[00:00:00] **Dr Mike T Nelson:** Welcome back to the Flex a Diet podcast. I'm your host, Dr. Mike T. Nelson. On the podcast we talk about all things to increase muscle performance, improve body composition, all in a flexible manner without destroying your health in the process. Today on the podcast, my good buddy, DC, Dr. David Church, and we are going to deep down the rabbit hole.

[00:00:27] Of all things, protein, training, testosterone, and much more. I've known him for several years now, and got to hang out with him at the ISSN meeting this past June. Once again, down in Florida, I was giving a talk there on Primer, on psychedelics. He was giving a great talk I think it was about protein, or it might have been about the study we talked about here with testosterone supplementation with military.

[00:00:59] And, I think you'll really enjoy this podcast. We talk all about Wingate testing, what that is. How I increased my calf size by 1 inch in about 4 months. And what he did for calf training. Our vasculature, or how you supply nutrients to the muscle. Is that really a limiter for muscle growth? Why you should be doing some aerobic and cardiovascular work, even if you just want to get bigger and stronger.

[00:01:28] Actual foundations of training, the impact of exercise, and how it affects protein metabolism. Why perfect nutrition can actually be a bad idea for some athletes. Is testosterone actually anti catabolic as a main mechanism of action? Some really great stuff there, looking at highly catabolic burn patients and what we think the role of testosterone really is.

[00:01:59] Why you probably don't want to be the supplement science guy in the room all the time if you're doing consulting. And a whole lot of other great stuff here. So he is an assistant professor at UAMS. and has published a ton of research in the area of protein metabolism. He just recently was one of the head authors on a new position stand through the ISSN, so the Journal of International Society of Sports Nutrition, all about the use of essential amino acids.

[00:02:38] And we'll link on the website to several of the great studies that he's done. So sit back and enjoy this podcast with the wide ranging super informative stuff. If you enjoy this, you can also check out my newsletter, which is completely free. Go to miketnelson.com/podcast. You'll find all the old podcasts that I've done.

[00:03:03] We've got quite a few now. Also any guest podcasts I've done. And if you scroll down, you'll be able to get on to the daily newsletter. That's where I send out all geeky stuff in a hopefully informative way to help you add muscle, improve body composition, all that wonderful stuff. So go to miketnelson.com/podcast and you'll be able to hop on to the newsletter completely free. We'll put a link down below in your favorite podcast player here that'll take you directly to it. So enjoy this podcast here with the wide ranging things all about muscle, protein, testosterone, and more with Dr.

[00:03:44] Myohead himself, Dr. David Church.

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[00:03:50] **Dr Mike T Nelson:**

[00:03:51] Welcome back to the FlexDiet Podcast.

[00:03:53] I'm here today with Dr. David Church.

[00:03:56] **Dr David Church:** How's it going, man? Oh, living the dream. What about you?

[00:03:59] **Dr Mike T Nelson:** I'm doing good. I can tell it's the beginning of the semester because your cork board is rather empty. So it must be the beginning of the

[00:04:06] **Dr David Church:** semester. I don't have to teach. Oh, then it might always be empty.

[00:04:11] Yeah, I was going to say that's exactly how it always looks. In fact that I'm going to study that we're getting ready to start. And the only reason it's up there is because my study coordinator wanted me to pay attention to it. So normally it's even more better than that. So, I almost forget. I have to see the the tweets in order to remember like when semesters start, when finals are all around.

[00:04:32] I'm a little, separate from that for better or worse. There's pros and cons.

[00:04:36] **Dr Mike T Nelson:** Yeah. I assume you like just doing more of the research then I would

[00:04:40] **Dr David Church:** assume. I like it. Yeah. I like the research. I think I wouldn't mind teaching like a graduate level course, cause yeah, I think there's a real value in, in, in teaching.

[00:04:50] Like physically that age range or even like undergrads, cause they know what's quote unquote, like the new thing being pushed and exercise and or nutrition. And so it's a good way to make sure that you're. You're aware of all the new developments and new stuff going on. That's not just in PDF form, so to speak.

[00:05:09] So I missed that part of it, but I certainly I like to be able to do research all the time.

[00:05:15] **Dr Mike T Nelson:** Yeah. The thing that was, when I did more of the undergraduate stuff, when I was doing my PhD was, I don't remember what I was talking about and I remember asking people, I'm like, you guys are exercises, phys students, right?

