Introduction and Guest Overview

Hi, I'm Dr. Scott Stoll and welcome to a regenerative life podcast where science becomes hope, food becomes a catalyst for healing and every conversation explores the profound connections between personal health, human flourishing and the earth and future that we will share together.

But more importantly, we'll explore one of the most important questions of our time. What happens when we actually begin living in alignment with the way we were designed?

Hi everyone and welcome. I am Dr. Scott Stoll and today I'm delighted to be joined by my very good friend, Cyrus Kambada. Cyrus is co-founder of Mastering Diabetes and bestselling author of, Master in Diabetic.

Sirus brings a very rare and powerful combination to us today of the lived experience of type one diabetes, but also a deep dive into the rigorous science and many, many years of helping individuals transform their relationship with themselves, with food, and with glucose, insulin, ultimately recovering metabolic health.

You know, today in a world where diabetes conversations have become reduced to carbohydrate restriction, glucose suppression, continuous glucose monitors, Cyrus is going to help us look deeper into insulin sensitivity today, mitochondrial function, how dietary fat plays a role in insulin resistance, human performance, and really the remarkable capacity of your body, the human body.

Its ability to heal when we simply align with the right design. So I'm really excited to dive in on this conversation, Cyrus. Thanks for being with me today.

And I am excited for everyone to learn from your incredible experience. Awesome, thank you for the invitation to be here. I always love talking with you, so anytime we can get nerdy on anything related to biology, I'm fair game.

Cyrus's Diagnosis and Early Diabetes Journey

Absolutely, it is going to a fun deep dive. You know, before we get started though and dive into that nerty science, also I want to help people make that kind of science translational and actionable in their lives, but I wanted you to share your personal journey.

Maybe, you know, share with people what it felt like to get that diagnosis of type one diabetes, and then move there to the key moments that really shifted you from simply managing your disease, like most people are taught today when they get into those deeper questions that you started pursuing of like, what is insulin?

What is Insulin Resistance? And how can I maximize my insulin sensitivity and performance and metabolism with lifestyle? Okay, yeah, sounds like a plan.

So in order to do this, we're going to have to time travel. Let's go backwards in time to when I was born, the year 1980. I grew up in Palo Alto in California.

And from the time that I can remember, I was probably like three years old, four years, five years. I, was a very, very active kid. So, as far as I could remember all I would do all day long is I'd go play baseball, then I go to play soccer, and then go and play basketball, run around, get on my bike.

It just seemed to never stop. And that was true all throughout my childhood and then all through out middle school. And then by the time I got to high school, I was playing competitive soccer and playing baseball and running on the cross country team.

Then when I got to college, all of a sudden I felt like things changed pretty quickly. I was 22 years old, I a senior and I just graduated trying to move on with my life with a degree in mechanical engineering and then all the sudden out of nowhere I get diagnosed with not one, not two, but three autoimmune conditions within about a six to nine month period.

The first one was Hashimoto's thyroiditis. The second one was alopecia universalis, which is code for you will lose all your hair. And then the third one, was type 1 diabetes.

And developing Hashimoto's wasn't really that big of a deal. I'll be honest with you, I felt pretty darn tired. And I'd wake up in the morning and I feel like I got run over by a bus.

That'd be like, huh, this doesn't feel right, right? But then you go to the doctor, you see an endocrinologist, they do a thyroid panel, and they find out that your TSH is extremely high.

They find that you're T4 is very low. Then they say, oh, okay, well, we have this medication called levothyroxine or Synthroid. And it fixes the problem.

And you go, OK, sounds like a plan. So you start taking it, and before you know it within three months, now you feel like $1 million. Right? And given that there's a very low, very safe medication, it didn't seem like that was a big imposition on my life.

Same thing with losing my hair, you know, like I didn't really have that much hair to begin with. I kind of had like been shaving it for a while and I eventually got to a point where a friend of mine said, hey, by the way, those bald spots on your head look kind strange.

Can we just bick your hair completely? So, get rid of all of your hairs. We got it all the down to the skin. And then before I knew it, I was like, Hey, this is my new look.

Sounds like a plan. Again, not a life altering decision, but you just something that I had to deal with, But then when I got type one diabetes, that was different.

That one was real different because when I got diagnosed, I went to the ER and I was in DKA, diabetic ketoacidosis. And I'm lying in a hospital bed with an IV of saline into one arm and then an ivy of insulin into the other.

I am lying there and looking around and like, What just happened to me? How? First of all, why do I have three autoimmune conditions? Second of All, what is insulin and why am I using this stuff and what what broke inside of me was it my fault?

Did I do something right? Can I go backwards in time? Right. That's Yeah. Yeah, it's tough because, you know, within a 24-hour period, the team of doctors that I was working with basically came to me at the bedside and they said a couple of things.

They said, number one, You have three autoimmune conditions. And they named them. Then they first one's Hashimoto's, The second one is alopecia, and the third one type one diabetes.

We've never seen anybody with these three, auto immune conditions, period. End of story. I said wow, that's interesting, but that doesn't really give me much confidence.

And I said, well, what are you going to do about it? And they said well you have what's called a poly glandular autoimmune syndrome and they come in many different flavors and shapes and sizes.

And you know your specific combination can't tell you that we know exactly what to. We can tell that for type one diabetes you got to inject insulin. You got a lower your carbohydrate intake and you've got watch what you eat.

I say OK sounds like a plan. So you get discharged. Imagine going the hospital and then getting discharged 24 hours later. with a prescription for two different types of insulin, syringes, a blood glucose meter, test strips, and a book that tells you how many carbohydrates are in each food that you would eat.

And they say, okay, you know, see you in a week, See you on a month, go back into the wild and, make this work. So at the age of 22, I was like, wow, this is, definitely different.

This seems a lot more serious. So, you know, for the first year of living this way, I was doing the traditional medical, going down the tradition medical route because number one, i'm a good student, number two, abide, and number three, this was serious.

So I going to the endocrinologist every couple of months and I showing him what my blood glucose values were doing and i was trying to limit my carbohydrate intake because that's the prescription.

And as a result of that, I was eating things like turkey burgers and peanut butter and salmon and cheese. And I try to limit my fruits and my pasta intake and oatmeal intake.

You know, classic low carbohydrate diet.

