



**Understanding the Biochemistry of Energy Production  
OR Understanding the Super Nerd Biochemistry of  
Energy Production OR The Super Nerd Biology of Energy  
Production (something like that)**



**Tom McCarthy interviewing  
Cyrus Khambatta PhD**

**Tom McCarthy**

I am so excited about our next guest. He's got a million watt smile which you're gonna... He's just starting to unleash it right now. You'll see it if he's not coming up right now, but he is become actually somebody that I really have grown to love. I love this guy, love being around him. He's just got such great energy, and his name is Cyrus Khambatta, and he's a PhD in... actually, what are your PhD in Cyrus.

**Cyrus Khambatta PhD**

It's in super nerd it's called nutritional biochemistry.

**Tom McCarthy**

Nutritional biochemistry and he got his undergrad degree at Stanford, which is quite a feat in itself. And then he went to Cal another great school to get his PhD. And I'm gonna hack... I'm gonna actually have him tell this story, and I'm curious if you were always interested in this, but when he was in Stanford, things were probably going pretty well. And then all of a sudden, The Global Energy Healing Summit, his energy wasn't there and ended up finding out that he had diabetes and type one diabetes, not type two diabetes. I mean, you look at him now he's incredibly healthy and fit, but he figured out a way to master diabetes. And he's sharing that with the world, thank God. 'Cause so many people still think you get diabetes, you're a victim of it, you can't live a healthy and full life, and not only is he sharing it with people, but he's sharing it by his example of actually doing that. So we'll dive into that a little bit too. I do wanna explore that a little bit Cyrus, but Cyrus, welcome to our summit. I know you're gonna help a lot of people with not just diabetes but with chronic



illness or not enough energy as we delve into to the discussion today. So thank you so much for being here.

**Cyrus Khambatta PhD**

Yeah, thank you Tom, I appreciate it. When we were first talking about The Global Energy Healing Summit, I thought it would be kind of fun to talk about energy from the biochemical perspective, because a lot of the times when people refer to energy, it has many different forms. We can talk about like how much energy do you have? like how much mental energy, how much emotional energy do you have? How much physical energy do you have? But from a biochemical perspective, there's a very clear description of what is energy and how is energy created? How is energy used? Which tissues are responsible for using it? How does the food you eat affect your energy levels and beyond? So, if you wanna geek out on a bunch of fun stuff, we can definitely do that today.

**Tom McCarthy**

We'll definitely have some fun and you got Mr. Energy right behind you, Albert Einstein.

**Cyrus Khambatta PhD**

That's right, my man.

**Tom McCarthy**

It's basically we interpreted to energy, E equals everything, everything is energy. So what we eat is energy our thoughts are energy, everything. So go back to Stanford, I think, was it your senior year where you started having these issues and tell us a little bit about what happened. And also I'm curious when you talk about it, did that really shift your course into the realm of what you're doing now? Not just the diabetes, obviously it shifted you in that way, but really studying the food and getting into the PhD level of that. Was that something you're already on the course too, or did this situation that happened, that you're gonna described, did that puts you on the course to it?

**Cyrus Khambatta PhD**

Great question, great question. Okay, so if we go way backwards in time, when I grew up, my mom always used to refer to me as, The son or the kid that she just couldn't tame. I was



the third of three kids, I have two older sisters, and I remember what it used to feel like to be three years old, five years old, seven years old. Where I would wake up in the morning and I was just a hellcat. I mean, I was just running around doing all types of stuff. I'd played baseball, I'd play soccer, I'd play basketball, I'd do running, I'd go swimming. And so my mom's objective at that point in my life was just to put me into every single sport that was available. So that by the time I got home, I was relaxed and it worked because I would go play baseball then I would go to basketball practice. And I just developed this love of sport from a very young age, right. So that was normal to me to be always active, to be performing some kind of physical activity and to really be sort of like competing in a fun way. So by the time I got to college, this is like, 18 to 22, 18, 19 20, I was still active, I was still lifting weights, I was still playing soccer. And then by the time I hit 22 years old, I noticed there was this a fundamental shift in the way that I felt. And I couldn't explain exactly why, so this is like November of 2002, and I'm sitting there and I'm studying for finals. And I'm trying to go through... I was studying mechanical engineering at the time, and I'm trying to like learn thermodynamics and physics and trying to really apply myself. And there came this point in one day when I was sitting there studying that I kept on falling asleep and I was like, whoa, like what is going on? This is very weird and in addition to that, I noticed that my thirst was insatiable.

I mean, I've definitely been thirsty in my life, but this was a whole different level of thirst, right. So what I would do is I would drink a glass of water, put it down and then I would continue studying. And I was like, "Wow, I think I'm thirsty or thirstier than I was five minutes ago." I drink another glass of water, put it down. And I was like, "I think my thirst is growing," right. Then I went and got some Gatorade thinking well maybe I'm electrolyte depleted. So I drink some Gatorade and before I knew it, I was like, "Oh my Lord, what is going on? My thirst is growing and I'm getting more tired." And so, because I was taking on so much liquid, I would then go start urinating frequently. So I was urinating like literally every 30 minutes like clockwork. And so I picked up the phone and I called my sister and she is a doctor of osteopathy and she's a family practice physician and she is mindbogglingly smart. And so I picked up the phone and I said, "Hey, Shanice, can you help me out? Here's my symptomology, this is what I'm experiencing. Have you ever heard of this before?" And she's as cool as a cucumber under pressure, and she just started crying immediately and she was like, "Cyrus, drop everything that you're doing right now go straight to the health clinic." And I was like, "Wow, what's going on?" And she said, "You're explaining that you have type one diabetes, those are all the telltale symptoms of it, this can be a very dangerous situation, I don't want you to freak out, but just go." So I went straight to the health center, they checked me in, they checked my blood glucose 'cause they know



