Yep. Drive up more nitric oxide production and, and better blood flow.

Now, did I miss anything there. Yeah. Sleep's a big one too. Yeah we'll talk about that. Yeah. Nothing works right a sleep like obstructive sleep apnea is a hypoxic nitric oxide deficient state.

so your oxidative stress is through the roof and it's connected with diabetes cardiovascular disease. And there's something we didn't mention either like there's a a receptor called good for receptor on the cell.

Yeah. It needs to have nitric oxide attached to it in order to translocate to bring glucose into the cell. any kind of insulin resistance, any kind of diabetes.

You are nitric oxide deficient. And just by optimizing your nitric oxide, you're helping your body utilize that glucose better. Yeah. Super key super key to understand.

Now taking antioxidants in general like let's say somebody take in raise their trial quercetin. How does that impact the nitric oxide pathway. Do you know.

Well it helps down regulate some of that oxidative stress. Yeah. And when you down regulate the oxidative stress this helps keep that not coupled. Right. Yeah.

We seem supporting the nitrate to nitride to nitric oxide pathway actually down regulates the production of superoxide. The three main pathways that produce it.

So our electron transport chain your mitochondria makes superoxide. nitrate helps down regulate that. The nADPh oxidase enzyme, that enzyme that I told you gets upregulated with environmental factors and infections supporting the nitrate to nitrogen nitric oxide pathway down regulates that.

And the uncoupled not those three ways are is the way our body makes most of the superoxide. And oxidative stress and inflammation go hand in hand. And supporting the nitrate to nitrate and nitric oxide pathway down regulates all three of those.

Yeah. Yeah. Well really good stuff. And it just great job of breaking down this pathway helping people understand this more and more. And and there's a lot more information that's coming out on nitric oxide a lot more research coming out on it.

And it's really good at to be able to understand this at the root of oxidative stress and inflammation is this breakdown in nitric oxide production. And also really good to know that it's not actually nitric oxide causing problems in the body. You know there's research out there.

Some people would say, well what's the nitric oxide driving up proxy nitrate.

Sleep, Insulin Sensitivity, and Final Takeaways

And, you know, different, proxy nitrate and different, free radicals. But it's actually this the breakdown in this coupling process. Right? This is. So. Awesome. Right.

And so it's really the super oxide, like you were talking about there that's driving up the overall oxidative stress load in the system. So really good to understand.

I think you know my audience you're so they're really interested in understanding inflammation at a deeper level. And so I think this information is just so vital for them to, to have a better grasp of.

And so any, any last words of any anything we missed or any last words, inspiration for audience here. optimize your circulation and micro circulation.

It touches everything. Like your illness starts when it when your cells can't get their nutrients, it can't clean away their debris. So my my optimizing your nitric oxide will not be the only thing that you do to keep healthy.

But it will be the base. Yeah, it has to be the base. Because if that circulation micro circulation isn't functioning correctly, doesn't really matter what else you're taking or what else you're doing because it's not going to get to where it needs to go.

Yeah. So good. Absolutely. You know, they say every every cell really needs it needs activation. It needs oxygen and it needs nutrients. Right. And so you got to have that oxygen being delivered through the red blood cells as well as the nutrients being delivered through good, healthy blood flow in order to get the cells components that they need.

Otherwise they're not going to be able to function, they're going to atrophy, they're going to wither away, become senescent and, and, and malfunctioning.

and so. Yeah. And without a, yeah, without the circulation to carry away that cellular debris. Yeah. Then you know, you've got dysfunction there. Yeah for sure.

Well thanks again, Beth. Thanks for all the great work that you're doing out there. Getting this information out about nitric oxide. Really appreciate you guys.

You can also check out nitric oxide powder on Dr. Jocker's Store. It's a product that Beth helped formulate and, has all the different components that we talked about with the arugula powder with, vitamin C in there with the five, methyl tetrahedra, folate, for the active b, b, or active form a full eight, magnesium in there.

It's got, bio flavonoids in there which really help with, overall circulation. And so a lot of really good stuff, really the best compound out there for supporting overall.

nitric oxide levels. So check that out. And Beth, thanks again so much for your time. Everybody be blessed. Thank you.