Mitochondrial Aging and Muscle Longevity

When we think about mitochondrial health, there's a lot of discussion that as we age there are fundamental changes that have to happen within the mitochondria from a negative aspect.

We talk about this increase in free radical formation, this decrease in mitochondrias ability to clean itself. But the reality is we know that under a microscope, if you were to look at a very fit 70 year old and compared the mitochondria to a very fit 20 year-old, you wouldn't actually be able to tell a difference.

This is Dr. Talks. Dr Lyon, my friend, welcome to the Mitochondria Summit. It's such a pleasure to have you. Yeah, it's really great to see you. I'm so sorry that we don't get to sit down in person, but who knows, maybe over the summer we'll get you to do it again.

For sure. And I will see in San Diego if you're there. Yes, I'll be there! Cool. So where should we begin? We need to talk about how all of your work around body composition links to mitochondrial health and energy levels.

What's your paradigm around understanding that connection? Yeah, well the first thing that I want to say is that we know muscle is the organ of longevity and muscle's the largest organ system in the body.

It's not the skin, it's anything else, the heart, you name it, endocrine system, skeletal muscle in and of itself, its own organ's system. And when you talk about mitochondria, As you can imagine, if skeletal muscle makes up 40% of our body weight, I don't know, R, you're pretty muscular, so for you, maybe it's 50%. But the reality is, is the majority of mitochondria makes skeleta- you know- within skeletile muscle, makes skeleton muscle a perfect way to study mitochondrial health.

Because of just the sheer capacity and the way in which we can leverage skeletal muscle to improve mitochondrial health. And that's really how I think about it as I was prepping for this summit thinking about, okay, well, how do we focus on mitochondria health for the individual and what can they do about and just from a foundational aspect, what changes and why does it change?

Yeah. So why do you call muscle the organ of longevity? What is the scientific basis of that? Well, the idea that muscle is the organ of longevity really focuses on the concept that the healthier our muscle, that, you know, people will say, well, bodybuilders don't live longer.

That may be true, but we're talking about within a physiological norm that healthy our skeletal muscle system is because of its pinnacle role in longevity, the better off that we are.

It truly is the organ of longevity and when we think about mitochondrial health there's a lot of discussion that as we age there are fundamental changes that have to happen within the mitochondria from a negative aspect.

We talk about you know this increase in free radical formation, this decrease in mitochondrias ability to clean itself, mitophagy, but the reality is is we know that Under a microscope, if you were to look at a very fit 70-year-old and compare the mitochondria to a fit 20- year- old, you wouldn't actually be able to tell a difference, which is crazy.

But the reality is, is we often look at the healthy, sedentary, older population, and there's no such thing. Healthy, sedimentary any population is a misnomer.

It doesn't exist. And really the healthier our skeletal muscle is by default, the healthier our mitochondria is. We have a number of lines of evidence showing that with each decade of life, mitochondrial capacity in skeletal muscle declines by about 10%. It may not sound like that much when you phrase it like, but the average 70 year old has lost 75% of their mitochondria capacity compared to a young adult.

75% so I often tell people this is like going from a Ferrari engine in your cells when you're 20 to a moped engine when your 70 and we also know. that if you look at a 70-year-old who is a lifelong exerciser, they don't lose 75% of their mitochondrial capacity.

They have the same mitochondria capacity as a young person. So we know that this is not actually a normal process of aging per se. This is actually the result of modern lifestyle.

Yeah. What's going on there? Can you add some layers to that story? Absolutely. What you're saying is very, very critical. Basically, to sum it up for the listener is that by the time someone gets to 70, they have lost the majority of mitochondrial function and overall mitochondria, especially as it relates to skeletal muscle.

I will say, when we think about the health of my mitochondrion, why it's so important is we can actually feel it. And initially, the cellular changes, we don't feel.

Right? From a fundamental process that happens from an individual who is sedentary, the ability of the mitochondria to replace itself to go through this process of mitophagy decreases, again, an individuals who's not exercising.

The ability to utilize energy, so for beta oxidation, for fatty acid oxidation. So that's really energy utility, utilizing the food that you're eating.

The other thing that happens, which is so interesting as it relates to mitochondrial health, is this decrease in flux within skeletal muscle.

Why Skeletal Muscle Drives Metabolic Health

This decrease and flux that when we think about healthy skeleta muscle, and I talk about it from a way in which we can all picture it, we all can picture what a filet looks like.

A filets steak looks red, it doesn't have a bunch of fat marbling, It looks unified. As individuals age, not even as they age and become sedentary, as the begin to gain body fat.

Body fat is not just in the periphery, right? It's not visceral body, it's just the body that you see, but you get ectopic deposits of body and you also get fat that infiltrates and deposits within skeletal muscle.

What ultimately happens, and again, this is a very complex topic, there's all kinds of fat and metabolites that end up affecting skeletal muscle, which all increase the risk of insulin resistance and increase in damage to the mitochondria and decrease its ability to counterbalance what's happening.

So this fat infiltrates. And then the other thing that happens is with the infiltration of fat, it affects the mitochondria. It also affects contractility, so an individual's ability to exercise to full capacity.