Discovering Plant-Based Eating and Lower Insulin Needs

But I tell you, Scott, it felt terrible. I just don't know how else to describe it. It just felt… terrible, right? My blood glucose was a disaster. On any given day within a 24-hour period, my blood could go as far as low as like a 40 and as high as 300. I had just graduated with a degree in mechanical engineering and there's like a decent amount of scientific rigor involved in like controlling these intricate electrical and mechanical systems.

So I learned how to do that like for a robot or for like you know a device that you build in the wood shop. but I couldn't even control my own blood glucose.

That was kind of embarrassing, truth be told. And then in addition to that, my energy levels were even worse than when I got diagnosed with Hashimoto's six months prior to.

Then I started to get depressed and it started take a very heavy physical and emotional toll on me simultaneously. I can imagine you're feeling like hopeless, right?

Like, what the heck happened to my life? Movement is life and now I cant even manage my blood sugar and I feel terrible. Exactly. And so it was very heavy.

It was challenging. Another thing, too, is I didn't really know anybody else that had type 1 diabetes. I don't have a friend that I could pick up the phone and call and say, hey, you've been here for three years.

Can you tell me what I'm supposed to do? And when I went to the doctor, it didn' really seem like he cared that much. He's a good human being and I wish him the best.

But I just kind of got a very standard medical protocol which was, please come here, show me your insulin pump, I will download the data, and then I'll tell you what to do 15 minutes later.

See you later, gotta go to my next patient. And I just saw this over and over again, and I was like, man, this is not helpful. Where's the information about food and exercise and how to put it all together?

So I had to venture out on my own. And when I did, I stumbled across the plant-based world, not because I wasn't looking for it, but because somebody told me that it was probably a good idea.

I said, great, now I'm an open-minded guy, let's do it. So, started looking information for a plant based diet, before I knew it I met a gentleman named Dr.

Doug Graham. and he taught me how to eat a, truth be told, raw food diet. So I switched over to eating a raw-food diet, cold turkey, literally cold Turkey on September 24th, 2003. And he told me that day, he said, you know what?

You're not going to be eating any more fish or chicken or red meat or white meat, or dairy products. Kiss them goodbye. You are done with that. I said sounds like a plan.

So I switched over to eating lots of mangoes and bananas and papayas and dates. And I loved it because those are really tasty foods. I was expecting that my blood glucose would go through the roof, but guess what?

It did the exact opposite. Right? Yeah, exactly right. It's the sugar that the medical world tells you not to eat because the programming in the world of diabetes, whether it's type one or pre-diabetes or type two, is that carbohydrates are the enemy.

You are told this very early in your diabetes life, in diabetes career. And truth be told, even if you don't have diabetes, if even you're just a general regular individual and you happen to go on a TikTok or YouTube, you'll see the same thing, which is that carbohydrate is bad for you.

Low carbohydrate, is good for. And so that's what I was being told. It did not work. When I switched over to eating a raw food diet, now all of a sudden I went from eating approximately 100 grams of carbohydrate per day, which is technically speaking a low carbohydrate approach, to 700 grams a carbohydrate a day.

Okay, so I seven-folded my carbohydrate intake and I predicted that my insulin use would go up dramatically. I didn't think it would 7X, but I thought it might double, right?

I though it may go from using 42 units of insulin per day to like 70, 80, 90 units per insulin day. And I said, listen, if that's what I have to do in the short term, that is okay.

Let's see what happens. But when I started eating 700 grams of carbohydrate per day and intentionally doing it in a very low fat environment, specifically low saturated fat, well guess what?

42 units of insulin did not go into 70, did go to 80. In fact, it went from 42 to 36 on the first day. Then it down to 34, then it to 31, and then to 27. Before I knew it, seven days later, after being at an in-person retreat, I walked away using 24 units of insulin, even though my carbohydrate intake had seven-folded.

And it was at that moment, somewhere along that first week, where I was like, wow, this is different. This is very different, because if the carbohydrate is bad philosophy, or the carbohydrates is that molecular biochemistry was true, then I would not be experiencing this right now.

So there's something very fascinating here. I think it has to do with the fact that insulin is not a single variable molecule. Insulin is affected by multiple different things.

Carbohydrates are sure one of them, but there are many other things that can control your insulin use. And that set me on the path to wanting to learn as much as I possibly could about carbohydrate metabolism.

Yeah, I think it's those moments of awakening where you start to realize the old narrative that I've been taught. That's the conventional narrative today in medicine.

And we like to create these simplified stories to tell patients because it helps, hopefully, where I the intention is to direct behavior. Lower your carbohydrates, lower your total insulin dosing and your blood sugar levels.

but they miss the incredible complexities of the body. And in fact, this narrative, and you know the Osiris, it has portrayed blood glucose and insulin as the enemy, as you said.

It creates fear, anxiety, uncertainty in people's lives, which we can talk about stress later, that drives blood-glucose as well. But physiologically, You know, an elevated blood glucose after a meal is normal.

Insulin is essential for life and it's not just about driving, you know blood, glucose into the cell. It's essential cellular communication as we'll talk about.

So let's maybe just take a minute and help reframe this idea of blood. Glucose and insulin so that people understand it. Not the enemy, but it a part of an elegant, beautiful communication device inside of our body.

Okay, here's the way that I like to think about it. I wrote about this in the Master and Diabetes book because I heard this so many times over and over again.

Insulin's bad for you. And the goal in eating food for every human being is to try and limit how much insulin is being secreted by your pancreas. Now, if you go down that path and you say, okay, insulin is bad for me.

Well, then what that would mean is that we human beings are manufacturing a peptide hormone from the beta cells in their pancreas is one of the central components of entire physiological system.

And if insulin was bad for you, then that would mean that human beings had a major design flaw, like a massive design flaws. And then in addition to that, if Insulin was Bad for humans, insulin would likely also be bad For dogs, and for cats, And for raccoons, for monkeys, For cows, sheep, all mammals.

But the truth is that all Mammals manufacturing secret insulin, and it is a central component of their physiology because insulin is, truth be told, the most powerful anabolic hormone.

in a mammal. And by that, what I mean is that is the most powerful hormone that stimulates anabolic processes. Anabolic is a term meaning synthesis, right?

