The Miracle Molecule: How Nitric Oxide Keeps Your Heart Pumping Transcript

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Introduction and Dr. Bryan's Background

Good morning Dr brian, how are you sir? I'm great. Good to be with you. Thank you. Welcome to the reverse heart disease naturally summit something that we think will give good practical but very science based information and couldn't be more excited than talk to you know, an authentic scientist of great renown as you know, I get patients that will ask me, what does Dr brian say about what you're doing with my supplements and my program because I reached out to you a couple of weeks ago specifically for that reason and for those that don't know you uh I'll give them the 30 seconds born and raised. I just learned in bryan texas just like your last name. Nathan brian earned a PhD in Shreveport Louisiana after other schooling in texas probably, you know one of the major notes as you went to the lab of one of the Nobel prize Laureates.

We'll talk about in a minute, Ferid Murad who it's certainly a legend in biochemistry of keeping your heart healthy cardiovascular disease. What we're talking about for everybody listening and then you've really had a distinguished career, written many books, many papers but you're a businessman too, which is a good thing and you're an entrepreneur who started many companies because you're looking for solutions and let's talk about the problem uh and the molecule and let's talk about, you know, some of your prior solutions and your current solution.

So thanks again for joining us. I know your time is valuable. You're about to zoom off to another place to educate and heal the world. But tell us. I mean there could be somebody here that has never heard of a simple molecule, probably the most famous and most important molecule in the body nitric oxide. And oh and tell us a little bit, you know, maybe where you ran into that at Dr Murad's lab and just give us a it's on what it is and what it does. Sure. Well it's a relatively new discovery in the medical and scientific literature. It's only discovered about 40 years ago.

But I got interested in micro cock side when I was a student at L. S. U. School of Medicine working on my PhD and Nobel Prize has just been awarded for its discovery. So we knew it was an extremely important molecule in human physiology but at that time we didn't really know how the human body made it, what goes wrong and people that can't make it what are the clinical consequences and then how do you fix it? So it's really it's a signaling molecule, It's how cells in the body communicate with one another.

What Nitric Oxide Is and Why It Matters

It's most widely known as its role as a beso dilator, meaning that when it's produced in the lining of the blood vessel, opens up the blood vessel and improves oxygen and nutrient delivery. So as you know, as a cardiologist, if you don't get enough blood supply and oxygen to the heart or any organ for that matter.

And that organ doesn't do very well and develop end organ disease and people die from this. So now it's recognized that the loss of nitric oxide is the earliest event in the onset and progression of cardiovascular. So, as you said, it is the most important molecule produced because, you know, you can't deliver oxygen. You can't deliver oxygen and nutrients and blood supply to every organ tissue and cell in the body without nitrous oxide.

All right. So, I mean, just to break that down. N. O. Nitric oxide one nitrogen one oxygen, you probably know I don't know how to how are they bound together?

Well, it's a covalin. It's a covalin bond. It's a free radical. So it's it's an unstable molecule. So when it's produced in the body, it's gone in less than one second.

So it's like this burst of gas that then starts this whole signaling cascade. So it's and then, you know, it's gone. So, I think that's been the challenge in medicine over the past 30 or 40 years is how do you make a nitric oxide based therapy a solid dose of a gap. And that's kind of what how I cracked it.

What I'm known for my discoveries, we were the first in the world to make a solid dose of a nitric oxide. Get alright.

And just to break down a little more of what you said in that eloquent intro to signaling molecule major function is to relax arteries to improve blood flow everywhere.

And think of brain health. Think of cardiovascular health. Think of sexual health. Think of gastro intestinal health. Everybody listening to this would probably want to maintain their healthy production of nitric oxide throughout their life. And then you threw at us because a lot of the audience doesn't know this, that three labs around the world were racing to understand, discover and characterize what the signaling malika was that resulted in those three labs.

And those three lead scientists getting the Nobel prize in medicine 1998 25 years ago. And of course, you were lucky to get to work with one of those three recipients, 1998 I think it was 1990 to 1 of the premier journal in the world Science called this molecule, the miracle molecule. And I think that probably still is deserving.

So for people that you know, want to say, well, it sounds like we should have a lot of nitric oxide. I want that good blood flow. Tell us about how blood vessels make it cause you're gonna tell us that there's more than one way to produce. And no, that's right.