the warning signs as well. And my blood glucose, at your normal physiological blood glucose is between approximately 70 and 130 on a daily basis. So if I were to check your blood glucose at any moment in the day before you ate food, after you ate food, it doesn't matter. Your blood glucose would be usually within that window. Okay. Now, at that moment, my blood glucose was in the 680s.

**Tom McCarthy**

Wow.

**Cyrus Khambatta PhD**

I mean, we're talking like a whole different... I was six times higher than it was supposed to be. And I didn't know any of this language, I didn't know what blood glucose was, I didn't know anything about human biology, I didn't know anything. I just was like, "Should I be worried?" And they were like, "Listen, we're gonna take you straight to the hospital." Took me to the hospital, 24 hours later, I got diagnosed with type one diabetes. So in the hospital they gave me IV fluids, they gave me a drip irrigation of insulin. And the whole purpose was to try and figure out what had gone wrong. And while I was there they diagnosed me with three auto-immune conditions. So the first one was actually called Hashimoto's hypothyroidism, which is becoming very more prevalent in today's world. So that's an auto-immune dysfunction of your thyroid gland, which decreases your thyroid hormone output, that's number one. The second one is called alopecia universalis, which is basically saying hair loss. And so as you can see, I used to have hair, but I don't have any hair, I had no eyebrows, no eyelashes, no ear hair, nose hair I got nothing on me.

And at that time I was losing my hair and they recognized that I actually had alopecia. And then in addition to that, they said you also have type one diabetes, three autoimmune conditions back to back to back. And I was like, "Whoa, what did I do? Did I do something wrong? Like, am I eating incorrectly? Am I, am I stressed out too much? Am I drinking too much beer? Like what, what is the problem here, right?" And so nobody has the answer to that question, even to this day, nobody can pinpoint exactly why I developed type one diabetes or Hashimoto's or alopecia. That answer still is un... That's still unanswered. Point being is that, that set me on the path to trying to figure out how to become a healthier individual, right? So for the first year of living with type one diabetes, I followed the recommendations of the medical world, which is to eat a low carbohydrate diet. So it was 2002 and the recommendation was eat a low carbohydrate diet because a low carbohydrate diet will help you lower your blood glucose, it'll help you use less insulin and



your life with diabetes with type one diabetes will just be easier, period end of story. So I was like, "Okay, great."

**Tom McCarthy**

Low carbohydrates, so you're eating mostly protein or what are you eating then?

**Cyrus Khambatta PhD**

Yeah. So what you're eating in a low carbohydrate setting is you're eating lots of... You're eating red meat, white meat, chicken, fish, dairy products, lean meats, whatever that really means. Plus things like peanut butter and olive oil. And what you're trying to reduce your intake of is things like breads and pastas and cereals as well as fruit, as well as potatoes. So I refer to those as being more like whole carbohydrates, the fruits and the potatoes. And they're telling you to lower your refined carbohydrate intake as well. So by doing that, you're eating less carbohydrate, which means that your blood glucose value will become more stable and as a result of that, you can probably get away with using less insulin. So that was the promise.

**Tom McCarthy**

But it didn't work for you, right?

**Cyrus Khambatta PhD**

Not even close, I mean, Tom, I wish I had my blood glucose meter from back in the day. I wish I had the data because my blood glucose was a total disaster. And again, blood glucose is supposed to be relatively well controlled between about 70 and 130, if you're living with type one diabetes, they say 70 to 180 to account for just a little bit of human error, but it was such a struggle to keep my blood glucose within that window, then on any given day, my blood glucose could be as low as like a 40, which is like a very uncomfortable and potentially life-threatening situation and as high as like a 340.

**Tom McCarthy**

Wow.



**Cyrus Khambatta PhD**

So I was literally like, ping-ponging up, down, up, down, up, down. And when you do that, it really takes a toll on your emotions, it takes a toll on your mental health and it takes a toll on your physical health as well. So, within a year of eating a low carbohydrate diet, my glucose was relatively uncontrollable, my insulin use was creeping up over the course of time, it started at like 25-ish units per day, and went north of 45 to 55 units per day.

**Tom McCarthy**

How frustrating was that, you're doing everything they're telling you and it's not working, right?