[00:05:27] You're all seniors. Like you, you must exercise. And then I just looked at me. I'm like. How many of you like don't exercise at all? And it was like half the class and I was like why are you here? And they're like, oh, we're pre nursing, pre physical therapy, whatever. And I was like, oh, okay.

[00:05:44] There was only like four, like hardcore only exercise fizz people in it, which I was shocked. I was like, oh, weird.

[00:05:53] **Dr David Church:** Yeah. When I taught, I did my PhD at university central Florida and I taught ex vis and strength conditioning sports nutrition there and, Florida's different. But I think the majority of my students were all pretty into exercising, even if there was some type of.

[00:06:07] Like you said, preclinical track, everyone there was very interested working out. So I hope now if we walked into it, I hope it's better. Yeah. I hope they're all like, yeah, I at least, get my 10, 000 steps a day. And so,

[00:06:19] **Dr Mike T Nelson:** yeah, they were all bitching on the wind gate day and nobody wanted to be the first person.

[00:06:23] So like by the third lab, cause he had, I did six labs, in one day and then it would repeat the following week. So like by lab three, I was getting pissed off and I was just like. Alright, I'll go first, and then you all have to see if you can beat my score. And they're like, oh, okay.

[00:06:38] Ah, good for you. I was regretting that after I did it, but...

[00:06:44] **Dr David Church:** I can't say I would have raised my hand to do the wind gate first either. So I can't blame him, especially when those 32nd ones, those

[00:06:51] **Dr Mike T Nelson:** are brutal. Oh it's horrible because for people who are listening, we had the old Monarch bikes where you get on there, you pedal as hard as you can.

[00:06:58] And it's a cool idea. They put this little band around a wheel. You put a bunch of weight on it and you pull this lever and boom, all the weight hits the wheel. So it goes from 50 Watts to 380, 400 Watts, like instantly. And it's so weird because at first you're like, Oh yeah, I felt that.

[00:07:15] Oh, this isn't so bad. I got this. And about like 15 seconds in, you're like, I'm not really sure. 10 seconds left. It feels like your legs just got replaced with bags of concrete. And then you wobble off and you're like. Oh, I don't know. The deals are good now. .

[00:07:32] **Dr David Church:** Yeah. Yeah. I, the it's a cool test.

[00:07:35] I love watching it. Oh yeah. Yeah. , I love watching it,

[00:07:38] **Dr Mike T Nelson:** oh, it was fun. We'd have the people from Cal Dietz, he was around the corner 'cause we were Marucci. And so his assistants would come down once in a while and it'd be funny just to see them pretend to walk through our lab, which they never did, and I asked the one guy, Kevin, I said, Hey. You guys must have figured out it's Wingate Day, because I noticed everyone just casually walking through the lab. He's oh yeah, one of your students was puking in our bathroom.

[00:08:03] **Dr David Church:** Yeah and I think that's the day that you consistently see lactates at 14 to 16, in there.

[00:08:10] And it's just it's a good, it's a good awakening as a student. I've done plenty, but when I did one, I was like. Oh, that's what anaerobic, the anaerobic

system is, so to speak, like predominant anaerobic system. So yeah, because like you said, that first 10 seconds, probably just that phosphagen system, but from 10 to 30, that's

[00:08:28] **Dr Mike T Nelson:** torture.

[00:08:29] Yeah, and you have a whole new, I think, respect for people who are like 400 meter runners or crazy stuff on bike sprints or, rowers of all kinds or people who just live at these like just crazy high lactate levels. And again, you're only looking at blood lactate. You don't know how much appears, how much goes away, how well they can buffer, all that kind of stuff.

[00:08:49] But, ugh, it's just, it's probably, I think, the most miserable area. And anyone who's done a lot of sprinting will be like, 100 meters, okay, I'm slow. So, 200. Definitely slow, like that 400 meter range. It just the 60 second range, 30 to 60 seconds to three minutes. If you're going all out it's always just miserable.