The tissue changes and one third of all adults report fatigue. That's one third. They report some form of fatigue as it relates to muscle strength, right?

So if the tissue in and of itself is unhealthy, is the house that the mitochondria live in is on unhealthy. We know that left alone muscle, strength declines by 1.5% per year from the ages of 50 to 60. I think that it's more, but again, just looking at the literature between 50 and 60 years old, you're losing 1% of your strength.

per year. And then, as you had mentioned, over the age of 70, 75, an individual will lose 3% per-year, okay? And when we think about that, that actually coincides with the increase in the rise of diabetes, cardiovascular disease, Alzheimer's disease.

I always frame it as these are diseases of skeletal muscle, but you've provided an opportunity to say, why? Why are these diseases that over 80% of individuals over a certain age are getting.

And it's because of the health of skeletal muscle. I often talk about it as it relates to muscle mass and strength and its metabolic impact, but on a cellular level, what is it?

And its mitochondria. So hopefully that kind of lays out the foundation of the potentiality of what can happen. And then when an individual is not moving, that skeletal muscle that we can think of as a suitcase becomes overpacked.

It's really this decrease in flux of energy utilization, whether it's doing resistance exercise or as it relates to mitochondrial health. So I did my fellowship at WashU, Washington University in St.

Louis, and Holizy, the guy, he was like the godfather of exercise and mitochondrial health. I mean, you was 80 at the time. He was still there. And he, I think in the sixties, began to publish this research about cellular health, mitochondria health and exercise.

So anyway, that kind of gives the big picture and lays a bit of a foundation as to what happens and hints to, what can we actually do to prevent it? You mentioned this word flux.

Can you define what that is? Yeah. This idea of flux is that when skeletal muscle, when individuals become sedentary, there's glycogen. Glycogene, which is a storage form of carbohydrates.

Fatty acids. So skeletial muscle uses a lot of fatty acids, fatty acid metabolism. One primary site is skeletum muscle. Glucose utilization is in part largely done by skeleta muscle Flux is the ebb and flow of these substrates, the Ebb-and-flow of the fatty acid metabolism and the Eb-And-Flow of moving that glycogen out, right?

If you think about it, if you have, I don't know, an item and you leave it around for long periods of time, dust accumulates on it. you know, and then like things stack up.

But flux is if you're constantly dusting it, you are dust it off. And that's essentially through exercise, through resistance exercise through walking, even, walking and doing some type of endurance training.

then of course you later on hit high intensity interval training and sprint interval. Training it increases the flux. The skeletal muscle must use these substrates and that is one of the keys to overall health.

If we believe the paradigm that skeletile muscle is this organ of longevity and obesity is a consequence of unhealthy muscle and ultimately all the other things that we're seeing are really They're anchored in skeletal muscle.

It's the only thing that we can leverage. I mean, Ari, can you go exercise your liver? Don't say drinking. Right? You can't. You cannot exercise you liver.

Can you exercise heart? Yes, but you couldn't sit here. you're kind of a very in tune person. I can't do that, the majority of people can, but I pick something up and do a bicep curl.

I go and run a sprint around the block. Not effectively, and I look ridiculous, I still do it. The skeletal muscle is the only organ system that we have direct control over.

And that becomes critical to understanding if we want to improve skeletal muscle energetics and we wanna improve mitochondrial enerjetics, how do we get ahead of these cellular changes that we've been fed happen with aging?

And it's not true. If you look at some of Brett Goodpasture's work and the original work by Holizy, and we stand on these shoulders of giants and look the evidence, we know that we can impact in a positive way through nutrition, through exercise, even through supplementation.

There's some very interesting nutraceuticals that have very good evidence, which is incredible. One is something

called Urolithin A which I've been very interested in and looking in the research of that, ways in which we can come in to affect that mitochondrial biogenesis, the health of the mitochondria.

Yeah, beautifully explained. There's an exercise physiologist named Inigo Sanmilan. I'm sure you've probably heard of him and he studies in his lab metabolic health and studies athletes of various kinds, in particular focus on endurance athletes.

and he also studies what he terms are the opposite end of the spectrum of metabolic health, which are obese diabetics, people with metabolic syndrome.

And he has found in his lab that there is about a 400% difference in the number of mitochondria and the mitochondrial capacity between athletes and people who have metabolic syndromes.

You literally have four times this, a 400% bigger engine in the cells of your skeletal muscle. If you're an athlete compared to a person with an overweight person, with diabetes or metabolic syndrome.

So, you know, again, Ferrari engine versus moped engine. This is not a small difference. It's not five or 10% difference, it's 400%. And there's, You made me think of this because.

You mentioned the word flux and there's actually a couple layers that I want to go, go into this with you on. But one thing that he found that's interesting is this, this weird paradox where both people who are with metabolic syndrome and the endurance athletes, but actually where you're going.

Interestingly, not the general population of sort of, you know, the typical average person who's not an athlete and is not very overweight and with metabolic syndrome doesn't apply to them.