**Cyrus Khambatta PhD**

Yeah, I mean, it was frustrating, honestly, it was so frustrating that I was like, I remember coming home from work one day, checking my blood glucose, doing everything right. I played a game of soccer in the middle of the day, I went to the gym and I lifted weights and I was eating exactly the way that I was told. And I come home to check my blood glucose before dinner because I'm excited to eat dinner. And I'm looking for a number that's between 70 and 130, and I get a number of 286. And I picked up my blood glucose meter and I looked at the wall and I threw it against the wall as hard as I possibly could and it just shattered. And then I fell into the couch and I started crying and I was like, there has got to be an easier way. This is dumb, it should not be this way. So that is what set me on the path to answer your question. That's what set me on the path to trying to learn more about human nutrition, to try and to learn about how I could apply a sort of more evidence-based approach to my own personal health. And then also to try and find a way to eventually help other people that are also going through either type one diabetes or prediabetes and type two diabetes. And so long story short, I went back to... I changed my diet to becoming fully plant-based. So I went from eating a low carbohydrate diet to eating 100% nothing but fruits and vegetables. And my blood glucose became so controllable so quickly that it was like, I almost didn't believe it. Okay, so my blood glucose used to be ping ponging all day long and by eating a plant-based diet, all of a sudden my blood glucose came down, my insulin use came down very quickly. I'm talking about a 40% reduction within the first week, which is a big deal in the world of type one. And I had more energy, I was more hydrated, my sort of anxiety about type one diabetes and the depression that I was living with at that time tended to just kind of go away and I felt like a million bucks.



**Tom McCarthy**

Yeah.

**Cyrus Khambatta PhD**

So I then put myself back to graduate school to go get a PhD in nutritional biochemistry so that I could really learn the nitty gritty, super nerd scientific details to try and answer a simple question, which is am I a freak of nature? Meaning is what happened to me end of one story, or is what happened to me something that's actually described in the medical literature and can this also be applied to other people. And in the process of going through graduate school and reading thousands of papers, it became very obvious to me very quickly that number one, there's literally almost 100 years of scientific information that demonstrates the power of eating a high carbohydrate slash low fat diet that is rich in plants. And that research dates back all the way to the 1920s.

**Tom McCarthy**

Wow.

**Cyrus Khambatta PhD**

So that's number one and then number two, what I was experiencing not only had been described in the literature, but it had actually been described to people living with prediabetes and type two predominantly. And so if you look at that information, you go, okay, great this could be a potential solution to the sort of epidemic of diabetes that we're experiencing right now. And what's even cooler is that this way of eating not only pertains to diabetes and blood glucose control, but it also is a very powerful cardiovascular health improving tool. It's also a very powerful, permanent weight loss tool, it's also a very powerful microbiome changing tool. So as a result of that, I like to think of a plant-based diet that is truly low in fat as being a very powerful solution to reduce your risk for chronic disease and reverse many existing chronic diseases at the same time.

**Tom McCarthy**

Well, and even just a anti-aging and fitness, you look like you're about 25 years old, 24 years old but you're a little bit older than that, right?



**Cyrus Khambatta PhD**

Yup definitely 41, 41.

**Tom McCarthy**

Yeah 41 Years old but I mean, you just... I mean, you're so fit and lean and a lot of that, I know you probably work out but a lot of that is part of your diet also. I think that your experience as tough as it was and explaining it we don't even get the depth of what it meant when you threw the glucose monitor against the wall and it shattered and you're crying in the couch, but it was those times that allowed you to really have the courage to venture beyond what everyone else was telling you what to do, and really find the secrets. And you ended up writing a book called "Mastering Diabetes" which was a "New York Times" best seller. You've done big summits like this where you've helped so many people, you've got coaching programs. So as tough as that time was, it was in the end a gift for so many people that you went through that experience, so you could learn how to help so many. Now, today, we're gonna discuss maybe a little bit about diabetes, but we're gonna go beyond that we're gonna be talking about energy. And when you went to get your PhD in nutritional biochemistry, you really were studying energy, everything is energy, food is energy, cells are energy, everything is energy. Give us a look or some insight into the biochemistry of energy inside every single one of us, what's going on inside?

**Cyrus Khambatta PhD**

Okay, so a simple way to think about energy inside of an organism, whether that organism is an amoeba or whether it's a chicken or a cow or a duck, or a raccoon or a human being, or a whale. Cellular energy from an organismal perspective, from a biological perspective comes in the form of a compound known as ATP, okay. So, ATP is called adenosine triphosphate, don't worry it's not gonna be on the quiz, but the idea here is that ATP is literally the thing, the compound that can be exploited that it contains energy such that when it is oxidized it can then yield energy. And that energy is then used to power chemical reactions that then perform useful work, right? So the ATP is the currency of biological systems. If you don't produce enough ATP there are consequences for that, if you overproduce ATP there are consequences for that, if you consume a fuel that inhibits your ability to manufacture ATP there are consequences for that, right? So you can really think of ATP as being basically the gasoline that enables an organism to exist and thrive.



**Tom McCarthy**

Before you go further though, you said something interesting. And thank you by the way for explaining it, I didn't go to Stanford. So thank you for explaining or calling it for explaining in a way that I can understand it. So I appreciate it.

**Cyrus Khambatta PhD**

Oh come on you got this.

**Tom McCarthy**

So many of us, we need that little bit lower level, but still really juicy so thanks for that. But you said you're in trouble if you don't have enough, you also said you can have too much. So, that's interesting 'cause some people go, I want more energy and maybe you think there's never enough you can have but there... And I know that you'll address this later, but there could be an issue if you have too much of it going on inside you too, right?