The synthesis of complex biomolecules. So sure, one of its jobs, of one its main jobs is to promote glucose uptake into a cell. Fine, I'll give you that.

That's one it's main job and the reason that it does that because when glucose is imported into a cell insulin that it also sets into motion a very complex cascade of Metabolic effects that take place inside of the cytosol inside a vessel inside the mitochondria inside in the nucleus Inside the ribosomes you name it long story short it sets in to motion carbohydrate synthesis fatty acid synthesis protein synthesis DNA synthesis RNA synthesis and the list goes on Right?

Without insulin inside of a human being, you're dead. You literally will die. I don't know what period of time it will take. It's something on the order.

Maybe you know the answer to this, but if I were to magically take insulin completely out of your body today and cripple your ability to manufacture it and then also provide you with no exogenous insulin, do you how long you would be alive for?

I do not know answer that question, we can both imagine it's not very long. Yeah. I mean, I think it's on the order of maybe months, right? before that's it, right?

Reframing Insulin, Glucose, and Carbohydrates

It's that powerful, it's important, its that integral of a hormone, but yet human beings in the social media world have just reduced the complexity of insulin down to, you know, two things.

Number one, It puts glucose inside of cell and number two it manufactures fatty acids. That's all that you'll learn about it if you really do a deep dive.

And it is unfortunate because if look into a scientific textbook, that is just the tip of the iceberg. It is crazy. Yeah, and that simple narrative, as they're describing it, then lends itself to this kind of secondary story, which is you've got to control your dietary carbohydrates to lower your insulin levels because if your levels are too high, you're

going to have inflammation, disease, heart disease and all kinds of other issues.

And that then leads to what we both know as the next solution, which is a low carbohydrate diet. And so people on social media listening to these one-minute sound bites of oversimplification and really just missing the incredible complexity, as you mentioned, of this molecule are led down a road believing that if you eat a mango, it's dangerous.

If you have a post, you know, meal elevation of glucose, it's dangerous and you need to just eat fat. Maybe take our audience through just a little bit of that and we could spend days on this, but a bit a that understanding so that we can kind of take away the demonization of carbohydrates and help people understand that this is more than a carbohydrate conversation and that, let's talk about dietary fat, a low carbohydrate myth.

And I really want to just help people feel some freedom to enjoy a mango. I mean, that's really what I want you to get to. The mango is a beautiful fruit, right?

I wanna feel like, enjoy mango without guilt. That's what we want. Yeah, exactly right. Which, for the record, is exactly what i did before I got on this podcast.

Just wanna let you know. Okay, so a couple of things we got to establish first. We talked about the fact that insulin is the primary, is that the master anabolic hormone inside the human body and it's essential for life.

Number two, human beings have a natural, what do you refer to as a diurnal, effectively a circadian rhythm in blood glucose fluctuation. Your blood glucose at any moment in time is affected by not just insulin, but the food you eat, the stress you're experiencing, how much sleep you got the night before, or how many exercise you performed, How much alcohol you drank.

Are you calorie restricted? Are taking on too many calories? And the list goes on. Right, so your blood glucose at any moment in time is sort of like fluctuating all day every day.

Now, in an ideal world, your glucose would sort-of vary anywhere between 70 milligrams per deciliter on the low end, and truth be told, studies in non-diabetic individuals wearing CGMs have blood-glucose fluctuations as high as 154 milligrams-per-decilitor in the non diabetic individual.

So what that means is that, you know, Your blood is designed to fluctuate and that is perfectly normal. That is a normal physiological, uh, pattern. But again, what the low carbohydrate world wants you to believe is that, no, it's not safe.

The only way to actually have a quote unquote safe blood glucose variation is if your blood is literally between 80 and 90 or 80 in 100 all day long every day.

Anything over 100, 105, 110, that's considered a, quote, unquote, spike. And they use this phraseology that just has, you know, incites fear in people, but it is not biologically accurate, right?

A spike is even close to 110 or 115. Not until you get into the 160s are you even talking about a non-physiological blood glucose elevation. So that's number two.

Number three, if we go back to insulin, okay, we talked about the fact insulin's not the enemy. Insulin is important, insulin is required, and insulin essential.

But most importantly, where the low carbohydrate world gets things wrong is that insulin isn't bad. Hyperinsulinemia, excess insulin in your blood is the boogeyman.

That's the thing. that significantly accelerates a therosclerotic risk. That's the thing that's significantly accelerate your risk for the development of chronic disease that can significantly increase your body weight in a short period of time and they can set into motion a whole cascade of negative health consequences that could lead to many

different chronic conditions.

So it is very important to live in a state where your pancreas is manufacturing insulin in the right quantity on a meal by meal basis, on day by day basis.

And the way that you know what your sort of quote unquote ideal physiological normal insulin secretion pattern is, is you can do it based off of your ideal body weight.

So you just, you know, depending on whether you're man, your female, whether male or female you, can calculate your idea bodyweight. Based off your body, weight you then calculate what your physiologically normal amount of insulin is per day, right?

So what ends up happening is that when you are eating a diet that is either high in calories, and contains excess calories or high in saturated fat or higher in refined carbohydrates that come from cookies and crackers and chips and pastas and sodas or all of those together that can set into motion an inflammatory state inside of your liver and inside your muscles and your pancreas.

which can then cause an over-secretion of insulin. So you end up first developing the insulin resistance pathology inside of your liver and muscle that's mainly stimulated by excess saturated fat that has accumulated in both of those tissues.

When the excess saturated fat accumulates inside of your liver, inside your muscle, those two tissues go into a high energy state and they say, hold on a second, we don't want any more stuff.

So they block insulin from communicating with the tissue. And as a result of that, when insulin comes around and says, knock, there's glucose in the blood, do you want to take it up?

Both of those tissues are saying, sorry, I'm not interested in talking with you right now. I have too much stuff inside me already. And so as a result of that, when you're eating glucose or carbohydrate rich foods, after eating foods that have saturated fat in them, you end up with a metabolic traffic jam that then causes the glucose to accumulate inside of your blood, thus leading to high blood glucose.

So that's a sort of simplified version but an accurate simplified of insulin resistance in your liver and muscle. So the net result of that is that when your blood glucose begins to elevate, well guess what?