[00:09:12] **Dr David Church:** Yeah I'm right there with you. And you start getting appreciation for why all those disciplines have these massive

[00:09:18] **Dr Mike T Nelson:** quads. Oh, yeah, it's

[00:09:20] **Dr David Church:** oh, they're just the amount of work, metabolic work being done in such a short time frame. It's just

[00:09:27] **Dr Mike T Nelson:** astronomical. So. Yeah. Cause that was the old argument for awhile that you can't build enough hypertrophy without eccentric exercise.

[00:09:36] And then you see the photos of these freaks who are like sprint cyclists with quads that are like the size of my trunk and you're like, I don't think they're doing a lot of eccentric stuff, but it looks like it's working for them.

[00:09:48] **Dr David Church:** I Know those guys have huge, you're right. Those legs are just ginormous.

[00:09:53] I've never seen anything

[00:09:54] **Dr Mike T Nelson:** like it. I think in sport, that is the biggest legs I think I've ever seen. It just seems and there's outliers here and there, but in terms

of what you would say is Olympic level sports, like that, I don't know, I think that's the one if I had to pick one, I guess.

[00:10:09] **Dr David Church:** I'm with you there, it's always I always draw that similar analogy to soccer players and their calves. Yes. They always have huge calves. It's you talk about, and I'm not making fun of them, but you know, bodybuilders where I was like, you can't get my calves to grow. It's man, go to the soccer field, man.

[00:10:22] They'll grow every single one of them. And it's not even like a, just an EPL thing. I remember I played division three sports, but you know, all the guys and girls that played soccer at my little D3 school, they all had, big calves, like they're, yeah. So I agree with you. It's something about different sports, different loads,

[00:10:41] **Dr Mike T Nelson:** different muscle groups.

[00:10:43] Yeah, my thought was, you also, you don't see any of these, I haven't seen an exception yet, but very large mammals always have large calves. Like you'll see the inverse, like you'll see some smaller people who have just freakish calves. And I always ask them about them because the answer is usually the same.

[00:11:03] Oh, I don't really train much. I've never really trained them. It's what the hell? But you don't see a large people with small calves. So the most I ever put on my cows when I actually bothered to really train them much other than just minimal right now was, I'm like, what if I just do heavy farmer's walks and barefoot shoes, like three days a week?

[00:11:22] I think I put like an inch on my calves in four months because I'm like, I'm just simulating heavy walking like all the

[00:11:29] **Dr David Church:** time. Yeah. Cool. To that point, like I'm not a small guy for your listeners at home and I've definitely been accused of you only have big calves cause you're a big guy and it's okay, probably it doesn't have to support me, but I've recently increased, doing a lot more cardio. So I've been doing a lot more running before I left and my calves are just getting bigger. No, it's yeah, repeated, repeated. It's like a little, it's a little resistance workout for them. Every time they got to push my body down the track. I mean, that's quite the load for them.

[00:11:57] So. Yeah, I do the farmer's walks and stuff, too. I agree with you.

[00:12:03] **Dr Mike T Nelson:** Yeah, because running, you're looking at, what, four to six to maybe eight times load? I mean, it's an impact load, so it's an impulse, so it's very short, but still, I mean, you had even just go up in body weight by 20 pounds. That's a big difference on the same human, that's a huge difference.

[00:12:19] **Dr David Church:** Yeah, and plus you're increasing, we know whether it's farmers walks or, I'm just doing some, I would call it jogging, when I played football, when I played football, I called it a hog jog. So maybe somewhere between that and jogging, but I'm just doing that, but we're definitely going to increase the vascular supply to the muscle.

[00:12:37] Like Luke Van Loon's I think I can't remember the lead off. I think it's Milan Betts. They've shown that, increased capitalization of muscles related to the the muscle metabolism. So, and I think Stu's lab, Stu Phillips lab just came out with the paper last year and the past year showing that if you did some type of, you took people who are untrained and you had them do, some type of aerobic training first and then resistance training and actually gain more mass.

[00:13:01] With the prior aerobic training. So, that blood supply is you're eating, like you said, you're getting that, that muscular contraction of a high force, but on top of that, you're increasing the blood supply. So you're coming at it from 2 different

[00:13:13] **Dr Mike T Nelson:** angles. Do you think muscle contraction is more oxygen based than what we realize?

[00:13:21] I know it's a broad, general, open ended question.