**Cyrus Khambatta PhD**

Definitely, definitely. So, a way to think about this is that your... Okay, your body as an example, okay. You are a human being and you have a certain rate of energy production inside of your body, okay. So when I refer to energy production, I mean, a certain rate of ATP that's being oxidized in order to power chemical reactions in your body that enable you to be alive. So these ATP, the ATP that powers these chemical reactions is required in order to operate your heart muscle, to operate your lungs, to operate neurons in your brain, to operate your eyes, to operate your sexual organs, to operate your liver, your kidney, your pancreas, you name it, okay. And then in addition to that, when you go and exercise, if you're gonna go outside and play a game of tennis, as an example, you also have to have the ability to perform, to use ATP that's stored either in your muscle or in your liver to power that physical activity as well. Right? So a simple way to think about it is that there's basically three components of what enable you to expend energy. In other words, your total energy expenditure is divided into three buckets. The first bucket is called your basal metabolic rate, your BMR, okay. And that refers to how much energy is required, how many calories does it take to power your body if you were just lying down flat on a table for 24 hours. Okay. so your BMR is basically, it's your basal metabolic rate, meaning how much energy does it take to just power Tom's body, period, end of story, okay. That's number one, bucket number two is called your TEF or your thermic effect of food, and that refers to how much energy is required in order to digest the food that you're consuming, okay. 'Cause when you



consume food, there's actually energy required by your digestive organs to digest that food and then transport those nutrients to other tissues, okay. So you got your BMR, you got your TEF and then you've got your third one, which is called your activity, okay. So again, if you're gonna go play a game of tennis, you're gonna go and play basketball, you're gonna go run around, there's energy required in order to operate your musculature at that point. So there's gonna be a certain number of calories that are required to move your hamstring muscle and move your glute and so on and so forth in order for you to be an active individual. Or if you're just gonna go to the grocery store and buy some stuff and come back home, again, that's activity, we're still gonna have to account for all of those, the energy required to perform that action, right? So if you add together your BMR plus your thermic effect of food, plus your activity, you'll get what's called your total energy expenditure. Now, that total energy expenditure is a very important number. And I don't know what my total energy expenditure is right now at this moment in time and chances are, you probably don't know what yours is either. Most people aren't walking around with a calculator that says, okay, great, your total energy expenditure is this number, but for the sake of argument, what we could do is we could open up a calculator and we could make some assumptions and then we could do some calculations and figure out what your total energy expenditure is. So I'll give you a hazard a guess for you based off of what I know about your lifestyle, I would say, how old are you?

**Tom McCarthy**

60 Years old.

**Cyrus Khambatta PhD**

60 Years old, 60 going on 35. So your basal metabolic rate is probably somewhere in the, I would call it somewhere between 1400 and 1600 calories per day. So let's just average it to be about 1500 calories per day. Okay, thermic effect of food is gonna be about 10% of the energy that you're consuming. So I'm gonna put that at another 250 calories right there, okay. So 1500 plus 250 and then your activity level, how many days a week do you exercise?

**Tom McCarthy**

Something every day, varies in intensity, but I do something every day, so seven days a week I'm doing something, yeah.



**Cyrus Khambatta PhD**

Okay, and then like how many minutes per day are you exercising?

**Tom McCarthy**

Sometimes it's qigong, so it's not super high intensity, I could go like 30, 45 minutes, that cycling I do indoor, we've got one of the indoor cycles here in the house, so probably 20, 25 minutes, and then play pickle ball sometimes for an hour. So it really varies, but not super high intensity. I'm not grinding out CrossFit, so more moderate some type stuff, yeah.

**Cyrus Khambatta PhD**

Perfect, okay so then based off of what you just said, I'm gonna estimate your activity expenditure to be somewhere around 400 calories per day, yeah. 400, maybe 500 calories so if we add together 1500 plus 250 plus, call it 500, that puts us at 2,250 calories per day. So that's the amount of energy that you're gonna expend on a daily basis, again, that's the ATP that's inside of your heart, your liver, your blood vessels, your muscles, you name it is required in order to power those calories, that's gonna operate your body, right? So to answer your question here, how do you have over nutrition? How do you have too much ATP on you, okay? How do you have too much fuel on you? In an ideal world, what would happen is that if you're burning 2,250 calories per day, then you would ideally take on almost exactly 2,250 calories per day and if you did, then the amount of energy that you're taking on is equivalent to the amount of energy that you're expending. And as a result of that, you would be in energy neutrality. Right? And that would be a good thing because that would enable you to remain weight stable.

You would not gain weight you would not lose weight. You would be energy neutral, right? But what happens in today's world is that due to refined and packaged and processed foods, due to foods that are extremely high in fat, due to processed meat consumption, due to dairy consumption, due to the consumption of just high calorie foods in general. What most people don't realize is that they actually consume more calories than their total energy expenditure. So for somebody else who might be living a sedentary lifestyle or somebody else who might be eating a very high fat diet or a diet that contains a significant amount of animal-based foods in general, they may be burning 2,250 calories per day, but they're taking on 2,900 calories per day. And so there's an energy surplus so that, 650 calories of energy surplus has to go somewhere, well, where does it go? Well, it goes into multiple locations, it goes into your adipose tissue, your fat tissue, okay. And it actually gets



stored as excess fat, which can then lead to weight gain over the course of time. Some of that energy can actually get stored inside of your muscles as triglyceride, some of that energy can get stored inside of your muscles as glycogen, some of that can get stored inside of your liver as well as either triglyceride or glycogen. So point being is that your body can act as a Costco warehouse to take on the excess energy that you're putting into your mouth. Right?