But both of the extremes, endurance athlete, and the overweight people have large fat drop deposits in their cells, in the muscle cells. Yes. And so this was this sort of, it seemed to them a weird paradox that the athletes would have the fat droplets the same as the overweight person, but they found that difference is flux.

The difference, since you know where I'm going with it, you describe it. Yeah, I'm not surprised at how well-read you are on this topic. And what you're describing is this, it's called exactly what your saying, the athlete's paradox.

There's all different ways in which fat can be stored in skeletal muscle. There's intramuscular fat, there's inter-fat tissue. It can in the tissue, around the tissues, in all the different places.

And one of the things that's so important to understand is fat is a good fuel source. And those endurance athletes rely on the fuel sources above and beyond glycogen, muscle glycogen, which, by the way, is one way in which muscles get energy.

Flux, Fat In Muscle, and the Athleteu2019s Paradox

It is not actually directly available in the bloodstream. People will say, well, my muscles will help stabilize my blood sugar. Well, it doesn't directly.

These amino acids have to go to the, or these substrates have help maintain blood sugar, but the flux is what keeps these athletes healthy, right? They have designed their body, and as we think about mitochondrial muscle, it's adaptable, which is very interesting.

It's adoptable. And the fat droplets within muscle are adapted for the athlete to be able to execute any span of endurance type activities. And it is healthy because of the flux.

It's not just sitting there. With sedentary behavior, with decreased flux comes increase in reactive oxygen species, increase what's called diacylglycerols, increases in these ceramides.

These are byproducts that build up and there's a whole bunch. And listen, if you were to go on PubMed and you're to Google mitochondria dysfunction, you'll see probably a thousand different theories and a 1000 different reasons why.

Is it, you know, endoplasmic reticulum stress? Is a decrease in NAD? is it a decreasing glutathione? You name it. And the reason I point that out is that it really highlights the complexity of the scientific literature out there.

What we can do is we simplify it in a way that we understand that the body is adaptable and we can train our muscles directly and subsequently train or mitochondria.

And it's probably the biggest mover that we have. Individuals with metabolic syndrome and when I think about for the listener what they would do and they will say, well, how do I know if I have metabolic syndrom?

It's a collection of symptoms or not symptoms, it's a collection of signs and some of those signs would be looking at blood work and seeing an increase in triglyceride levels or an increasing fasting glucose and an increases in fasting insulin and potentially elevated levels of body fat and hypertension, these kinds of things.

So if you have those things, you can say that in some area, on some degree, your mitochondria is likely not healthy. Certainly your muscle is not health.

And again, it's not a black or white picture. It's just like flux happens and doesn't. The spectrum of change is non-linear. This spectrum is what we call the catabolic crisis of aging.

which we can of course discuss if you want. So when we are doing activities like endurance type activities and high intensity interval training and getting out and moving and let's say I would say three to four days a week someone should be involved in resistance type of activities that really pushes their body.

It's not, you know, I'm not calling Ari on the phone doing a bicep curl and not fatiguing my muscle because again, We can't say, okay, mitochondria turnover, but I can say well, I'm going to work hard enough so that my muscles are fatigued over the week if we break it down into a week and then doing some kind of high intensity interval training and some longer endurance to improve that flux.

So this was a long winded way of saying that there is a paradox of what we see if someone were to look in the literature that yes, it is fuel source for those that are highly active and it's something that is Deadly for individuals over a lifetime.

And the difference is that the fat that's in the muscles of those athletes is moving constantly. All the time. It's all the times. The fat, that there is temporarily there before, only for a few hours before it gets used up.

Whereas the, fat and the overweight people is just stuck there producing all these toxic byproducts. Exactly, exactly. And what do these toxic byproducts then leverage and what did they do?

Well, again, if we believe muscle is this organ of longevity and muscle, is the home to mitochondria, and we know that as it relates to glucose disposal, utilizing glucose from the diet, it has to go to muscle.

And if that muscle is already overpacked, we're going to start seeing increase in blood sugar. We're gonna start see an increase triglycerides. we are going see increase fasting levels of insulin.

So we can directly see the impact from skeletal muscle as the primary site of our metabolism, essentially. Another thing that came out of my listening to the work of Inigo Sanmilan, this exercise physiologist, researcher that I mentioned, He said something that struck me in a really, in bad way, which was he said that when he tests the metabolic health of athletes who just lift weights and do high intensity interval training, that they don't have nearly as ideal metabolic as the ones who are endurance athletes.

And as someone who had just spent at that time, 20 plus years only doing resistance exercise and high-intensity

interval training and not doing any endurance training, I went, well, damn, that really sucks.

But the thing is, there's still hope. I have since dramatically upped my endurance activity because of that. But what's interesting about this is I just want to impose like kind of the cultural narrative, the dominant narratives, popular narratives within the evidence-based fitness, nutrition movements.

For the last 20 plus years, it was very focused on, hey, endurance training is kind a waste of time. It's silly cardio, it's not really effective for fat loss, It is kind of worthless.

Hey, if you want to waste your time doing that stuff, that's fine, but it is not needed. What you really need to do is lift weights and control your diet to look good.