[00:13:25] **Dr David Church:** Disclaimer, I study metabolism of macronutrients, but we'll give this one a shot. And for people that don't know at home you're probably like oxygen, it's bioenergetics. It's bioenergetics is a little different than metabolism.

[00:13:37] Yeah. Related, I get into it, but there's certainly something better to answer this question, but... One of the papers I like the most that I've been on was a review paper I wrote with Nate Jenkins and his group at the University of Iowa. Niall Banks and Emily Emily Rogers were the lead.

[00:13:54] They were his grad students. They took the lead. We, they came from the vascular side of things and Dr. Frando and I provide the muscle metabolism input. We were just trying to make the argument that, the vascular

system is totally overlooked when it comes to protein metabolism, it's like you don't have healthy blood vessels masses there.

[00:14:12] It doesn't really matter how many, how much protein you take. You know what I mean? So I, when you're talking about muscular contraction being related to oxygen consumption, is that what you're like? Yeah. Yeah. Yeah. I mean, probably. I mean, I'm, I can't really expand too much, but my knee jerks to say, yes.

[00:14:33] If you look at like the blood flow restriction research, i, as soon as they strap on those cuffs they hit failure task, failure much quicker than without the cuffs on. So yeah, I mean, yes.

[00:14:47] **Dr Mike T Nelson:** Yeah. I mean, that's. I think 10 years ago, I would have said no because all your heaviest loads are my little air quotes here anaerobic and you need the heavy loading and you need just tension.

[00:14:58] And that's the only thing you just give it some amino acids and you're good. But then I started seeing stuff like I've talked about this before, but Aaron Davis, I think had a guy do 30 second all out on the rower, so Wingate, stuck a MOXIE, so a little thing that looks like infrared that can look at local oxygen use on one of the quads, and you see it start off, it's 85%, and then it just starts dropping immediately.

[00:15:23] And by the end of the 30 seconds, it was down to 19%. Yeah. And which for people listening, that's basically just saying, my air quotes again, oxygen use, right? It's just depleting the oxygen out of the muscle. And I'm looking at that. I'm like, Whoa wait a minute. Either this device is complete dog shit or everything I learned is not right.

[00:15:43] Because I was told like, this is very anaerobic still, like 10 seconds is the max. And then it drops from there. And that Wingate, sir, you build up a lot of lactate, and it's anaerobic glycolysis, blah, blah, blah, all this stuff, which is true. But I never would have thought that your oxygen depletion would be that low at the end.

[00:16:00] And it turns out it looks like the device is probably correct. And I think that you're always using oxygen in the background just to higher degrees than I think me as a meathead would have ever envisualized, I guess, or thought about.

[00:16:14] **Dr David Church:** Yeah, that's a good way of putting it is like from what you would expect like this is all like a relative conversation.

[00:16:21] Oh, 100%. Yeah if you were to talk to some of the like studies that they'd like of course, and it's like, of course, you idiot. We're talking about from when I was like, a, like you said, a little meathead in undergrad. And then I had a similar experience. My PhD, Kyle Beyer was doing a dissertation on repeated sprints and adolescence.

[00:16:37] And we got a nearest device, which like you said, Yeah, it's measuring hemoglobin saturation. technically, I think, or myoglobin saturation and I was willing to be the guinea pig and we did that. And then we did a O2 sat on my finger. And we got my O2 sat down to, on my finger down to 60 percent or something.

[00:16:56] Oh, Jesus. Yeah. I remember like getting a little lightheaded and you're also playing with the caveat there is we were playing, we just got new altitude chamber systems. Oh, okay. And so I have a picture, I put the mask on and we put me up at 13, 000 feet too. Oh, that'll do it. Yeah. But the point is you just kept seeing with each success, with each sprint, it just got lower and lower.

[00:17:19] lIke I did three or four and I had to stop and I had to wait like an hour to get home. I just three or four sprints, at Pike's peak altitude, no big deal. Just subsequently down. I got down to like I said, like 65, 60%, something like that. And I was like, I'm not feeling too good, guys.

[00:17:34] I know me just waited about an hour, went home, everything was fine. But yeah, I mean, clearly oxygen is a major component of performance. I mean, it's huge in my current transport chain, book. So yeah, anyway.

[00:17:47] **Dr Mike T Nelson:** Yeah, I always ask people my crazy question and then have you ever dreamt or thought that you read a study and for the life of you for 10 years after you can't find said study and it just drives you insane.