**Tom McCarthy**

Yeah.

**Cyrus Khambatta PhD**

And then at the same time, the flip opposite happens as well, where your energy expenditure is 2,250 per day, but yet you're only taking on 2000 calories per day, okay. And maybe that's because you're highly stressed and you forgot to eat food, or maybe you're performing an intermittent fasting regimen, or maybe you're very... I was gonna say, you're so active that it actually suppresses your appetite, and that happens for some individuals. So point being is that when there's an energy mismatch, when you're burning more than you're taking on, now there's an extra couple of hundred calories, which have to come from somewhere. Well, where does that come from? It comes from the tissue that you already have on your body. And so your muscle tissue in that situation ends up actually being catabolized. And the amino acids that are inside of the muscle protein can get broken down and liberated from the muscle. And then it can get sent to your liver to get converted into another fuel, oftentimes glucose, and that glucose is then used to actually power more chemical reactions, right? So point being, is you can gain energy, you can lose energy. And it all depends on the balance between how much you're taking in and how much you're spending.

**Tom McCarthy**

That's fascinating and when... So someone is trying to lose weight, they are eating in a way and or eating in a way where they are taking in less calories than they're burning, is that correct?

**Cyrus Khambatta PhD**

That's exactly right.



**Tom McCarthy**

Yeah, you've explained it in a way that makes a lot more sense than I've ever thought about, so really, really cool. You talked about intermittent fasting and I know that that's something you do, correct?

**Cyrus Khambatta PhD**

So it's not something that I do, and the reason for that is because my energy expenditure is like 3,400 calories per day, okay? And the reason it's 3,400 calories per day is because I have a pretty darn high basal metabolic rate, I also love to exercise and my thermic effect of food is also a little bit higher than the average person. So if you put those three together, that sum total comes out to being 3,400.

**Tom McCarthy**

You need a lot of calories, you need to be eating and throughout the day.

**Cyrus Khambatta PhD**

Yeah exactly, so I have to eat a significant amount of calories. And if I were to perform an intermittent fast and not eat food, it would be health promoting for sure. But I would end up sacrificing, I've tried this before, I ended up losing weight and I don't wanna lose weight, right.

**Tom McCarthy**

Now, what are your thoughts on an intermittent fast? And that's a big topic right now. what do you think about it?

**Cyrus Khambatta PhD**

Yeah. Intermittent fasting is actually one of the core principles inside of the method that we've developed specifically to help improve blood glucose control, to reverse the underlying cause of many chronic diseases called insulin resistance. And so, I've read the literature on intermittent fasting, I literally did my entire graduate degree on it and it is unbelievably powerful. It's more powerful than almost any other intervention that I can think of, right. So we are huge fans of it, and what we try and tell people to do is to... If you're a beginner at intermittent fasting, the easiest thing to do is perform a 24 hour intermittent



fast for one day a week. So you just literally choose one day of the week where you're hopefully not gonna do too much exercise, and you would basically not eat food for 24 hours. So you would say... Let's say you would eat dinner on a Wednesday and then you would stop eating food right after your dinner. And then you would basically go to sleep, wake up on Thursday morning, skip breakfast, drink some water, drink some green tea, suppress your appetite a little bit, and then keep moving forward, skip lunch. And then by the time you get to dinner time on Thursday, approximately 24 hours later, go ahead and eat some food again. Right. And so that's a simple way to kinda get started with the process, but people who have done that multiple times and they really understand what it feels like to go without food for 24 hours, we then tell them to do a daily 16/8 intermittent fast, where they're basically fasting for 16 hours and condensing their eating period to being about eight hours. So you can think of it as being like, you start eating at noon and you finish eating at 8:00 PM. Right. So in that window, you can eat lunch, maybe you have a snack and then eat some dinner, just don't overeat, just eat a reasonable amount of food during that time.

And then the rest of the time you're gonna fast, and what we've seen, not only from the literature, but also what we've seen in having road tested this in thousands of people is that when you perform an intermittent fast and you become a sort of habitual intermittent faster, you would think that by going into an energy deprived state where your, again, your total energy expenditure is now higher than your energy intake, because you're skipping a meal, you end up creating that calorie deficit, you would think that you would become very low energy, you would think that it would sort of like turn down the volume or turn down the thermostat inside of your body and you would sort of like, you'd get tired, you wouldn't want to move your body as much, but the exact opposite happens. When I was in graduate school we did a lot of experimentation using mice and rats, 'cause that's sort of the model that you use to test out many different things. And one of the things that we found every single time that we performed calorie restriction and or intermittent fasting on these animals is that the animals that ate less food were more active. We would go in to feed them, and the group that was eating that had access to a buffet, all you can eat buffet, those animals were very sedentary, they were very lethargic. The animals that were calorie restricted were running around their cages and they were looking, they were forging, and we hypothesized that it was because they were literally looking for their next meal, they were trying to figure out what they were going to get, right. But in human beings that also same thing happens whereby restricting your calorie intake can lead to an increase in your feeling of having energy. And part of that is due to the fact that if you're losing a little bit of weight it can relieve a little bit of the metabolic stress that's on your liver, that's on your



muscles, that are on your heart. And as a result of that, you might just feel like you have more energy, you might become a little bit more mentally active and get rid of a lot of this sort of brain fog that people refer to and just start to feel better, period, end of story.