So just like what you're doing now, modern physical exercise stimulates the production of micro cox. So when we begin to exercise that causes shear stress in the lining of the blood vessels and that tells those blood vessels.

Hey, I need to make more nitric oxide because I need to widen that blood vessel to meet the increased metabolic demands on that particular skeletal muscle or the heart muscle.

And so that stimulates nitric oxide. Do an enzyme called micro oxide something and that's the enzyme that becomes dysfunctional with aging. So the older we get, the less nitric oxide we make through that enzyme and it's it's really complex Entomology and biochemistry, but it uncouple and then it becomes a super oxide or you know, an oxygen radical producing enzyme. So we figured out years ago how to re couple that nitric oxide synthesis enzyme so that now when you do exercise or you do nasal breathing, we can activate micro cock side production. But the other way is through diet, you know, it's the mechanism and the explanation for a plant based diet.

So we've discovered that inorganic nitrate that's found primarily in green leafy vegetables can be metabolized by the bacteria that live in and on our body and then they produce nitric oxide so that that pathway can compensate for loss of endothelial production of nitric oxide. And so when you lose the ability to generate micro oxide through both pathways. That's when you start to get clinical symptoms of an elevation in blood pressure to develop sexual dysfunction, mild cognitive disorders, which if not corrected, will develop into alzheimer's, it's involved in insulin signaling. You need micro cock side for insulin signaling.

So if you can't make micro cock see develop metabolic syndrome type two diabetes. So a number of clinical manifestation it occurred.

How the Body Produces Nitric Oxide

You can't make micro So again, just anybody taking notes, write down number one. Your arteries make nitric oxide, but you lose some of that production with age because an enzyme N.

O. S. Three starts to become less and less competent. And that's under genetic control two, we don't all have the exact same efficiency of our nitric oxide.

That's correct. That is correct. So there's two primarily what's called single nucleotide polymorphisms or genetic snips. One is in the nose enzyme. So there's a disruption in the coding of that protein that it's not functional. And the other is, you know, more common, which is the M th fr which is a metal Tetra hydro foley reductase enzyme. So that sniff, which I think the literature reveals probably 45 to 50% of the people in the US have maybe a single or double copy of that snip. And then that enzyme is responsible for making tetra hydro box, which is another important molecule or substrate for nitro.

So M th fr patients are typically nitric oxide. So before we shift to the second way we make nitric oxide diet of which you're an expert and which I encourage everybody to take a look at a book you've written in a moment you mentioned. I'm on a treadmill desk.

I'm getting rather light exercise because we're talking and I'm working uh certainly encourage everybody to do moderate to sometimes vigorous exercise.

But how do we protect our arterial production of nitric oxide is c separate from dietary nitrates will get to I mean, does eating the white rind of a watermelon to get more situation help? Does taking five g of l arginine powder?

Like I learned in cardiology fellowship because the Mayo clinic was doing it at the time for mary pays a spasm. I mean, at an archer level of course don't smoke, monitor your diet, but I mean healthy and afi liam healthy lining is one way to protect your nitric oxide production at the at the arterial level.

That's right. So we have to we have to promote conditions that that prevent oxidative stress, that oxidize those substrates and molecules that are required to make micro toxin. So our sertraline is a byproduct of micro oxide production and argentine is what's called a semi essential amino acid, meaning that we get it from the breakdown of proteins in our diet or and it's also produced through the urea cycle. So we're never limiting the amount of l arginine that our body has to make micro dockside.

So the problem is is that the body has just lost its ability to convert argentine to micro So supplementing with more argentine or situations never made sense to me biochemical because we already have enough in our body even in the sickest of patients to theoretically saturate the binding sites of the enzyme. And there is that one article that scares cardiologists and in people who've had a prior heart attack supplementing with l arginine may actually have a negative effect. So I've been cautious about that, particularly in that group of patients. Excellent.

So then you've just told us there's a so you know, the Nobel prize was awarded mainly for that L arginine and nitric oxide since these pathways at the end of filia level.

Right, that's correct. When did we learn that chewing leafy greens? And you'll tell us about that right now. And I will say dr brian has an excellent book that really supports the role of eating lots and lots of brightly colored green leafy vegetables and beats and other sources. And it's just a great read functional nitric oxide nutrition. So pick that up.