[00:17:59] **Dr David Church:** I know, but that's because my dreams are like real life. So I'm usually writing a paper, or writing a grant or a paper, but I'll do that. Like in my day to day life, I'm like, I know I read that somewhere. And then I spend. Like a whole day trying to find it. And I never do, but someone usually knows what I'm talking about.

[00:18:21] Yeah. Cause

[00:18:21] **Dr Mike T Nelson:** I swear I read this. Of course it was a Russian paper, right? Of that when you do aerobic training for, let's say, increasing muscle hypertrophy, to augment blood flow, vascularization, angiogenesis, all this stuff that there was a big uptick at around like the, I think the four to six week mark.

[00:18:39] Which I've seen anecdotally in, in clients, but again, maybe that's just because of training, they're not new to it, who knows. But I think their hypothesis was that the blood vessels grow from opposite sides, and that once they connect, you'll see this huge uptick in blood flow. Which, makes kind of sense, but I can't find that paper if my life depended upon it.

[00:19:02] But it sounds like a cool story. Yeah,

[00:19:06] **Dr David Church:** I'm gonna have to punt on that one. Yeah. Yeah, that's all right, but it would agree with the data. Like I said, we were talking earlier, I think all those studies do show four or six weeks of some type of aerobic preconditioning just, just takes off. Yeah.

[00:19:18] And I'm sure there's something about, I mean, you get into I just butchered that, but you know, I'm talking about just like generalized training is where you got to start. There's no needy in this specific training or trying to be an elite master. And so you just get like a base level of of of fitness, so to speak.

[00:19:38] And I hate that word fitness, but black, the better one, it's the base level of a foundation of training. And from there is, then you can start having a little bit more fun.

[00:19:48] **Dr Mike T Nelson:** Yeah. I mean, if you're here to max your aerobic capacity is that of a field mouse and it's like sub 20s, like good luck trying to recover from fricking anything, you just need to get more condition trained, whatever word you want to

[00:20:01] **Dr David Church:** throw at them, yeah. Yeah. You're not going to be doing any 20, 20 rep squat sets. There's no way that's how Yeah, I'm with you on that. So I, and it's funny as I've been talking to more and more people, PhD scientists in my field, but also, people that walk the walk, right? There's plenty of us that train hard and plenty more than me that have the credentials to show that they've trained hard but also have a good background education.

[00:20:26] And we're all starting to be like, I've been ignoring this aerobic system for too long. I'm just starting to see my I'm starting to see my gains and

my strengths and my performance go up and I'm feeling better. It's oh, who would have thought? It's like you said, you go back and you read.

[00:20:42] You just read the literature and it's they tried to tell us. We just didn't want to listen.

[00:20:46] **Dr Mike T Nelson:** Yeah. And that, especially the history of exercise fizz, like aerobic stuff was like the thing because, Oh, look, we got these cool metabolic hearts now. We're not using Douglas bags anymore. And Ooh, we have a treadmill.

[00:20:57] We can do all this stuff in the lab and we don't have to chase people around with shit,

[00:21:01] **Dr David Church:** yeah. No I, the amount of professors that were like, you really need to do some aerobic training. I'm like, no, I play football and baseball, man. I have seven seconds at best out of me, they probably were right.

[00:21:11] Probably should've done a little bit more aerobic work, probably have been a little better athlete. Might've slept more of the field, but not too much, right? I'm not saying you need a ton, particularly in those sports, but yeah, I mean, Now it how old am I in the last two years? Like I'm 32 to 34.

[00:21:25] I'm like, Oh, it felt a lot better than I did when I was 28, 27, maybe not as good as I was when I was 24. But you know, when you're under 26 as a male, I think you're like indestructible

[00:21:36] **Dr Mike T Nelson:** is my, you're fine. Doesn't matter.

[00:21:39] **Dr David Church:** We've tried to break like 18 to 25 year olds in these military studies. So, and they're just unbreakable, just, like me, how they get injured and they're not feeling great, but we're throwing the kitchen sink at them, I mean, yeah, I was doing my PhD, but I was eating a caloric surplus getting pretty good, reasonable sleep, so to speak and this, that, and the other, it's like that compared to now I got.