Your pancreas then says, oh wait a minute, you know what, I think I can solve this problem. let me try and solve this problem by just making more units of insulin.

So rather than making, let's just come up with a number, 25 units per day in order to control your blood glucose, if it's not working, well, the beta cells are going to say, great, we're going go manufacture 29 units insulin tomorrow.

And if that doesn't work, then we're going to manufacture 36. And then if doesn' work we are going manufacture 47. Before you know it, you can go into a hyperinsulinemic state where you are over secreting insulin on a meal by meal basis and a day by day basis which then leads you to a state were you now have excess insulin in your blood because insulin is having a difficult time talking to your liver and muscle.

And that excess insulin inside of your blood is so unbelievably dangerous, especially if it's enabled to live and persist in your body for many weeks to months to years, and that hyperinsulinemic state is really what can damage the endothelial lining inside the blood vessels, significantly damage your brain, set into motion a pathology of cardiovascular disease that you and I absolutely do not want to venture into.

Yeah, and it almost seems like this is a Chinese finger trap. You know, it's like everything is comfortable until you start pulling on the ends, right?

That, you know you go on a low carbohydrate diet and boy, lo and behold on your continuous glucose monitor it is

rock solid because you're not eating any glucose.

But at the same time, You've got this accumulation of intramuscular lipid dysfunction of insulin signaling. And the minute you add in carbohydrates, It's that finger traps starts Right?

And so, and we know from the science and you can maybe speak to this, like the least sustainable of all the diets based on Kevin Hall's research at NIH and others is a low carbohydrate diet.

100%. So it's unsustainable. And, so when people stop a Low Carbohydrate Diet, what happens, Cyrus? Okay. So when they stop eating a, let's pretend like you start eating low-carb diet and see this tremendous low carb.

Yeah. Yep. So let's actually do two different things. Let's talk about it. What happens when you eat a low-carbohydrate diet in the short term? What happened when we eat low carbohydrate in a long term and then what happens if you stop eating a carbohydrate diet?

Perfect. I think that's great for the audience. Yeah. In the shorter term, what ends up happening is exactly what you described, which is you start eating low carbohydrates diet.

If you play the carbohydrate avoidance game, that means that you are limiting your carbohydrate intake to approximately 30 grams of carbohydrate per day.

And as a result of lowering your carbohydrates intake, you then have to substitute with more calories from protein and more calorie from lipids, or I should say fat.

So as result to that, your fat content goes up and your lipid content, I'm sorry, fat and protein content go up in your diet. And in a properly designed low carbohydrate slash ketogenic diet, you can get as much as 70% of total calories or 80% total of calories from fat.

We're talking about eating north of 150, 200 grams of fat per day, sometimes even more than that. And then protein also tends to go up, not as much, but people end up eating something like 150 to 200, maybe even 225 grams of protein per day.

So in that scenario, what you'll find is that because you have subtracted carbohydrate, well guess what? Blood glucose variability is likely to down significantly because the reason that your blood glucose was variable in the first place was not because, you ate too many carbohydrates.

It's because the type of carbohydrate that you are eating was most likely refined. But most importantly, any type carbohydrate you're putting into your mouth in a high-fat environment is not going to work.

So it's actually an interplay between the saturated fat content of your diet and the carbohydrate quantity and quality. And when the fat is high, then carbohydrate just does not work Okay.

There was a researcher back in 1963, his name is Philip Randall. Philip Randal invented the Randalls cycle. And he has gone down in history as being one of the most insightful observations in all of metabolic biochemistry that basically demonstrated that fat and carbohydrate do not like each other.

Low-Carb Diets, Fat, and Insulin Resistance

and that when you are consuming a high-fat diet, the high fat diet in turns on the hi fat machinery or the machinery responsible for uptaking fatty acids, processing those fatty assets, sending into the mitochondria, storing the fatty acid and beyond.

And in that situation, carbohydrate metabolism literally shuts down. vice versa when you reduce fat intake then carbohydrate machinery increases and all of the machinery, all the enzymatic machinery required for carbohydrate import, carbohydrate storage, carbohydrates manufacturing, glycolysis, Glycogen synthesis and beyond all that

goes up.

So you literally have reciprocal processes of either you're in fat burning mode, I should say you are in the fat utilization mode or you in carbohydrate utilization but the two of them just cannot exist at the same time.

The reason why that's important is because when you're eating a low carbohydrate diet, what you doing is you are mechanically suppressing your carbohydrate intake, increasing your fat intake and as a result of that, your blood glucose variability becomes nice and flat.

It's awesome. And you look at your continuous glucose monitor and you go, oh my God, my low glucose has varied between an 82 and an 87 all day every day.

Look, I just proved it to you. Carbohydrates are bad for me. I shouldn't eat them. Because when I eat my blood, glucose does weird things. In the short term, you'll see that effect.

Not only that, but you'll also see a lower A1C value, and you can see this in the literature, that people who had a ketogenic diet over the course of six months to a year end up with producing their A 1C by as much as 1 to 1.5%. Okay, great.

Nice job. Okay. But if you carry that out over time, what you are likely to find is a different story, maybe about a years in future, two years, three years.

Because like you said, Kevin Hall has demonstrated That low carbohydrate diets are not sustainable. He's not the only person. There's plenty of research that demonstrates that low carbohydrates have a very low adherence rate.

And the dropout rate is actually relatively significant. So if you take that into account, part of the reason why that is, is because number one, the diversity of food is very little.

But number two, there's many problems that come along with a ketogenic diet. Okay? Number one, first and foremost, the single most important thing in my mind that most people don't really give credit for is a high LDL concentration.

When you eat a diet high in saturated fat, your LDl cholesterol, which is the quote unquote bad cholesterol goes up. And it is such a significant increase in LD l cholesterol that you cannot ignore it.

You know, I know. Dr. Kim Williams knows. Everybody in the whole food plant-based world knows LDL is not your friend. But somehow the low carbohydrate world has spun it to say, oh no, you know what?

Cholesterol's not bad for you. LDl is bad not for. And in reality, cholesterol is actually good for because guess what, your brain's made out of cholesterol.

You need cholesterol in order to live. And they come up with all these ridiculous stories that have no biological basis. But the point is that when your LDL cholesterol begins to increase, you're setting into motion a significantly increased risk for a future cardiac event.