### **Tom McCarthy**

Yeah, and I'm a fan, but I don't actually do it, I don't need to... I don't usually wait till noon, but early dinner too. So sometimes I'm eating something at 10 if I've got a lot of activity in the day, sometimes 11, but I don't eat past 6:00 PM or 7:00 PM. And it's amazing, and plus at age 60 it just does keep you nice and lean when I might not have the metabolism of a youngster like you at 41. So yeah, it is amazing. The other thing it does too is it changes your relationship mentally with food because I used to be... They used to say, get up, have a good breakfast. Right. And so the first thing you think about is, all right, what am I gonna eat? And when I get up I don't think about what I'm gonna eat 'cause I know I'm not gonna eat right away. So I can do my qigong, I can do my meditation, I can do my workout and just feel good. That's what I'm eating, I'm eating this workout or this qigong practice. And yeah, it really... The hard one to me is probably going a whole day, although I have done that, but a whole day for some people when they're just so used to just thinking about the next meal, you guys getting them to do that that's really powerful too, I love that.

### **Cyrus Khambatta PhD**

Yeah, for sure. I mean, it definitely, it takes us sort of at the beginning of the intermittent fasting process, it feels weird because most people haven't really deprived themselves of eating food for many years, but once you become used to it and you understand what it feels like to either become a little bit hungry or to become hangry, which happens to everyone, they get a little bit like upset. Once you go through that process multiple times, you recognize, number one, you're probably not gonna die, even though your brain likes to tell you that you are, nothing bad is gonna happen to you, in fact, it's actually a extremely healthy way of being. Here's a fun calculation that we can do, you've probably heard this before where people say, hey, how long do you think you can go without drinking water before you died? Right. And how long do you think you can go without eating food before you die? Right. And the truth is that you're gonna have to drink some water before you eat some food. Right? And as far as water is concerned, the answer is probably somewhere between four to seven days, maximum. And at that point you don't have enough water, you get super dehydrated, not compatible with life. Right. But when it comes to food, okay, you can easily go 30 to 45 to 60 to 90 days without eating food. And most people think that that's not possible, that they would die by the time they hit the two week marker. But the



truth is that it depends on how much mass you have on your body, how much tissue you have on your body. Okay.

**Tom McCarthy**

Most people think that they die if they hit the five-hour marker

**Cyrus Khambatta PhD**

Right, exactly right. So you can... Yeah, mentally, your brain is sort of conditioned in this world in which we live, where you can get food anywhere at any time.

**Tom McCarthy**

Yeah.

**Cyrus Khambatta PhD**

It kind of makes you feel like if you go three hours without food or six hours without food that something bad is gonna happen to you, but in reality the exact opposite happens which is it's actually better for you to eat less food. The last thing I'll say about this is that when we talk about calorie restriction, calorie restriction is literally the only known mechanism in all of biology to actually add time on this planet.

**Tom McCarthy**

Yeah,

**Cyrus Khambatta PhD**

There is no other mechanism that science has discovered that can actually add years to your life, add time to your life. The only known mechanism that is repeatable and conserved amongst all species, most species, everything from yeast, to worms, to flies, to rats, to mice, to dogs, to sheep, to monkeys, to human beings is calorie restriction. So in other words if you eat less food on a daily basis, like 20%, 25% less food, you actually will add time to the end of your life, and you will become a healthier individual and live a longer period of time. It's crazy.



**Tom McCarthy**

I'll bet. Hey, what do you say to people that say, well, if you just eat fruits and vegetables you're not gonna get enough protein.

**Cyrus Khambatta PhD**

Yeah, hogwash. Complete. That's what I like to call is like nutritional folklore. It's a fairytale, it's an absolute fairytale. And where this originated actually was the idea that protein is nothing more than a necklace that contains a bunch of amino acids. Okay. So the beads are these things called amino acids. There's 20 of them, approximately 20 of them that you find in food, and they vary from protein to protein. So some proteins have more of specific types of amino acids and some proteins have less of specific types of amino acids, but the idea here is that when you consume foods that contain protein then you get those amino acids and those amino acids then serve a biological function inside of you. Now, the truth is that most people like to think, or at least on the blogosphere, fruits and vegetables are thought of as containing either very low amounts of protein or no protein, and both of those are fundamentally incorrect assumptions, okay, And in addition to that, meat and dairy products and animal products are thought of as being high protein, and that is a more true statement. And so the thought process goes, well, if you're not eating animal based foods and you're only eating plant-based foods, then your protein content is gonna go down and as a result of that you're gonna suffer, it's gonna take a toll on your musculature, it's gonna take a toll on your bone mass, it's gonna take a toll on your bone mineral density, you might become osteoporotic, et cetera, et cetera, et cetera. But the truth is that the plant-based world has plenty of protein rich foods in them. But more importantly, when you consume an animal based diet, most of the time the amount of protein that you're consuming is too much. So there is such a thing as consuming too much protein, okay.

**Tom McCarthy**

Yeah.