[00:21:59] Two kids, sleep, sleep's a mystery, but yeah, it's it turns out running helps do some type of cardio, it's not always running, but some type of cardio, I feel a lot better. I feel a little sharper mentally. And then on top of that, I, my my lifts are just like, it just feels smoother for those that live and they know exactly what I'm talking about.

[00:22:18] And I'm getting stronger. So that's

[00:22:19] **Dr Mike T Nelson:** always fun. Yeah. That's one of those lessons. It's hard to impart to people until they actually feel the difference. Because I was the same way, like for like many years ago, I did some competitive powerlifting, but I, my bench press was more than my squad.

[00:22:35] The first time I ever squatted the announcer, he's okay, three white lights, plenty deep because I was doing like an Olympic level back squat. I was like this far off the ground, 185 pounds,

[00:22:48] **Dr David Church:** that was me in my undergrad. I was like, cause that was, I was an undergrad from 28, 2008 to 2012, something like that.

[00:22:55] I could be wrong. Someone's going to listen to that to tell me I'm way off. Like the ISIS in conference, I lied about my age there on accident. bUt back then it was like ass to grass. And so I was, some guys on the team would always make fun of me like, yeah, I was deep enough.

[00:23:15] Okay I'm just trying to make sure I'm hitting it in depth. And then, I started I did an internship at Baylor, a gathlet performance team strength. Oh, nice. Yeah. That was back when like USA today ranked in like the freakiest team in the country. So we had Sean Oakman and Blake Seastronk and.

[00:23:31] And all the, all those guys there, but then on top of that, like they, they had the year of the bear right after I got there. And it was like every team won the big 12 championships. So there's just great athletes everywhere. No I worked with like even Akron tumbling. They were great. And talking about strength, power athletes, come on.

[00:23:47] No. And, but I started seeing like how they're training and particularly like the track team. And I saw on the female thrower is doing three 15 to a box. And I was like, I don't know if it's good enough for her. And if it's good enough for website, it's probably good enough for me. And so I started incorporating more box spots at that point, like I adapted, it's like you said, I remember like when I was doing my dissertation, I actually did it on motor units not stocks.

[00:24:09] And it was like, when I finally got an appreciation of what a motor unit actually was. And I would start, I was squatting and I was doing box squats and I'd be like, Ooh, there's a new motor unit. Like I just got a new part of the

muscle activated. So yeah, it's funny how you got to go through those learning lessons on on doing different things.

[00:24:25] It's you don't always have one way. There's always then, even now I'll squat past the craft sometimes, but then sometimes I just squat to a box. You got to mix it up.

[00:24:35] **Dr Mike T Nelson:** Yeah. I think a lot of it goes back to, what are your goals? For me, my Main goal is more related to grip sport and doing kiteboarding stuff.

[00:24:42] So if I'm going to get dropped out of the sky 20 feet and try to land on my feet, like I, I'm probably want the ability to go to a full range of motion by virtue of, I may have to get into that. And I don't want that to be like rep one of once I get past parallel, some shit goes wrong. I'll live with much lower.

[00:25:07] just because it's not specific to what I'm doing. So, but yeah

[00:25:13] **Dr David Church:** no, I get it at the time. I was really big on the Olympic lifts. Oh yeah. Yeah. Just me. I front squatted just as much as I back squatted. And so it just made, yeah, it made it to me, it was just what I did and it's what it used to, and it didn't feel like I was going deep.

[00:25:27] It just felt normal. Yeah. I think that's the other thing we forget. It's if it feels normal and it doesn't. Just let them be, so to speak. And yeah I the conditioning thing, like the aerobic conditioning thing, and then you'll appreciate this too, a proper warmup or two things that I learned way too late in life, I would just save myself and your listeners here, this is the most important thing we'll talk about, learn those two things and you'll save yourself so much pain and misery.

[00:25:54] **Dr Mike T Nelson:** Yeah. I, even now I have this. Weird thing where it's yes, people should do a warm up. Yes, you should be prepared. No, don't do any stupid stuff. Yes, I did way too much stupid stuff, but I also have this other thing in the back of my head where I'm I feel like I'm running this line of, I want to be able to do warm ups, I don't want to get injured in a controlled setting, which is the gym.