And we have to talk about that. So one of the things that happens on a low carbohydrate diet is that LDL goes up significantly. Then the need for statin medication comes in or the needs for a PCSK9 inhibitor comes and beyond.

Long story short, in the short term, a Low Carbohydrate Diet looks great on paper. In the long term a LCOH diet can become very hard to adhere to. Even though there's oftentimes a significant amount of weight loss, people plateau.

They lose 20 pounds, 30 pounds 40 pounds 50 pounds and they get to a point where they're like, oh, wait a minute, hold on. I can't lose any more weight.

This isn't working anymore. And then all of a sudden their weight starts to go back up again. You've probably heard the stories just like me. And if you look behind the scenes, what you'll actually find is that the very thing that set into motion the insulin resistance pathology, which again what I said earlier was that it's the excess accumulation of saturated fat in liver and muscle.

Well guess what? When you're eating a low carbohydrate diet, Insulin resistance in your liver and muscle gets really really loud really strong You just can't see it and detect it because you're not eating any carbohydrate But as soon as you put some kind of carbohydrate energy into your body, it could be a cracker.

It could Be a mango It could be a bowl of black beans. Guess what? Blood glucose through the stratosphere. And I'm not even joking. 180, 200, 250, 260. Right?

And that's because the amount of insulin resistance under the surface has grown so significantly in both your liver and your muscle, but also inside of your pancreas that carbohydrate metabolism is just very, very inefficient.

So did that answer your question? Yeah, no, that was fantastic. I think that's helpful for people to understand the process and to see why the literature suggests that in the short term, low carbohydrate diets appear to affect positively some of these biomarkers that we're following.

that then can be linked or associated with lower disease risk, even though it doesn't translate one for one. But I think that's helpful in understanding kind of the literature for people and bring some context.

Yeah, thank you. And I want to continue on that same line and just move to high performers because I see lots of people in this high performance world, you see it on Instagram, people wearing continuous glucose monitors as they're training for high rocks like you are.

But they are wearing these CGMs and they were worried about their glucose spikes as their training. So, you know, what are they getting right? And what do they missing as they think about the bigger picture, especially as an athlete yourself training at a very high level?

How can we understand the physiologic nature of insulin, food, and our health through that anabolic state? Dr. Matt Nagra talks about this very well as well.

And the simple way to think about it is that when you are exercising, he says this, I think we can all generally agree that exercise is good for you, right?

Everybody would agree, that moving your body is a good thing for, you right. Did you know that, when your move your your, body you're increasing your blood glucose, increasing blood pressure, Increasing inflammation, increase micro tears in your muscle tissue.

and setting into motion inflammatory processes. Does that mean that you shouldn't exercise? And the answer is no, because temporarily there's physiological adaptations which are happening in order to enable you to perform and enable to exercise, especially when you're exercising at very high intensity.

All right, so one of the things that happens, as you know, given that you have a very strong exercise physiology background as well, is that when you are exercising, glucose has to become available to muscle tissue to utilize.

Okay, you've stored glucose as glycogen inside of your muscle tissues and inside your liver. and that stored glucose has accumulated over the previous 24 to 48 hours and it's ready and its waiting for you at the very beginning of exercise.

So you start moving your body and now that glucose reservoir inside of the muscle fibers themselves can start to be degraded and sent to the mitochondria and turned into ATP and used as energy, which is great.

But in addition to that, as you are going through the exercise process and as your depleting your glycogen stores

inside of your muscle, your liver also has its own glycan storage warehouse and the liver says, you know what?

I think the muscle is gonna need a little bit more glucose. So I'm the backup system. Let me do a couple of things. Number one, I need to maintain enough glucose for the brain.

I am gonna be drip feeding glucose into the blood and ascending that glucose all the way to the brains. The brain can use that for every 24 hours a day.

But in addition to that, i also need increase the amount of glucose that i'm dropping into blood because that glucose is going to get sent to muscle and the muscles gonna use during exercise as its backup fuel source.

glucose availability inside of the blood and That's a really important thing because that means that your muscle tissue now has more fuel available to it should it need it and what ends up happening is that Your blood glucose can temporarily rise as a result of having excess blood.

Glucose or glucose in your blood then your adrenal gland also gets involved And your adrenal gland goes, oh, you know what? I have these things called catecholamines.

Let me go secrete a little bit of cortisol, let me secrate a bit adrenaline, and that's going to get the heart rate going higher. And that is going stimulate a very fight or flight style mechanism that will get me ready to be able to move quickly and sprint quickly, push things and move heavy objects.

So when you are in the middle of high intensity exercise, not even high-intensity, when your in middle exercise there is this whole cascade, this symphony of processes that are making glucose available in the blood, that they're knocking on the door of the liver and saying, hey, by the way, you have a bunch of glucose, put it in a blood now.

This is the time. And then your glucose starts to go into the, glucose gets elevated. So you could stop in middle of exercise, take a Polaroid snapshot of your blood glucose meter and say, uh-oh, we got problems.

My blood is currently at 162. Uh-Oh, I should probably stop exercising. That's bad for me. You could do that if you wanted to. Or you could say, no, the reason why I'm at 162 right now is because this is part of the background work necessary in order to liberate glucose to make it available for the muscle tissue so they can use it.

And then you can continue your exercise regimen and then guess what? As the session ends, your blood glucose is likely to come down and the best part is that in the resting state, this where the beauty happens in my mind.

There's a temporary rise in blood glucose, there's temporary rises in inflammatory processes, and there is a rise of blood pressure as you're exercising.

All of that is temporary. It's totally normal. In the post-exercise state, that's where the magic happens. Because now your muscle tissue is trying to repair itself.

So now it goes into net import mode where it's saying, okay, I need to import glucose, amino acids, fatty acids. Give that stuff to me so I can go repair these micro tears.

I have to go store more glycogen, manufacture more fatty acid and turn them into a triglyceride pool. And then simultaneously, blood vessels, they have to undergo a repair process as well.

They're manufacturing nitric oxide, which then goes and helps the mitochondrial network repair itself simultaneously. But long story short, over the course of the next call at 23, 36 hours or so, that's where the magic happens because insulin sensitivity can go up so dramatically during that period of time.

you can get non-insulin dependent glucose transport into the muscle. What that means is that the amount of glucose that can be put into muscle tissue is significantly higher in the post exercise state than it was pre-exercise because the tissue was opening its doors and it's saying, I need glucose now.