And now you have this very smart exercise physiologist saying, actually, its pretty important to overall metabolic health. So I am wondering if have any thoughts on that and maybe like me, you've maybe changed your relationship with endurance exercise.

I love that you're bringing this up. It's interesting, the narrative swing, right? Initially, it's Jane Fonda, let's just do cardio. You've got to get a great bandana and amazing leg warmers, and that's all you need to do.

And for the longest time, that was what everybody did. Well, I mean, you and I were not doing that, but you understand the picture. Everyone was eating the food guide pyramid and doing lots of cardio and no weights.

Now over the last, what would you say, maybe the 10 years or so, maybe not quite that long. It's been, don't do any zone two cardio, Don't Do Any Endurance Training.

All of that is an absolute waste of time, which is not the case at all. And that's not what the evidence would suggest, especially as it relates to mitochondrial health.

Resistance exercise, high intensity interval training is great for flux utilization. It's great. For strength and hypertrophy, but as it relates to overall mitochondrial health, mitochondria health and say VO2 max, which is the amount of, you know, is a way in which individuals are measuring output, right?

Like this respiratory potion and this, this output is. all about endurance training. Endurance training is a critical component of overall health and wellness.

And actually the combination of endurance with resistance is key. It's interesting, if you go back and you look into the literature, the majority of literature when it talks about input and outcome in, about, and around mitochondrial health, it's all endurance So you are absolutely correct in saying it's super important.

In fact, my husband just ran the Boston Marathon. Speaking of endurance training, so, and this was a, you know, a former Navy SEAL who is, kind of like a tankish dude who, for him, it was always about weight training.

And as we all think about longevity and what is it going to take to not just have longevity, but also to have energy? increase in energy and a decrease in fatigue, we have to think about endurance training.

And I'm curious as to how much endurance you're doing nowadays. You know, I started actually riding a bike. I set up a friction trainer with a fiction trainer and then measuring my heart rate.

So that I could be in zone two and do 45-minute sessions on the bike, But the problem was right now I'm doing so much surfing almost every morning for two plus hours.

Oh, so rough. And I started playing tennis and I am doing Jiu-Jitsu and Capoeira. I realized I was doing endurance and high intensity interval training plus weight training like four days a week.

So I realized I just don't have the bandwidth to fit in the dedicated zone two sessions. So, I'm doing many, many

hours, sometimes three, four hours a day of a combination of endurance and high-intensity interval training, but it's not perfectly zone 2. But I don t have bandwidth just to put in extra zone to work beyond all the stuff I m doing.

And I figured, you know, probably got it covered at this point. Very active. I think you bring up a good point. I mean, you know, when we think about the current recommendations, what do we know?

We know that 24, only 24% of adults are meeting the daily activity requirements. 24 percent are reading both.

Endurance Training vs. Resistance Training

Exercise aerobic activity and resistance training. 24% of adults. That's insane. Why is that? I think part of it is cultural. Part of is time. And then the question is, is knowing what to do.

There is a lot of distraction that happens when individuals are distracted, then they don't execute. So what can we do to mitigate some distraction and execute in a way that is meaningful?

And to me, if the current recommendation is 150 minutes of moderate to vigorous activity a week, plus two days of resistance type training, you're doing way more than that.

So you've met your needs, right? I would say I'd probably get that per day, not per week. which is incredible. And if we know that the baseline recommendations, which are the minimum to prevent and eliminate active disease process, then you're probably right on the money.

I would encourage everybody to do something where their heart rate goes up a bit over a period of time. It doesn't have to be something crazy. Even if it's speed walking, you are still getting some kind of activity.

running a marathon or running, you know, long distances, but doing some kind of endurance type activity, which could easily be also riding a bike every day, 30 minutes to 30 Minutes a day.

You can do 30. What do you do personally for endurance? Well, right now for me, I am adding in one longer endurance session, a zone two session a week.

And that's 45 minutes on a Saturday or Sunday. I've had to really work to do that because my normal proclivity would be do some kind of resistance training, which Ari and I, you and, I've been friends for many years.

You know exactly how I train. I do, some kinda resistance and i'll do you some high intensity interval, but I won't be spending long times doing these endurance type training.

But because of the literature, it's so serendipitous that i've also been thinking about and reading. i have added in that one day. As well as starting to add two other days where I'm just doing, so we have an air dyne bike and instead of doing all out sprints, just, doing a pacing, you know, maybe it's a 120 beats per minute, nothing crazy where, I can have a nice conversation.

So, yeah. Awesome. Yeah. The air dine bike to do all-out is, is pure torture. You got to be a serious masochist to all, out intervals on that thing. Yes, all which I think is really, really critical.

But what I love about what you're saying is that it's all free. These are free ways in which people can move the needle if they understand the science and they're motivated by the idea that People often think about fatigue as some, I'm not sleeping well enough, or maybe I ate too big of a meal, and all of those things are true, right?

But what about doing the activity that truly moves the needle? I'll give you an example. So an individual could sleep all they want, like sleep great, and eat well.