We have a bunch of copies in my office, patients love it. But tell us when did we learn about that pathway? Well, the science was clear even back in the early nineties, but kind of the pieces of the puzzle work put together until you know really around 2010 In 2012, not long ago at all. And so, you know, really in the 2012 Olympic Games is when it really became popular because it was recognized that a lot of these athletes were drinking a lot of beetroot juice to improve their performance. So at that time there were a number of clinical studies showing that the inorganic nitrate found in green leafy vegetables and some root vegetables to be metabolized in the nitric oxide through the bacteria.

So what happens is when we eat a plate of spinach or kale or any dark green vegetable, 90 minutes after we consume that particular vegetable, a single molecule called nitrate, which is N. 03 minus is taken up in the gut and concentrated in our celebrate link. So now for the next 8, 10 12 hours each time we salivate were secreted this nitrate and then the bacteria that live on the crypts of the tongue use this as a substrate for respiration.

So they then reduce the nitrate into nitrite and nitric oxide. So now every time we swallow our saliva for the next 8, 10, 12 hours we're getting a burst of nitric oxide in the aluminum of the stomach and then that nitric oxide actually acts as a hormone and then goes systemic and elicits a lot of physiological responses that can lower blood pressure that can improve exercise performance.

But the challenges and this is where people get into trouble when you disrupt the oral microbiome. For example, if you're using mouthwash, we and others have published that people use mouthwash, disrupt nitric oxide production.

Their blood pressure goes up and they lose lose the protective benefits of extra. So that's the first path with the first

step that gets disrupted and the other is people on an acid, you need stomach acid in order to convert that salivary nitrite into nitric oxide.

If you can't make stomach acid you can't make nitric oxide. And really the big problem where are these class of drugs called proton pump it? Because not only do they suppress the nitric oxide coming from our dietary pathway that they lead to an increase in a an inhibitor of nitric oxide called A.

Diet, Oral Health, and Nitric Oxide Pathways

D. M. A. Or asymmetric by mental at large. So P. P. I. Is completely shut down nitric oxide production through both pathways and can lead to a number of problems.

And you're probably familiar with this. And I think it was in 2015 or 2016. There was a large database that was mined by dr john Cook, another famous cardiologist.

And and revealed that people who have been on P. P. I. S. For 3 to 5 years had about a 35% higher incidence of heart attack and stroke. So this isn't a trivial problem.

You have to get people off mouthwash and you have to get people off of an acid specifically the PPS. And and so I mean you said so much of value. And again so we're gonna eat our leafy greens, we're gonna eat our beets, We're gonna chew them. We have an amazing system involving a parody gland to produce ultimately more miracle molecule nitric oxide.

But we can mess that up with uh antiseptic antibiotic mouthwashes that kill bacteria and the grooves are tongue. And we can mess it up by taking P. P. I. S. PriLOSEC and pant appraisal?

All uh NexIUM and the rest. What about you know a little different drug? ASF amantadine. Pepsi Pepsi A. C. Do you know if it has the same detrimental impact because it seems safer for the cardiovascular system and I try and get people out of P.

P. I. S. And if I have to that's where I have them land with a histamine. It's not as damaging because it doesn't lead to the increase in the A. D. M. A. Those seem to be specific to Cpr but it's still disrupts the nitric oxide production that's being produced to this Ontario celebrated circuit of swallowing a large you know we're supposed to have acid in our stomach to digest our food to produce more nitric oxide. It's involved in vitamin B.

12 absorption. So the problem is those drugs are labeled for six or eight weeks use and people are on PriLOSEC life And then you know I encourage them to talk to their medical team and ask is there an alternative?

So you've been producing ways, Well let me ask before we get to supplemental support of which you are probably the world expert. You know dr brian. This sounds amazing if I don't make enough nitric oxide.

My blood pressure might go up, my erectile function might go down my cardiovascular health and end ophelia may suffer. How do I know? Is there one or two different ways I can at home or at a doctor's office in the lab get a direct clue. I produce a lot of nitric oxide or not because there's no simple blood test called the nitric oxide level at quest or Labcorp or mayo or whatever. So tell us you of course know that there's a couple. What can a person do?

Well, that was a challenge that we encountered about 12 years ago when we started developing innovative nitric oxide products. Because the number one question was, how do I know if I need this? How do I know what my nitric oxide levels are?