Exercise, Performance, and Blood Glucose

So it is allowing glucose to come in for free. You can kind of use exercise as a technique to boost insulin sensitivity. And if you repeat it on a regular basis, you end up with significantly higher insulin, sensitivity, which then relieves the stress on your pancreas overall.

That means the pancreates can go into a mode where it's no longer hyper secreting insulin because it doesn't need to anymore because the liver and muscle are so awake and so receptive and happy to see glucose.

that tiny microscopic amounts of insulin are able to put glucose inside of the muscle, inside the liver, and everyone's happy. So your pancreas goes, oh, this is the break I've been looking for, thank you so much.

And it turns down the volume and it reduces its insulin output because it doesn't need to do it as much anymore. Yeah, so move after your meal, right?

Yeah, move after your meal, no question. Move even before a meal in my opinion as well, right? Stimulate, you know, an opportunity to store fuel for free.

And you don't want to answer your question, You tell me what is your answer to this question as Well, when you see high performance athletes getting neurotic about a blood glucose elevation, what do you say?

Yeah, I think one of the interesting things about this too, and it translates not only for athletes, but just into the general public, we manipulate those things that we can measure.

But we forget, you know, as a good engineer, that it's a part of a larger system. And so rather than being myopic about manipulating our blood glucose, we have to step back as you just so elegantly helped us to understand and look at the system and say, what's happening?

You know, why is it elevated? We know sometimes we jump to the conclusion that it's elevated and that's bad. But as you showed us, it's elevated and it is necessary.

It's a part of an elegantly designed, fully aligned system that is providing for the body's needs in that moment when more is being asked of the Body than when it was at rest and the Bod is simply responding.

And I just tell people, like, listen, this is the way your body is designed. And as you explained, it's going to go up. But after exercise, four channels are going open up, glucose is going into the cells, blood glucose will go down, your insulin sensitivity will grow up and all of this is gonna help your body repair more quickly.

And the more important question, rather than just trying to manipulate carbohydrates or glucose, what kind of food are you gonna put in that's also gonna work with the repair regenerative systems of your to repair the oxidative stress and the micro tears in your muscles, tendons, and ligaments that came from exercise.

How are we going to assist your body in that entire process of recovery, repair, regeneration, in preparation for the next bout? And so I just like to help people understand that there's this grand design that we're not trying to manipulate, but we are actually trying harmonize with in our flow of daily lifestyle choices.

You're right. It's like, I think it's very easy for humans to miss the forest for the trees and say, oh, there's this one. I just learned about this thing called IGF-1.

So let me go super nerd out on IG-F1 as an example. And then I can construct a world in which everything related to IG F1 can turn into an enemy, right?

And if you do that, then you're like okay, well now I that these 12 things are gonna stimulate IGF-1 production, therefore you're gonna die. It's not a good thing.

You should eliminate all 12 of these things from your life. But if you back up and say, well, wait a minute, what's the purpose of IG-one in the first place?

Why is IGf- one, you know, it's a growth factor. What's its whole purpose? And you start to see, oh, its a small puzzle piece inside of a much larger complicated system.

Its part of multiple feedback mechanisms. Oh, Wait a Minute, hold on a second. Let me rewrite that idea, right? So, You know, you have to interpret everything.

That's one of the things I'm learning over the course of time. And I think there's a lot of people in the whole food plant based world that are learning as well, which is that you can't just interpret one system in isolation.

It doesn't work that way. You have two interpret systems in as a whole. Yes, interpret them in Isolation. But then you to zoom out and look at the hole picture together and say, how does this blood glucose system interact with this oxygen delivery system?

And how does this interact with the anabolic process of building, you know, lean muscle mass? And, how, does it interact, with, the process, of losing fat mass and how?

Does it affect my brain and, How does that affect, my cardiovascular system and my kidney? and then before you, know it all of a sudden you're like, wow, this is a pretty sophisticated machine.

I don't think I have many answers, but I do understand that all, these processes are interconnected. It leaves you with a sense of awe and wonder. And then the idea of just working with your body and being appreciative for this incredible system that exists.

You know, I love the term like harmonized human performance, understanding that we're all performing every day. This is not just Olympic athletes. But through the idea of harmonization, that's a symphony.

It's wind instruments, it's percussion, its brass, strings, all working in unison in ways that we can't even begin to imagine and appreciating that and stepping back.

And along with that, speaking of performance, but also it it is important for everybody with energy production and all the ideas of mitochondria in energy production, again, gets kind of pigeonholed into this idea that these are the powerhouses of the cell, as we all learned in high school biology.

But mitochondria are also an important component of insulin and glucose metabolism. So maybe just take a minute and walk us through this kind-of synergistic understanding.

Just, I think, to pull back a little bit with opening the aperture, Let's talk about mitochondria and relationship to this conversation that we're having.

Yeah, for sure. Okay. Mitochondria are some of my favorite organelles because I did my PhD and I studied mitochondrial biogenesis, which is the process of making new mitochondrion.

And it's fascinating. It's one of the most elegant processes in the entire human body. I love it too. You know exactly what I'm talking about. It's like this interconnected network of hundreds to thousands of different molecular players that are coordinating their actions between the mitochondria plus the cytoplasm plus, the nucleus in order to facilitate this construction project of building a brand new mitochondrion.

It is just unbelievable how complex it is. But the short story here is that mitochondria are the, you know, people refer to them as the quote-unquote powerhouse of the cell.

Okay, fine. So mitochondrion, most people think, okay, well, they're just in your muscle tissue. No, in fact, mitochondry are present in every single tissue in the human body with the exception of red blood cells.

That's the only cell type that doesn't have mitochondrial. And they're not just, it's not one copy of mitochondria per cell. You know, on the low end, some cells have a hundred copies of my mitochondrion, right?

On the high end. Some cells, have 4,000 copies. Okay. Depending on what tissue you're in, even within the muscles in the world of muscle physiology, a white.

muscle tissue which is a glycolytic muscle which effectively a muscle that doesn't have very much mitochondrial density can have something on the order of 500 copies of mitochondria per cell per muscle fiber.