[00:26:15] I'm not getting paid to do this stuff. But I also don't want to be the old guy who shows up at the gym an hour beforehand before he can do anything at all. So I feel like if I'm getting strained too far away, I'll do weird stuff like, Okay, can I walk in? And do like an axle deadlift where grip is going to be more

of the limiting factor than my back, what's the heaviest weight I can do that without necessarily doing a warmup, but yet doing it in a very safe manner and the backup fail safe on that is that it's a two inch overhand bar.

[00:26:47] So if it's not there, my grip is going to fail before I try to look like a pooping dog to, to get it up. It's always like I'm running this line between the two of can I escalate the stuff I can do without a warm up and do it safe and do a condition well, and also still being, safe and not be an idiot at the same time.

[00:27:07] **Dr David Church:** Oh, I like that. That plays on oh man I'm, it's a surfer. And I forget who it is, but I'm pretty sure they're a surfer. It might be Kelly Slater, but yeah, but one of them has a quote or they have a theory of you got to be able to perform if you're running on like farm truck food.

[00:27:22] You're not always, yeah, you're not always going to be like on, 93 octane, like a Ferrari, and for most of us, yeah, that's a, I try to eat as good as I can now, particularly with kids because sometimes. Things happen and I just can't get in the gym, so it's like I've always liked food I like donuts and tacos and oh, they're

[00:27:41] **Dr Mike T Nelson:** great.

[00:27:42] Yeah

[00:27:43] **Dr David Church:** My weakness man, that's my biggest drug is food. But I was always able to like i'll run it And as you get later in life and you get more responsibilities It ain't happening, so but it's something i've thought about where it's I mean some days I just i'm gonna have what i'm gonna have and I gotta be able to perform, so that's a similar That's a similar concept, but I like that.

[00:28:03] That's probably something I should start doing a little bit more. Yeah, the gym. And like you said, not take an hour. I got an image of a couple of people in my own gym where you

[00:28:11] **Dr Mike T Nelson:** see them at the gym and it's good for them. I'm glad they're there. I'm glad they're being safe. But, a

[00:28:18] **Dr David Church:** little bit of specificity there.

[00:28:19] Principles, specific adaptations to impose demands. Cause it's, if you're ready to go on a, like you're on a trip and you want to go hike up in the

mountains I mean, I say that we got some mountains here, but they're like 2000 feet. Thank you. When the conferences are in Denver or something and you want to go out there and you want to hike up like Pikes Peak, I guess Pikes Peak is in Colorado Springs, but you don't hike up one of those mountains.

[00:28:38] Like you're going to do an hour warmup before, you're just probably going to get your friends and go. Yeah. Yeah. So I like that. That's a good concept.

[00:28:45] **Dr Mike T Nelson:** Yeah, and the food idea is the same idea I have with metabolic flexibility, is that, I mean, people assume that it's like, Oh yeah, elite athletes, their nutrition's amazing.

[00:28:54] It's some of them, yes, but a lot of them, like more often than not, the ones I've looked at, like a couple of them, I thought their coach was like punking me. I thought it was like a practical joke. And then you realize, Wow, they're doing that on that little of food and I think of the inverse to where I've worked with some guys who are getting ready to go through selection and the guys who are always the hardest are the people who come in who generally more towards the bodybuilding background.

[00:29:21] It's yeah, you might be a little bit heavy. You should probably lose a little bit more weight, even if it's muscle and. You realize you're not gonna have all your food perfectly timed out, ever. And if you get hangry and can't go to the gym because you missed your 9am meal, you're screwed. So it's we add more variability, like fast food, like eventually...

[00:29:43] Like you just want to be able to operate on anything and everything and not worry about it

[00:29:47] **Dr David Church:** And I agree completely. I looked at going officer candidate school at the end of my master's and then a little bit during my phd as well And so I talked to a few guys that had gone to through ocs and then some of it and we had a few individuals in our lab at ucf that had I've been in some pretty elite units in the Israeli Defense Force, the IDF.

[00:30:05] Oh, yeah. I've been fortunate enough to interact with some other members of the special forces community of the U. S. In that time since, and, I asked them oh, what can I do to train? I'm thinking I'm going to get some type of probably people come to you some tailored approach.