So I developed a salivary test strip. So it's similar to a urinary dipstick. But instead of there you go instead of you just apply some saliva to the end of that And then allow it for 3-5 seconds and then hopefully it'll turn bright pink.

So what we're measuring there is celebrating nitrite. So through the the ability ability of the body to utilize the inorganic nitrate and convert it to nitro. So that's I tell people it's a good tool to have in your toolbox, but it's not the

only tool that you should be using.

So this is a biochemical measure really the best. Look at this guy. I mean I got one right here and you know people listening, you can go on a big seller like Amazon and look at nitric oxide test strips?

You'll find four or five. You have a particular one that you either were involved in. You know the chemistry. Look, you know, I followed those patents back in 2009 or 2010.

So there are a number of companies now that have that the chemistry is all the same. So I don't have a preference. They all do this thing and it literally it took me 10 seconds to put saliva on the tip of this, fold it over, hold it together for 10 seconds and looks like I'm producing a good amount of salivary nitrite, correct? That's right.

That's what we're measuring. As I mentioned, it's you're not measuring nitric oxide because it's fleeting gas. So we have to measure these more more stable metabolites.

So that's a good tool but you know to measure the IND epithelial pathway. The only way to do that is through what's called flow mediated validation. Some FDA cleared devices that will give you the functional production of nitric oxide in the lining of the blood. So that's really a really good tool for assessing cardiovascular risk. In fact, what's your you know your thoughts there? You can go to a Quest lab and you can get a blood test. You already said the word A. D. M.

A. A symmetric dimethyl arginine. But it's a simple blood test I think maybe more than Quest offers it. But that's where I ought to offer. And tell us how that reflects nitric oxide production and how you know what what kind of database we have that?

It's an important file marker? Well I think it's so it's it's an inhibitor. So it competes with arginine binding to the enzyme micro oxide stuff. You have an elevation of A. D. M. A. Then it's competing for binding to the site of arginine. So it's it's a competitive inhibitor that shuts down nitric oxide production. And so the manifestation of that is if you can't make nitric oxide then you increase your cardiovascular disease severity or risk.

So if that and now we're fine that I'm not sure there's outcome data showing patrons with an elevated A. D. M. A. And outcomes in terms of cardiovascular events.

But biochemically it's clearly not a good molecule to have because it inhibits nitric oxide production down. So it's a it is a blood test available and when it's elevated it reflects nitric oxide production is suppressed.

Suboptimal I am challenged and that's what I called you about a few weeks ago trying to improve it in my patients. I've actually found your new supplement is assisting that. Uh There is data.

There's several 1000 papers and humans on A. D. M. A. And prognosis if you're a heart patient and you get the blood test and it's elevated you should work a bit harder and everything we're talking about?

What I'm not aware of is does dropping it into the normal range has anybody tried to do an interventional study big enough long enough to say we don't only treat blood pressure and blood cholesterol but we treat A. D. M. A. Levels and we intervene.

I do because I want endothelial um to be popping little nitric oxide molecules along at their maximum. But I do have the endo pat device in my clinic to measure directly endothelial function. Simple little safe non invasive test.

But you know it's a pretty much a specialty.

Testing Nitric Oxide and Supporting Endothelial Function

So tell us you you have uh brian and I think you call it Nitra Sue tickles. Right? We turned the new coined a new term Nitra su tickles. Right? So I mean a play on the word.

Not everybody knows the word nutraceuticals which are pharmaceuticals from nutrition and often used as a synonym for a vitamin or a supplement nutraceutical.

But you've got a nitrous ooh tickle and it's now a name of a company. And you have I don't know for the last 4567 maybe a year now. But tell us what you put in this endothelial support nitric oxide support lozenge which I've been using twice a day which I think hope Is the appropriate does it.

I will tell you it is a delicious little but tell you tell us about what you did and why you formulated it and what it might offer people who are you know end ophelia focused.

So over the past 20 years we've learned a lot in terms of micro oxide in both patterns kind of the Entomology and the biochemistry through all of this.

So our whole concept and really I got on this path to develop safe and effective drugs. I mean that's what we as drug discovery chemists and biochemists do is try to develop safe and effective drugs that positions like you can uh confidently prescribed to your patients. But when we started figuring this out, we realized we didn't need a drug application for this because everything we were doing was recapitulating physiology and we could use, you know, natural substances or natural products.