But then a red muscle, what's known as an oxidative muscle can something like 2,500, 3,000 copies And it's an exquisite biology. Now here's the thing.

The reason why mitochondria are so numerous inside of cells is because it is the primary location where ATP is generated. And so ATP it the currency that cells use.

Mitochondria, Antioxidants, and Biogenesis

It's their energy source that they utilize to power every single biochemical reaction you can think about. So a cell has to be able to synthesize enough ATP in order to stay alive.

So, in the muscle tissue in particular, mitochondria are so incredibly important because muscles generate a ridiculous amount of ATP on a minute-by-minute basis, especially when you're in a middle of exercise.

They have to be able to synthesize and then utilize that ATP because the energy demands in muscle tissues are extremely high. But simultaneously, the energies demands inside of your brain are extreme high, The energy demands inside of your heart are extremely high.

And so as a result of that, all of these tissues have very dense mitochondrial networks. The mitochondria aggregate towards one another and they group together and form these networks because when they form networks, they can share resources.

and they can share nutrients between one another and basically protect one other inside of the cellular architecture. So everything is good and everything's fine up until the point where mitochondria end up generating these things called free radicals.

Now free radicals are kind of these pains in the butts because free-radicals, otherwise known as reactive oxygen species, are these molecules that are electronically unstable.

And generating free radical is just a kind-of natural byproduct of mitochondrial metabolism. It just happens. So when free Radical's are generated, you have to be able to neutralize the free Ratical as rapidly as possible because what free ratical do is they damage many different types of cellular structures.

They damage the mitochondria themselves. They damage the cellular membrane. They damaged the protein synthetic machinery. The damage, the existing proteins, they damage DNA in the mitochondria, DNA inside of the nucleus.

It's a disaster. So you can think about it as though you have a factory that's cranking out a bunch of cars. And that a good thing because you want more cars to be produced.

But if the by-product of manufacturing those cars is giant black smoke up into the atmosphere, well, that is a problem. So you're going to want to find a way to neutralize that black smoke while still manufacturing the cars.

It's this kind of simple way of thinking about it. So the black smokers in this situation are the free radicals. And the Free Radicals, because they can cause such extensive damage to the cellular environment, what you want do is provide them with something that will neutralise them.

The somethings that neutralises them are these things called anti-oxidants. An anti oxidant, I want you to think about as though it's a molecule. that has a bunch of electrons.

And the reason why it has bunch electrons is because the electrons are its currency. The antioxidant comes to the location of a cell and it senses that there is free radicals causing damage.

It says, hey, free radicles, I have what you need. Why don't you take this electron? I'm just gonna give you one electron and then that will satiate you so that you're no longer as hungry.

As a result of that now, the free radical gets neutralized. The free-radical stops being problematic. And it does this over and over, and, over again.

More antioxidants are present inside of your diet, the more electron donation can happen. the less problematic free radicals become for every single cell in every tissue.

So I like to think about one of the main reasons why eating a plant-based diet is so powerful for total body health is because the antioxidant content of a whole food plant based, of well constructed whole-food plant base diet is tremendous.

The antioxidant density that you get with every single bite of food is massive. As a result of that, whether you're eating green leafy vegetables, or whether eating mangoes, tomatoes, Indian gooseberries, cacao powder, You're getting different antioxidants, aka different polyphenol compounds, that have different structures, different shapes, and different sizes, but you're also getting so many of them that when you put them into your mouth, they get inside of your blood, start to donate electrons to all tissues, neutralize free radicals, make the mitochondria happy, everyone wins.

So in order to keep mitochondria happy, I'm always a huge fan of a whole food plant-based diet, no questions asked. But in addition to that, i also want people to understand that your mitochondrion are the engine that drives everything inside of you.

So treat them well. Yeah, and one additional benefit is, you know, not only having more antioxidants available, but whole plant foods, broccoli, et cetera, reboot our own body's natural antioxidant systems, like glutathione.

Bingo. And so we're rebooting antioxidant systems, we have more antioxidants available, We're reducing oxidative stress simply through dietary means as well.

So it allows for this maximum efficiency of mitochondria. Maybe just as we kind of wrap up this section, let's talk about mitochondrial biogenesis because I love the efficiency, the protection, but there's also the opportunity which always blows my mind that the way that we live, through pathways like PGC1 alpha can increase mitochondrial biogenesis.

So maybe tell people what that is and why that's just stunning. Yes, great question. Why you and I get excited about this? I know, super nerd time. Okay, so the world of exercise physiology has clearly demonstrated that if you want to make more mitochondria, the most powerful way to do it is to go and exercise.

You put yourself into what's called a hypoxic state, meaning an oxygen deprived state. And oxygen deprivation leads to mitochondrial growth after oxygen depravation is over because when you restrict oxygen, then the mitochondria go into a very high stress state.

And in order for them to actually become stronger, the whole network has to manufacture more mitochondrion so that they can handle more oxygen. All right.

So that's why exercise is so powerful because it then stimulates the need to manufacturer more, which then increases the ATP production power of a given cell.

Now. There's actually some biology which has been demonstrated over the past 15 years, which demonstrates that you can actually stimulate mitochondrial biogenesis just by eating specific foods.

These are polyphenol-rich foods that have incredibly powerful mitochondria, direct mitochondrion effects. And these foods, they're the most antioxidant- rich foods you could find.

One of them is cow, raw cacao powder. Okay, or I should say uncooked raw cacao. What you do is you take this raw cocoa and it contains a polyphenol known as epicatechin.

An epitatechin has direct mitochondrial crosstalk ability. In addition to that, acai berries have a very high poly phenol content. They can also stimulate mitochondria biogenesis.

The talk to very specific complexes in the mitochondrion network and they can generate, they stimulate the production of new mitochondrio. In addition to that, there's a polyphenol known as genistein that comes from soybeans, and genestein is a very powerful mitochondrial biogenesis stimulant.

In additional, resveratrol from the skin of red grapes, that's another very power mitochondria biogensis agent. And in addition, to there is another one, nitrate-rich vegetables, I should say.

Beets. arugula, spinach, swiss chard, celery. These foods indirectly stimulate mitochondrial biogenesis because what they do is when you eat them, they contain nitrate compounds.