And if they are not moving and if are they not actively recruiting skeletal muscle and focusing on what they need to do for strength, resilience, mobility, mitochondrial health, they'll still feel terrible.

They'll still feel tired. Yeah. Don't care if you were eating perfectly and laying out. Have you gone on vacation where you've totally relaxed and you're in Costa Rica on the beach doing nothing?

The more you do nothing, the more tired you get, even if your sleeping, getting massage and eating well. So I think that the way that the body has designed is we have these homeostatic processes, which homeostatis is really just being in balance.

And the homeo static processes which we normally go to is how do we influence the things that are easy? It's easy to eat well and people argue with me.

No, it is. I mean, I think so. It's easy to get sleep, even if you're not disciplined to do it. Doesn't mean that it's a difficult thing, right? You know, we're talking about, you know the barrier to entry is, for example, just came back from special operations week in Florida, flew home.

I could have easily gone to bed at an appropriate time because I had to wake up at freaking five in the morning to go train, but I didn't. I woke up at five to go train, but I didn't do the easy thing, which is get sleep.

The difficult thing is actually leveraging the physicality to be working hard enough and putting the effort in to actually move the needle. So especially as it relates to, if you were to think about the body, the is designed for challenge.

Nothing is more powerful than exercise. No medication. And the reason is, is because exercising skeletal muscle not only impacts the mitochondria, but exercising, skeletile muscle secretes these myokines, which is which they're peptides that travel throughout the that interface with the immune system.

We know that As individuals have a healthy skeletal muscle, they also have healthier immune systems. Skeletal muscles leveraging this house of the mitochondria does everything else.

So it challenges the homeostatic balance and that challenge is what's necessary. And in the same vein of the example that you gave of sitting on the beach doing nothing and that not being energizing, it is also the case that if you, you know, provide more fuel to your mitochondria, like your, mitochondrion depend on mostly carbs and fats for fuel.

And if, if. You say, Hey, maybe the reason I'm not energetic enough is my mitochondrial don't have enough fuel, but maybe I'll provide. Carbs and fat.

and of course. that not only doesn't energize you, it actually is the opposite when you have a chronic excess of those fuels. It's actually toxic to your mitochondria.

So to you point, body likes balance and I would add the body like flux. Going back to the earlier point. The body to be in movement with these ebbs and flows with things flowing through it.

it likes to in movements with nutrients flowing in and out, not in a static state where nutrients are stuck and the bodies stuck. We have to because that static state would essentially be a disease state.

I know that your community is very astute and are very interested in the research and you do such a good job at providing that. If they go back and they look at the literature, they will see populations of people defined as healthy, sedentary individuals.

And I would argue that that in and of itself is a diseased model. It's a model and as we begin to think of what does health mean. It does go back to muscle, it does back mitochondria because these are the things that we can leverage.

And especially from a nutritional aspect, excess calories, regardless of where you're getting it is very challenging. If you are not utilizing it, whether it's in the form of carbohydrates or fats, protein is difficult to store as energy.

But a fatty protein meal would be challenging for the body, right? Because now you're talking about over consumption of calories and those kinds of things.

But lean proteins alone, those amino acids are very difficult to store. So if we were to think about how would one eat for mitochondrial health, there's the bigger input, which is movement and exercise.

If I were say that's probably 75% of the equation, but 24% percent of people are doing it, yet 100% people eating. 100% of people are eating. So how do we get the low-hanging fruit, which is really nutrition?

How do get that thing right that 100 percent of the people doing? And we have to think about how to we fuel for mitochondria and how we do fuel from mitochondrion is how you fuel muscle health.

And I've often talked about dietary protein to help maintain muscle-health and this is very suiting for the conversation of mitochondrial because inactivity and as we age, again, could you overcome the, quote, aging process through activity?

You could. And the evidence you have quoted is there. Aging is not a thing that happens. Is it potentially a, you know, are there normal things that potentially could happen?

Yes. Do we know what a amazing, healthy 80-year-old looks like? Nah, that's probably 1% of the population. As it relates to nutrition, there are certain things, and I say this cautiously because I've always talked about this concept of anabolic resistance.

An anabolic resistance is the inefficiency of skeletal muscle to sense dietary protein. And why is that important? And just to take a step back to lay the foundation for the listener is skeletial muscle as an organ system is a nutrient sensing system and it's exquisitely sensitive to dietary And one of the things in the literature that we see that happens with the, quote, aging population, which now I have to rethink the way in which I speak about it, is the aging.

Population is that. We see a decreased ability for skeletal muscle to recognize these amino acids. The efficiency of utilization goes down. And this is called anabolic resistance.

So we've seen every, you know, people that we love that are older get sarcopenic and, and small. And, that's often why people come to the clinic because they say, oh my gosh, I don't want to age like my parents aged.

But this idea of anabolic resistance can be overcome by dosing dietary protein correctly. And Aria, I've always talked about this even distribution of dietary proteins.

What does that mean? I often recommend one gram per pound ideal body weight for dietary proteine as it relates to muscle health, which then relates mitochondrial health.