So the design of that laws and was if your body can't make micro cock side because you have an ethical dysfunction or maybe you have your own in acids or use mouthwash.

And so if your body can't make it, we do it for you. And then we also put some components in there that re couple that nitric oxide synthesis enzyme. So we can actually improve the body's own ability to make night. So in order to do this, what are those that are in here that caused the enzyme to be more efficient or functional?

Well, it's complex. What we use is a redox potential. So everything in the body is electric, There's a certain amount of voltage needed to prevent to transfer electrons. I know that's very complicated.

But sodium nitride is one of these substrates that we use. So as that matrix falls apart in that laws and these active components come together and generate micro oxide gas. And then we use, you know, vitamin D. Or magnesium is essential uh central co factor to make micro oxide. And then vitamin C.

Is really there's a certain redox potential of vitamin C. That allows for extending the biological half life of micro cox now from one millisecond out to tens of minutes and hours. So that's the design of it.

So if your body can't make nitric oxide, so when that laws and just dissolving in your mouth now for 5 to 6 minutes, we designed it to have a certain resident time.

You're liberating about 30 parts per million nitric oxide. Get and then we're finding about four hours later you're endothelial function can be improved by about 15 to 20%. Does this does this laws supporting both sites of nitric oxide, endothelial and the oral peroxide gland dietary.

It's both. That's right. It's both. And so that's the beauty of it. So if you're compromised either, that lozenge overcomes both of those deficiencies.

So it doesn't matter if you have the right bacteria. It doesn't matter if you can make stomach acid of your own and assets that laws will always generate nitric oxide in the exact same way in every single patient that puts it in their mouth and of course, you know, it's not a FDA approved drugs.

So we don't say it treats anything, we talk about what it supports. I imagine if somebody added in a lozenge twice a day. And I gotta say I've not been good about 5 to 6 minutes.

The thing tastes so good. It doesn't last. But I will start doing that. I mean, a person seeking a new pathway to support of course we always encourage the Greenleaf, ease the beats.

Uh And I want to ask you another food question a minute. A person could get test strips and just show that they are now apparently producing and showing a lot of Nigerian nitrate. But I mean, it could support healthy blood pressure levels. Give us that list of supportive activities that uh nitrous ooh, tickle like this might do well. We've got that same technology, we're now developing into two drugs FDA approved, we went through FDA approved clinical trials, different company. Obviously these are drug trials.

But I'll tell you what we're finding in the drug studies is we've got a drug in phase three trials now for Covid. But we improve blood oxygen saturation.

We're seeing patients with severe covid with blood oxygen saturation of 78 improved to 96 within eight minutes of taking that laws. So when you generate nitric oxide, you just got to realize what is nitric oxide. Doing well, it's dilating the blood vessels. So if you have an unsafe elevation in blood pressure, it'll reduce your blood pressure, normalize your blood pressure.

We're seeing an improvement in insulin signaling. So you can improve glucose uptake, reduce the amount of insulin that the body secretes. So it's the hyper insulin anemia hyperglycemia that causes a lot of the inflammation in the body. So if we can normalize that you decrease inflammation, in fact, one of my issue patterns is on a method of reducing systemic inflammation through c reactive protein. And as you know, inflammation is really the silent killer. That's the problem.

And people, you know whether it's a vulnerable plaque, it's the inflammation that causes that plaque to rupture and causes heart attack or stroke. So we improve circulation, improve oxygen, delivering decreased inflammation, oxidative stress and immune dysfunction. That's really the hallmarks of cardiovascular disease.

Nitric Oxide Lozenges and Clinical Applications

I want to ask you a very uh you know, specific questions a lot of the listeners to this summit will have heard from other speakers at various places, Not just this summit, that it's best to chew your leafy greens and you may be robbing your body of benefit.

If you were to take out a blender, put a handful of kale and some blueberries and ground flax seed and and uh you know, oat milk and make a smoothie. It goes past your mouth too fast to participate with these uh faculty native anaerobic bacteria and the group of your tongue. You know your thoughts.

I mean, you know, it's better to have a green smoothie than a donut and a frappuccino? We all know that. But because of the recycling do you think you still capture most of the nitric oxide benefit if you were to just pound a green smoothie down?

I always encourage people take some time and chew a smoothie. I haven't given up on the idea that there are ways. Now look, the more resident time you can have in the mouth for the food.