**Cyrus Khambatta PhD**

And people who consume animal based products generally can over-consume on protein, and people who consume plant-based foods, lower their protein intake, and there is a lot of people who consume too little protein, right? So just because you're a plant-based eater does not mean that you eat inadequate amount of protein, you kind of have to think a little bit about where you're gonna get your protein from.



**Tom McCarthy**

What are some of the foods that can get protein if they're plant-based.

**Cyrus Khambatta PhD**

So people can get protein mainly from legumes. Truth is you can get protein from anywhere. You can get protein from a banana, you can get protein from a lettuce, you can get protein from tomatoes, it's everywhere, right? It just tends to be more abundant in certain types of foods in the plant-based world. So the foods that are more abundant tend to be legumes, which are beans, peas, and lentils. And then in addition to that whole grains tend to also be relatively protein rich as well. So those are things like quinoa and brown rice and oatmeal and beyond. So point being is that if you're consuming a diet that contains what we refer to as the four sort of pillars of green light foods, including fruits, plus starchy vegetables, like potatoes and yams and root vegetables that you find in the ground, plus whole grains plus legumes, and you're distributing your calories amongst those four types of food, then you're gonna likely be eating plenty of protein on a daily basis. And it's not really a concern that your health is gonna suffer as a result.

**Tom McCarthy**

Yeah. In this diet, you went in this direction because you had diabetes, right. And disease. But this diet is really good for all people that wanna be healthy and well, and even overcome other chronic diseases, not just diabetes. Right?

**Cyrus Khambatta PhD**

You nailed it, you nailed it, yeah. At first when I went into this graduate degree, I wanted to try and figure out what was happening inside of me, and soon I got the answer to that. And then I started to recognize that eating a plant focused diet or a plant strong diet, or a plant based diet, whatever you wanna call it is actually a very powerful diabetes reversal tool, not just a diabetes management tool. I don't care about managing diabetes, I care about reversing diabetes when it comes to prediabetes in type two. But in addition to that, eating a plant strong diet is a chronic disease reversing tool. And when I refer to chronic disease, I'm talking about the chronic diseases that affect the majority of the world today, not just Americans, but the whole world. Okay. Things like hypertension, high blood pressure is literally affects more human beings today than ever before in the human history. When you eat a plant-based diet going all the way back to the 1950s, Walter Kempner, over at Duke university, he was the first person to describe that eating a plant-based diet is literally the



most powerful anti-hypertension diet ever discovered for human beings, okay. And then in addition to that, people who have high cholesterol, which is another form of cardiovascular disease, you eat a plant-based diet, your cholesterol plummets, okay. People who are at risk for coronary artery disease or atherosclerosis, if you do a plant based diet, boom, that risk goes out the window, fatty liver disease, chronic kidney disease, pre-diabetes, type two diabetes, many forms of cancer, and even now Alzheimer's disease, Alzheimer's disease being literally cognitive decline which happens over the course of 20, 30, 40, 50 years. Now, researchers are finding out over the past 10 to 15 years, that when you eat a plant strong diet or a diet that contains actually low saturated fat content that that saturated... The low saturated fat content actually enables neurons to be alive for a longer period of time, which staves off the cognitive decline that affects so many people that staves off dementia and actually keeps you alive and mentally happy for a much longer period of time.

### **Tom McCarthy**

Yeah. I'm already sold. This is the way that we've been eating for a long time, but I'm so glad you're explaining it in a way that will hopefully help a lot more people. I wanna ask you a question and we're getting close to the end of our time, but whose got a bad name for well, stay away from fruit, too much sugar, especially around diabetes. Right. Like watch out for it, but you talk about eating fruit. So talk to us about fruit a little bit.

### **Cyrus Khambatta PhD**

Yeah. I'm so glad you brought this up actually, because fruit is just an absolutely completely misunderstood food group. Okay. So the narrative goes like this, don't eat fruit because fruit contains sugar and sugar will make you fat or sugar will cause your cholesterol to go up or sugar will make you diabetic. Okay. So don't eat fruit because fruit may contain sugar and that's bad for you. Right. But there's so many things wrong with that statement, I don't actually know where to start. The first thing that I would say is that people use the word sugar completely incorrectly. Okay. What I recommend doing is when we refer to the word sugar, when you use that word, the only thing that you should be thinking about the only time you use that word is when you're referring to white table sugar, literally a white crystal, that's it. Okay. Because that sugar is the sugar that we colloquially use and that's in our vernacular, and that's what people are visualizing when they think of the word sugar, right. Even when they refer to a fruit, they literally think if I eat a banana it'll turn into that white crystal and that white crystal is bad for me. Okay. We know from plenty of evidence that when you consume that white crystal or any derivation of that white crystal, whether it's... even if it's high fructose corn syrup or any kind of artificial sweetener, that those artificial