Protein Timing and Muscle Preservation

People will say, well, what's my ideal body weight? I will see I have no idea. Ari doesn't know his ideal weight, and I don't my idea bodyweight. But I could say I'm 110 pounds, I am happy with that weight.

I want a very low body fat percentage because that's just the place that I live. And good with 110 grams of protein. So if you know where you are happy, you can say it's one gram per pound of your ideal-body weight make up that number.

The last time you felt amazing, do that. Now, for the longest time, I've said, okay, well, you need to have 30 grams, a minimum of 30g of protein per meal to get enough of that, those amino acids to hit this mechanism within skeletal muscle to create this muscle protein synthesis.

So I'm sure the listener home is going like, what is she talking about? Well, 30 g of proteins, that would be, four

ounces of a steak or four ounce of chicken.

That would the minimum requirement to stimulate this tissue. Well turns out, you know, that it's actually the first meal and the last meal that are most critical or overcoming this anabolic resistance, which simply means you are improving the efficiency of dietary protein to be recognized by skeletal muscle.

to protect skeletal muscle. Again, you're eating dietary protein because skeleta muscle is made up of protein. You have to eat that to lay down, to do tissue turnover.

We turn over 250 grams of proteins a day. we're only eating 100 grams and maybe a bigger person is 350 grams of protein. So if someone is thinking and listening and they want a tangible takeaway and are thinking, well, how do I protect my mitochondria by protecting my skeletal muscle?

And I would say that first and last meal of the day is most important. And your protein target could be between If you really want to get crazy with it, 40 and 50 grams of dietary protein, which, you know, would equal a five ounce or six ounce protein serving or some kind of protein shake.

First and last meal, and you will protect your tissue. And it's probably worth pointing out to people that our body, it is not, this protein intake isn't just important for sort of building muscle, but a huge portion of our bodies is made up of proteins.

Yeah. Nearly all of it. Exactly right. Including much of what's in mitochondria as well. Yes, absolutely. And when you eat with a protein forward perspective in mind, you support skeletal muscle and subsequently support mitochondrial health.

And by really keeping calories in check, we know that obviously gaining weight, decreasing blocks, excess calories really become toxic to just the overall metabolism and mitochondria in and of itself, right?

Because you're now increasing free fatty acids and you are increasing glucose and all these things that really destroy mitochondrion, How do we design a diet that optimizes for mitochondrial health?

And the way that you design it diet, that optimizing for my mitochondria health is really two-fold from my perspective. Number one, the foundation. And that foundation is dietary protein and dosing that correctly.

Quite simply, 40 to 50 grams, probably closer to fifty. If everyone was thinking about doing it at that first and last meal, they don't really care about that middle meal.

And it allows individuals to eat within a time-restricted window, which is very big for people. You know, there's a lot of talk about autophagy, and there are many ways to get there, Which is really this body's renewal process.

But I don't care about that middle meal. And the reason I do not care that that meal is because the mechanisms of the input of amino acids are still going.

I think that this might be a part two conversation, but quite simply, that Middle Meal doesn't matter. That middle meal does not likely need to meet a threshold.

It's interesting that you say that. I've never heard somebody say before. And I have noticed through my own self-experimentation, and partly this results from living in a warm climate like I do in Costa Rica.

During the time of year that I'm here, I eat less. There's some research suggesting that when you're in hotter climate, it tends to reduce appetite, which is what I found.

I get super lean, super easily. When I combine doing a lot of exercise, I'm very, very active here, and I combined that with eating two meals a day. I don't focus on eating a third meal in the middle of the day, my first meal, maybe it comes after surfing, 10 or something like that, 1030, and then I eat a second meal at 630. I can get super lean

like within a couple of weeks of doing that.

And I find actually that if I incorporate a third meal in the middle of the day, it doesn't really do anything significant as far as muscle mass, but it does seem to prevent me from losing body fat.

Isn't that amazing? You're already doing, you know, very tuned in and you're actually by mistake or by design doing the things that we've now started to teach and move forward for practitioners, which is exactly that.

I just gave a lecture at Obesity Medicine, and we talked about this. Everyone's thinking about, you know, for the longest time it was all about the even distribution.

Well, it's kind of about even the distribution in some regards to protect skeletal muscle, but do we need that middle meal? You don't. And there's only two ways to stimulate muscle.

Exercise and diet. You're already hitting that balance. I would encourage everybody to try what you're doing and what your talking about those two big meals and then spacing it within an eight to nine hour window.

I'd suggest everybody try that. And I'll have like 60 or 70 grams of protein in each meal. 30 grams of protein, that's not true. So are you are utilizing all of that protein from a muscle perspective at about 55 grams?

You're probably no longer gaining muscle benefits, but you're gaining benefits from everything else. All those other tissues that you talked about, which include liver, gut, skin, all the other tissues, and all of the cellular processes are now getting benefit.

So once something caps out for skeletal muscle, the reason I talk about eating for a skeleta muscle is because that's our foundation. But we need all So now to the second part of how do we eat for mitochondrial health, I like to think about phytonutrients, and I'd like think to about antioxidant capacity.