I mean, the mastication of food is really essential because the more surface area you expose than when you swallow that, the more efficient the digestion is gonna become.

And also it allows those bacteria more time to respond on that nitrate to generate the nitrite nitric oxide. But even if you drink a smoothie, you know, the body is a pretty efficient system whereby you can absorb that nitrate in the duodenum and proximal gut and then you'll concentrate it back in our celebration.

So it's been recognized, created. You may slowly secreted on your tongue for a number of hours and get, you know, it's not of no benefit, even estimate that pathway of not residing in your mouth.

You think it's half as efficient as slow chewing. We haven't never we haven't ever quantified that, but, you know, you're certainly losing the efficiency of it because everything we do, we try to recapitulate physiology because that's how the body is designed to work.

And so, so that's why we designed that laws and have a certain resident time to mimic that slow mastication and that one would have from, from chewing their vegetables.

and as I said, I encourage patients that asked me to run the blender for just a couple of seconds. You end up ike call it a chewy and you know, you almost have to spend a little time on the kale on the walnut on the taxi because it's not like going to the smoothie shop where they blend it down to, you know, pure liquid and you know, you're probably somewhere in between in terms of efficiency. I hope I remember to do this with every honored guests, but just tell us in your own life, people don't know you married kids, dogs, horses, what you got married? I've got three boys.

We lost our oldest son Grant in a car accident. So several years ago. So we've got a 14 year old Lincoln and 11 year old conley. But I live in texas of have about 800 acres. We're out in the middle of nowhere, have horses, cattle, we raise our own food, grow our own vegetables.

So we're pretty self sufficient. So I've been very blessed in order to do to do that and live that kind of lifestyle. I also want to ask this of most people what's, uh, you've got 30 minutes exercise. What are you out there, bailing hay or what, what do you do in your own personal busy life?

Well, you know, it's discipline, right? So I try to get at least 20 or 30 minutes of some type of exercise every day. I travel a lot. I'm on an airplane, you know, every week of my life for probably the past certainly three years. But I always go to the gym.

I like to exercise outside. So we're exposed to direct sunlight, certain wavelengths of light that can stimulate micro cock side production. Um, and then I like an infrared sauna, you know, because it's very impor important that we sweat because they're ammonia oxidizing bacteria that live on our skin.

So every time we sweat, they're oxidizing that ammonia to nitrogen oxide. So, and that's a problem with americans. Today. Nobody sweats anymore. You know, we get in our air conditioned cars and drive to our air conditioned office and then sleep on an air conditioned home and nobody sweats.

And it's a major source of detoxification. So I try to sweat every day. But you know, trying to maintain an 800 acre ranch. There's always something to do in texas, especially now it's extremely hot.

So sweating. It's never, you know, so many things come out of your mouth that are such pearls, but the fact that sunlight is not just a vitamin D generator, but we're a little bit like plans sunlight makes production of nitric oxide.

We don't know for sure, sunlight makes energy in their body. There has actually been one report that that may happen in mammalian cells, but sunlight can be very therapeutic and I share with you an infrared son in my house that gets used quite a bit. And we'll have a interview segment on the cardiovascular benefits of infrared sauna during the summit.

So people will learn more. What about real quick? And we are diet. It's a plant forward summit, but we're not limiting it to discussing exclusively. But what's a breakfast, lunch dinner? Just your optimal day.

As a scientist that understands the food is medicine pathways? Well, I typically don't eat breakfast. I'm a big believer in intermittent fasting and caloric restriction. I think the data are pretty, pretty solid on the, so I eat my last meal of the day at 5 30 or six p.m.

And so I do a 16 hour fast every day. I have one cup of coffee every morning. And then for lunch I try to eat something like a good balanced meal. So I'm not a big fan of a straight, you know, carnivore, keto diet, everything in moderation, a balanced diet. So I always try to eat a salad before and there's a reason for that because we're priming the body.

Lifestyle, Fasting, Supplements, and Closing Thoughts

You know, there's certain foods that are inflammatory. So I do avoid a highly processed uh meal or processed carbohydrates. So I do I do kind of limit the amount of cards. But for me, I think it's very difficult to apply a one size fits all because, you know, if you're burning a lot of calories, you can afford to eat a lot of calories.