The nitric compounds are turned into nitrous oxide inside of the endothelial lining of your blood vessels. Nitric oxide is a gas. Nitric oxide dilates blood vessels and reduces your blood pressure, which is a very good thing.

But one of the side effects of nitric dioxide is that it can talk to mitochondria in the nearby area. And as a result of doing that, it actually helps stimulate mitochondrial physiology.

It makes mitochondrion more efficient, and it provides a stimulus to manufacture more mitochondry after exercise. So my recommendation would be, I want you to do two things.

Number one, to move your body every day periodontal story. Okay. I wants you move body because that's what it was designed to. When you moved your buddy, you stimulate mitochondrial biogenesis.

And then simultaneously I watch you eat polyphenol rich foods because those poly phenols can then help also stimulate more mitochondria biogensis and the recovery state.

Do you do those in a regular basis? I do. My smoothie is a lot of those foods every single morning. Yeah. Can't go wrong. I love it. No, you can't go wrong.

And I, when you were just talking about movement, this is just a quick story. I remember when we were speaking on the cruise and you and I at 6 a.m. were in the gym together.

Yeah. We had so much fun. It was incredible, yeah. Yeah, I love working out with you. I'll do that any day of the week. But secondarily, you know, it takes a special type of person to say, You know I'm on vacation, technically, but I am still going to get up at 6 o'clock in the morning and I still gonna go do something really hard because, not because somebody is telling me to do it, because I just love it.

And it is really fun. You get such a powerful benefit from it right? And the community. I love the communities too. Light-minded people. A hundred percent.

Nothing better than sweating with a friend, right, in a gym. Oh it's the best. It's the best. It is great. Especially first thing in the morning because then you earn the ability to go eat a lot of food without any guilt.

And then, you can put those mangoes in your mouth and say, oh, I'm insulin sensitive. My mitochondria need this

mango. I am not going to worry about it.

That perfect segue is kind of my final big question. What does metabolic freedom look like for people? Metabolic freedom is a hopeful concept, and that's one that I really appreciate that you teach.

Metabolic Freedom and Closing Reflections

It's restoring trust in the body. as we talked about, your body is magnificent and it's restoring trust in these inherent, aligned, magnificent systems that are present.

It's allowing us to expand food freedom without guilt, as were talking about eating mangoes and not feeling guilty because we have this idea of metabolic freedom.

and helping people to live with more energy and more confidence. So maybe just kind of describe that idea of like metabolic freedom for people and what it feels like to life that way.

I would say metabolic freedom to me is the state in which you are living a lifestyle that has been documented by scientific research that is not a hope, it is a dream, not prayer, but has effectively been proven by science.

to be incredibly effective at reducing the risk for chronic disease and or reversing chronic diseases. Because the unfortunate truth is that a large majority of the United States population is obese and an overwhelming majority the world population now is suffering from one or multiple chronic And to a certain extent, sometimes I find that we don't need more research.

We don' need to investigate anything further because I believe that I already have the answers. And the answers are very simple. And when you put those answers into play, which is a whole food plant-based diet, moving your body on a regular basis, minimizing or avoiding alcohol and addictive substances, getting plenty of sleep on daily basis.

Which is limiting your stress and operating in a low stress environment. Eating a large diversity of plant based food on regular bases. All of these stimulate a freedom within your body that minimizes your risk for chronic disease and can reverse any chronic diseases that you currently are living with.

Yeah, that's powerful. That is a hopeful statement for people. And for all of you listening, if you want more information, Cyrus, where can they find you?

Thank you, by the way. I appreciate it. This has been an awesome discussion. We could talk about this for years. You can find me at, I have a company called Evolution Health.

So you just go to Google. The easiest way to do is go Google and just type in Evolution health Cyrus. That's the easiest thing to. You'll see the website and there, you know, we, have, programs that can help people completely transform their life, lower blood glucose, cholesterol.

blood pressure and lose weight permanently and do it via as much natural methods as possible. And we're here to help in any way, shape or form. I appreciate all the time and attention that you've given today.

So thank you so much. Yeah, you're welcome, Cyrus. And so people understand this is a coaching platform. They can get individual coaching to help translate the science into a healthy lifestyle.

You got it. Yeah. It's actually a 12-month-long lifestyle change program that is 100% evidence-based. No fads, no gimmicks, nothing. And it's a guaranteed process, it works.

We're here with you every step of the way to walk you from a position of having multiple chronic diseases to minimizing or getting rid of them completely altogether and reducing your need for pharmaceutical medication.

It's so fun to watch people change, It really is. it is one of my favorite things. I feel like it the reason why I'm on this planet, and it really just that simple.

Yeah, there's nothing better. So last question for you, Cyrus. You know, I just like to ask people because you live with vibrancy and joy. And so what quote, concept, belief or idea allows you to live vibrant energy and enjoy every day?

What is it that like inspires you? If you'd asked me this question four years ago, i might have given you a different answer. But now, I gotta say, my daughter, Indigo, I look at her every single day and I think to myself, wow, she's the most incredible thing I've ever seen before.

I love her more than I ever thought I could. And I wanna be the best version of myself physically, emotionally, mentally, every step of the way so that I can demonstrate for her what's available in her life.

and, and want to be a role model for here that she grows up thinking like, My dad's superhuman. That's what I want. And just the thought of her looking up to me keeps me going all day, every day.

It's something that doesn't seem to ever get old. Thank you for joining me for this conversation. Our conversation was really deep and profound, perhaps more profound than people might realize.

The information that you shared took you decades to uncover. It is not something that people learn in medical school, PhD programs. This really took years and years of personal, intensive study.

to gather what you have and then to be able to disseminate that information in a package that we all can take in and assimilate and enjoy. It's like taking the raw pieces of food that you buy at the farmer's market and creating a magnificent curry.

That's what I feel like we've enjoyed in this afternoon with you. So I'm really grateful, Cyrus. I appreciate your friendship. And I'm really privileged that you joined me today and that shared all this information with my audience and look forward to many more opportunities to get together.

And hopefully it'll be at the Power to Play conference next year, 2027, and we'll have you up there speaking. Thanks everyone for joining us, and I'll see you again on the next A Regenerative Life podcast.

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