And I'll throw in there gut microbiome, which is this compound urolithin A. So when I think what are some things in the evidence that we know can improve mitophagy, And I would encourage everybody to go back and look at the literature on Urolithin A.

It is a postbiotic, and 30 to 40% of individuals don't even make it. And so basically, we think about Uralith in A, there are these elagitannins that they come from pomegranates and other kinds of foods that are high-polyphenol foods.

The gut microbiome convert it to Urealith A but not everybody can convert, which is so fascinating. And you're probably thinking, well, why do I care about urolithin A?

Because in the literature, there are multiple, 20 years of data that would support its impact on mitophagy, which is the capacity of the body to regenerate and renew mitochondria.

It's incredible. I'm taking it. Shane's taking. And I think it's going to be the next biggest thing after fish oil. You know how fish oil came out in these omega-3s and we're seeing all of its effect.

You there's some very good evidence that it improves strength and it improve endurance in VO2 max, things that are incredible. So I think that combining dietary protein, understanding that there is a phytonutrient component which would be reds, and greens, if individuals are not interested in eating high volume, which I'm not.

that you can do a red or green powder, right? That's easy. Again, how are you going to get your fiber? One should consider that. And then this postbiotic addition, which would be urolithin A, another supplement that I think is valuable is glutathione, whether you're eating it or getting a shot.

I Think there's evidence to support utilization of kind of that triad. This is a big thing. I've been debating for the last few minutes in my head whether we should open this up, but I think it's important.

And I know it something you could talk about for two hours. So I might not know the answer, you do because we've talked about it in person before. The world is filled with lots of competing dietary cults, dietary religions, dietary ideologies, and they really are like cult, unfortunately.

There's also a lot of shady stuff that goes on, a lots of cherry picking to support particular dietary narratives and ignoring of evidence that conflicts with that.

A lot people wanting strong financial incentives for people to have the next big secret diet. And hey, everybody else is stupid, you know, keto and paleo and veganism and they all got it wrong.

And really this is the greatest new thing. So we've now got, virtually every, I think everything other than water has been demonized at this point. We have everything from the carnivore people who are convinced that broccoli and lentils and blueberries are trying to kill us and the vegan people who are convinced that your protein recommendations are deadly, right?

So let's just speak to that component, this idea that high protein consumption is harmful to health, is going to lead to increases in mTOR, it's going promote IGF-1 and cancer.

Just summarize kind of the latest thinking on that. Well, the first thing that I would want everyone to think critically about is what is actually considered high protein?

What number would that be? We know that high-protein is, what? In the literature, it is not defined. But we do know, that the bare minimum to prevent deficiencies is 0.8 grams per kg.

So 0.8 grams per kg, I don't know what that comes out to be, a pound. I dunno, you're good at math. But 0,8g per kg is the minimum to prevent deficiencies.

So around 0 point four. Okay, so 0.4 grams, per pound is, the bare minimum, to, prevent a deficiency. Would a high protein diet, and that's so basically how that set up, it's two standard deviations between what would be deficient, right?

So it is two standards deviating above of what we would consider deficients. So if that is the bare minimum and we were to double that number and get 1.6 grams per kg, would that be considered a protein?

No, that would From a definition standpoint, if we double the minimum, then that's moderate. So we now double them in. So now we know that 1.6 grams per kg may be more in line with optimal health.

Yet people would say, well, then that would be considered high protein. It's not. High protein would likely be consider above 2.2 grams for kg, right?

Or one gram of protein per pound. Yeah. That would considered more of a high-protein diet.

Diet Myths, Supplements, and Practical Takeaways

In terms of evidence to support dietary protein, every study out there would suggest that if you look at body composition changes, and body competition would be a decrease in body fat and an increase in skeletal muscle mass or at least the maintenance of lean body mass, which I wish we had more time, we would talk about that, but lean-body mass is all tissues outside of adipose tissue.

that every single one of those studies, people do better above the RDA, above minimum. And in fact, they've landed on the general recommendation is between 1.2 to 1 point 6 grams per kg.

Okay, so this is now in a more optimal range. If someone were to say, okay, what is the issue with a higher protein diet? I would say well, you're now at 1.6 grams per kg.

Is it really that much higher? Not terribly. And at what point do we see any detrimental effects in the literature? And we've never seen detrimental affects even above 3.3 to 3.4 grams per kg.

Now, I'm not saying people should eat that, but if we were really to say, what does the evidence support? The evidence doesn't support any known issue with a high protein diet.

And people need to take a step back and realize that the way in which these recommendations and these definitions came out were really to prevent bare minimum disease states.

So there is no evidence to support that. And in fact, the lower your protein intake towards the RDA, The more animal-based products that you need because you have to be able to compensate for the nutritional value, meaning you have to be able to reach your bioavailable zinc, B12, multiple kinds of B vitamins, iron.

So the lower an individual's protein intake is, the more it should actually be high quality sources, animal-based sources. If an individual is choosing to just eat a plant-based diet, they're going to require more total calories if they are eating whole foods and a higher amount of dietary protein, which goes against if protein is bad.