But it's the people who don't burn it and then store it as fat develop metabolic and then for dinner I'll eat a light meal uh and usually have one glass of wine or one glass of scotch with it. But again for me it's about the the intermittent fasting and a balanced diet in moderation and physical activity really.

I think that works. I mean we've known diet and livestock and prevent chronic disease for what hundreds of years. It's it's applying those principles and trying to understand the mechanism of that so that we can make it more efficient great. And we will be sharing thoughts with dr joseph Antoun ceo of l nutra during this summit and talking about the variety of approaches to fasting and calorie restriction and benefits. So, you know people are looking for you know, a lot more than most, including as I say, you've written how many people have written a book on nutrition at a very high level. But I encourage people look this up, look up and where do they find information they can read about this product and, you know, to you dot com. And then I've got a an educational website dr Nathan s brian D dot com. I do a monthly blog and try to, you know, keep up with the literature and try to bring some practical timely, you know, common sense approaches on how you can make some very simple choices and very simple changes that will have a dramatic influence and change in your health and overall well being. Last question on a personal level, how many supplements a day would you estimate you take?

I probably take 10 or two, 12 different supplements because and there's a reason for that because it's theirs. It's known that since 1948 there's a 78% decline in the nutrients in the foods we eat. So the foods we eat today are missing certain minerals and vitamins. So we're not getting what we need for optimal performance through the foods we eat and you can try to eat clean, you can eat organic.

But the facts are those plants and vegetables and food are deficient in certain minerals. And so what I do is I do a micro nutrient analysis and figure out okay what exactly am I missing? And then I supplement.

The one thing that I think is the biggest bang for your buck is I don't know iodine is critically important. We don't get in the american diet, we need it for thyroid function, we need it for stomach acid production.

Um And so that's it's a routine test in my clinic is urinary iodine and we live I'm in Detroit where we live in a salt mine. Not everybody knows that but nobody touches I deny salt anymore. I as a plant eater add sea kelp season this is my little I get a dietary source of iodine. Plus I do rotate.

It's interesting dr valter Longo suggest taking a really broad multivitamin, multi mineral about every third day. Just kind of plug the holes that might be there.

If you don't do a micronutrient test to directly measure. So there's def approaches to it and I don't think supplements are always expensive urine. I think they are often a good support to health but you know, we do fight that idea that they are all right. Well I want to wrap it up and just thank you.

I think the audience has learned what is the miracle molecule, how we make it in arteries. We make it through a dietary approach we've only known about for a dozen plus years. We can support it through good diet, good fitness. All the lifestyle messages.

Even your comment about the methylation pathway m th fr being so important in nitric oxide synthesis. That's actually new to me because I've been testing and supporting and correcting methylation defects in the clinic but I wasn't aware about the nitric oxide aspect. I'll read more and thank you for that.

And then of course your contribution solutions. I mean we can talk all day long about Nobel Prize winning science. I will say for those listening and you know this doctor brian I mean the average interaction with a primary care doctor or cardiologist will never bring up the word nitric oxide because it hasn't really been addressed directly by the pharmaceutical industry And the supplement industry is generally disregarded by physicians. They're not unintelligent but they don't believe there's a role to discuss what we've just talked about.

I mean if this were the only interview for this summit, people would have walked away with tremendous advantages. So thank you for what you do. And I think the future is bright. I think we will have doctors saying your blood level of nitric oxide as I measured by a D. M. A.

Or salivary or some other creation. You're gonna come up within the next 10 years. You know, is as important as your LDL level your blood pressure, level your blood sugar level. And now we have you know better and better tools to correct well we're in the process of changing that, you know, we've got an I. And D.

Which is an investigational drug application in for a skeptic heart disease, ischemic, non obstructive coronary artery which is as you know, a microvascular disease. And so we're developing those now to give physicians even, you know, contemporary al empathic physicians who want to prescribe a drug, we're working to give them the tools they need to not only better diagnose micro oxide deficiency. But as we finish and complete these clinical trials actually have a bonafide drug on the market, it's safe and effective then it will become part of the primary conversation because the right nitric oxide and the right patient at the right time. There's not a single indication that nitric oxide would not be beneficial. So I think this has a chance to change the face of health care and how we treat patients for the next 100 years and we need it.

We need we need advances. All right, well, thank you so much gratitude. Fly safe today and hopefully your back and beautiful brian soon amongst your family. Thank you dr khan.