sweeteners are literally metabolic napalm, they are terrible for your vasculature, they're terrible for your brain, they're terrible for your sexual organs, they're terrible for your kidney, they're terrible for your pancreas, you name it. We gotta get away from those foods, right? That's the only time you should be using the word sugar. All other times, you should be using the word carbohydrate because carbohydrate is different. Carbohydrate is a much more complex structure from a chemical perspective. And that is technically speaking, the biologically correct term to use when referring to food. Okay. So if you look at a fruit, as an example, a fruit is a complex three-dimensional matrix of many different macro and micronutrients together. You have carbohydrate, you have fat, you have protein, you also have vitamins, minerals, fiber, water, antioxidants, and phytochemicals. You have nine classes of micronutrients and macronutrients that are all wound up into one complex, very complex structure. Okay? So you eat a fruit, you have a pear or you eat a mango, right. And most people think, oh, okay, well the mango equals sugar, again, the mango is just gonna turn into a pile of white sugar and that's gonna be bad for me, but the truth is that that mango has some carbohydrate energy in it, for sure, and that's part of what gives it a sweet flavor. But in addition to that, there's a little bit of fat and a little bit of protein, and there's all those other micronutrients I talked about. So what happens to that three-dimensional matrix is that once it goes inside of your digestive system, it takes time to unravel that matrix, it takes time to start to partially digest the fiber rebar and get access to the micronutrients and get access to the carbohydrate and the fat and the protein.

And it starts to degrade that stuff and pull it out of your digestive system and put it into your blood. And then once it's in your blood, it has to get transported. So there's a whole symphony of things that are happening. And the point that I wanna drive home here is that when you consume a fruit, because it's a complex structure, the fruit takes time to digest and absorb, and time is your friend when it comes to food. Things that take more time to digest enable glucose, not sugar, but glucose and amino acids and fatty acids to get into your blood at a reasonable rate, at a reasonable speed. When they get inside of your blood at a reasonable speed, then biochemistry unfolds exactly the way it's supposed to. But when you consume that white crystal that we talked about, the white crystal has no protection, there's no fiber, there's no vitamins, no minerals, no antioxidants, no phytochemicals, there's no fat and there's no protein. So as a result of that, it's literally missing eight of nine nutrients. And as a result of that, when you consume that white table sugar, well guess what happens? It travels into your digestive system and it gets inside of your blood very quickly, we're talking within five minutes. And as a result of that, it gets in quickly and it's unprotected, and a lot of it will get in at the same time. That is what starts the process of many chronic diseases.



**Tom McCarthy**

Yeah.

**Cyrus Khambatta PhD**

That's the type of physiological process that can get your liver upset and your pancreas to over secrete insulin and your muscles to get pissed off and your heart to get off and your eyes to start getting degraded and your brain start suffering, right? So if we're gonna talk about sugar, we can only talk about refined sugar. And if we're gonna be talking about things like fruits, even potatoes, even whole grains, even legumes, we have to use the word carbohydrate and more specifically whole carbohydrate energy that comes protected with all those macro and micronutrients. And when you think of food as being a complex three-dimensional structure, it makes a lot of sense and your whole understanding of biology becomes just that much more accurate.

**Tom McCarthy**

Now, that description was worth the price of admission. That was amazing, that was so cool, the way that you talked about fruit. Yeah, that was so good. We could talk for hours and hours, but our time is coming up. I do wanna thank you, you've been so amazing, and I know you've blown so many people's minds. Where can they find you and your work? Where can they go to get more of you?

**Cyrus Khambatta PhD**

Yeah. Thank you for asking. I appreciate that. There's two sort of main places that I would go, the first one on your computer or your phone, you can just go to [masteringdiabetes.org](http://masteringdiabetes.org). Okay, that's our website. And then we basically run a coaching program for people living with all forms of diabetes to help them reverse the underlying cause, which is called insulin resistance. And when you do that, then you could reverse prediabetes in type two and get phenomenal control of type one.

**Tom McCarthy**

And before you give the second one, people watching this, you may or may not have diabetes, but I bet you know someone who does and send them to that site if it's not you, if it is you go there obviously, but if it's not you, send your friends, family, loved ones to that site because rather than just having them medicated, Cyrus has real answers to help them with this situation.



**Cyrus Khambatta PhD**

A hundred percent, a hundred percent. And we are not anti pharmaceutical medication, we recommend that people use pharmaceutical medication when necessary, we just use a food first approach. And the whole process here is to basically allow your... To educate people about how your food is actually your most powerful medicine. And once you learn that, and once you apply the principles of the mastering diabetes method, you are likely to find that you can get off of many pharmaceutical medications, not only for diabetes, but also for heart disease and also for weight loss and beyond, and get to a more physiologically normal state of being where you feel great, you look great and you're basically free of chronic disease.

**Tom McCarthy**

And then the second site, the second place.

**Cyrus Khambatta PhD**

The second place I would send people to is go to Amazon and pick up the "Mastering Diabetes" book. Okay. And again, I'm gonna say this, even though it has the word diabetes in the title, the truth is that the book is actually not necessarily about mastering diabetes, it's about mastering your health, it's about mastering chronic disease. Okay? So just go type in mastering diabetes and pick up that book and read it. And hopefully you'll learn a lot about what we're talking about here today, but it goes a lot into depth about, what is the actual reason why so many people in this world are living with many forms of chronic disease and how every chronic disease effectively can be traced to one central condition, and that one central condition is called insulin resistance. And when you really conceptually understand what insulin resistance is, how it's formed and what consequences it has on your body, and you eat in a way that reverses insulin resistance, it's literally a gateway to reversing most of the chronic diseases that affect most people in today's world.

**Tom McCarthy**

Amazing Cyrus, it's amazing job. And I thank you so much for being with us and helping so many people. We appreciate so much.

**Cyrus Khambatta PhD**

Thank you, Tom. I really appreciate it.