You are now needing to consume a high amount protein above and beyond that minimum amount, 0.8 grams per kg, just to cover the amino acid need. And again, it's kind of complex, but just to simply understand, there's no evidence to support that a, quote, high protein diet is detrimental.

In fact, its used for modalities for individuals that have to undergo surgery. It's used by individuals who have undergo healing. A higher protein is used to those who've been injured or burned.

There's a hole in the academic arena, and there is a whole host of reasons why a higher protein diet is better. Okay, so there's that piece. Then there was this whole big thing about red meat and cancer, which has largely been retracted, and then the Annals of Internal Medicine examined this body of literature.

The lead individual was named Johnston, People that are not aware, Annals of Internal Medicine is like the Super Bowl of journals. There were multiple, multiple studies done with multiple individuals for checks and balances.

They had no investment into outcome. There were vegans, there were vegetarians. They all examined this evidence. It was run through a process called the grade process in which evidence is evaluated and they found no high quality evidence with the addition of red meat, not processed, but whole red meet and cancer.

Yet it's pervasive. And I'll just leave them with one more thing is that people will say, well, you should reduce red me because you reduce cholesterol.

You should your eggs because of cholesterol, that cholesterol recommendation was taken out of the dietary guidelines in 2015. We don't have a cholesterol recommendations.

If something is repeated over and over enough, people believe it to be true. And these myths die hard. Yeah, 100%. Dr. Lyon, I could talk to you for another five hours, but we're pretty much at the end of our time here.

Is there any final words that you want to leave people with, or do you wanna maybe provide a quick summary of your key recommendations that have gone over here?

Yes, certainly. So, number one, muscle is the organ of longevity, and it is your only organ system that you can directly impact. The way in which you are going to do it, is, the obvious, physical exercise and nutrition, as it when it comes to physical, exercise, resistance exercise is key.

Also endurance type exercise. And just sprinkle in one day of doing something that, you really don't want to, whether it's high intensity interval training, that could be different for everybody.

But really doing the difficult thing is exercise. 24% of the population are meeting the recommendations. Now,

moving to dietary interventions for healthy mitochondrial health and muscle health.

100% percent of people are eating. In order to leverage food for muscle, mitochondria health, I'd like to intertwine them because, again, skeletal muscle is the home of mitochondrion.

for the most part, is optimized for dietary protein, separated into the first and the last meal. Those are your primary targets. The middle meal I don't really care.

Really thinking about that, I strongly recommend high quality proteins because of the nutrient density, especially when you're keeping calories controlled, right?

You don t need a ton of calories, but you do need to ton a quality. And then sprinkling the adjunct things on, like, if you have a beautiful home and now you're going to add drapes, you'll add in some kind of phytonutrient, whether it's a red or green powder or even a purple powder.

And, my favorite, mitopur or urolithin A, this compound, and potentially, If you wanted to get crazy with it, You could even also add an omega-3s. thinking about those things.

So it's the exercise piece of the recommendation, it is the dietary piece. And I will say, leaving individuals without confusion. Do not be distracted.

There are core fundamental principles that are evidence-based that you can execute on. It doesn't have to be confusing. Remember that confusion is a distraction.

As you age, the window of time in which you can get better closes. And that's intense to think about, yet true. So do not be distracted by the shiny objects.

Focus on evidence-based information. Move that needle forward. Please, and tell people where they can learn more from you and follow your work. So I had a TED Talk come out recently where I explain muscle as the organ of longevity and really as a key component.

Maybe you would be so generous to link it, they could find it. It's a Ted Talk. I have a book coming out called Forever Strong, where it takes these core fundamental principles and it breaks it out into very easy pathways.

And there are pages and pages of high quality references. there so that if individuals are interested in evidence-based information, I have done what I feel is a very good job in doing that and providing that.

People can find me on Instagram, Dr. Gabrielle Lyon, my YouTube, and my podcast. I'm hoping Ari, you will come on my podcasts, which is Gabriella Lyons Show.

We have a great newsletter and we're going to be doing 30 Gs, weekly recipes, Nice. Awesome. When does your book come out? October 17th. Okay. It's available for pre-order right now.

And it took two years and two babies to do, but it's done. Dr. Lyon, thank you so much for coming on, sharing your brilliance. I really appreciate it.

it is always amazing to chat with you. To everybody listening, you should feel very blessed to get this information because You know, this was an hour talk, but the methods that she's outlined, she has given you very explicit advice on practical things to do each day and each week.

And implementing this advice versus not implementing it literally can add years and decades to your life and certainly massively increase your health span, the length of time that you have a functional brain and body.

This is not an exaggeration when I say decades. I mean, this advice may be the difference between dying at age, you know, 63 from a heart attack versus living to age 93, in pretty good health.

So it like the tools that she's given you here are truly foundational to good help, to great energy and to a long life and a longer health span. And so I hope you will implement it.

Thank you so much, Dr. Lyon. As always, I look forward to our next conversation. Same. Thank you for tuning in to Doctor Talks. We hope today's episode has enlightened and inspired you on your path to optimal health.

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