[00:30:17] Yeah. And it's one, the one that will always stick in my mind, they'll be, like, Just have someone set like random alarms for you and you just have to wake up when that alarm goes and go, but just get, do that or another one was like learn to go hungry. That was, that, that was the stuff they were telling me.

[00:30:33] And then they said, run, like they're like run. So it basically came down to be able to wake up whenever, be able to be hungry and deal with it and then be able to just run. And if you look at the literature, that's what supports it, the most injuries those that have like lower aerobic fitness have greater injury rates and like basic combat training and those other school.

[00:30:54] I mean, basic combat training, it's not the same thing, but the principle will continue to fly low aerobic fitness is a major predictor for injuries in military populations. So if you want to be in one of those, in one of those situations, liftings, beyond body weight is probably irrelevant.

[00:31:12] I'm not saying it's not useful. I mean, yeah. Yeah. And I heard things in a vacuum. I had one guy was like, cause I'm a bigger guy and he was too, he's like just cut down to make the tape and he goes, if you make the tape, once you get there, you'll stand out cause you'd be able to do things other guys can't.

[00:31:25] Yeah. But he had that for, I mean, it's not like it's for nothing, but yeah, it's just different from what you think

[00:31:31] **Dr Mike T Nelson:** going in. Yeah, I remember a buddy of mine, he was in Iraq, the, he's an MP there, and he said that on their base while they were there, which, it was an active war zone at the time, he said their biggest casualty and injury was basketball.

[00:31:48] Yeah. Because he said all these people were not prepared for high velocity change of... Direction stuff would go out, and they eventually had to literally ban the basketball court because so many soldiers were getting injured. Just because they're not prepared for it,

[00:32:05] **Dr David Church:** i, yeah, and even, by the way, even when you are, basketball's a tough one.

[00:32:09] Oh

[00:32:09] **Dr Mike T Nelson:** yeah, it's a violent change of motion and if your tissue's not ready for that,

[00:32:14] **Dr David Church:** yeah. Yeah, that's the worst I ever hurt myself. I was an 8th grader, so I was a genius. And I was, all at five foot eight, then I'm like five foot ten. So I'm not much taller. And I'm an Indiana kid. So I should have been hanging out at the three point line anyway, but I was like, ah, we got out of a chair.

[00:32:30] And we were dunking basketball. And that's what I did. I didn't go wrong. Put it through, came down, landed, felt fine. One step, two step, one step. And then I took my second step on my left foot. Oh, I tore both tendons on each side of my ankle. Oh, yeah. So I haven't done it since because I haven't tried to dunk a basketball since then.

[00:32:56] Anyway, there's another lesson your listener shouldn't do, I guess.

[00:33:00] **Dr Mike T Nelson:** Yeah, that whole Let me, at least when you're doing your own vertical, like your neurology will stop you a little bit, right? Your brain will be like, Hey, you're not going to take off so high if you can't support that landing. But if we use technology like a chair and override that, it's a bad stuff could happen.

[00:33:19] **Dr David Church:** Like I said, I was an expert. I'm not saying I'm much smarter now, but I'm a little bit smarter. I'm sure we were trying to impress someone, right? Oh yeah. It great boys that I'm sure there is like a coach or some girls or something. We were trying to like, or each other most likely,

[00:33:35] **Dr Mike T Nelson:** totally.

[00:33:37] And tell us a little bit more about the study you did on the military people, right? If I remember right, you had them, you were trying to simulate an overtraining scenario, right? And then you were using testosterone and some other stuff to see what would be effective countermeasures?

[00:33:53] **Dr David Church:** Yeah and to be fair with all these like military studies, I'm like it's this is like the opening slide of the presentations, like I'm a very small part of this, like Dr. Frando is a big part. It was my postdoc mentor. And then 7 Pasiakos, who was the division chief up at usarium for the military performance division.

[00:34:11] I was like, director of NIH is office of dietary supplements. I mean, it was like something they've been wanting to do for years, so, them and then.

One of my good friends from University Central here behind me Alyssa Baranofsky. She's the lead author on that paper.

[00:34:25] Oh, okay. Yeah. Yeah. Yeah. So it was really cool because I was here at UMS Usarium. And so we got to work together through this bridge again. Nice. Yeah, she was right behind me. My PhD, same mentor, like we're each other's right hand person, so to speak, so it's good to work for her again, and there's a bunch of others, involved, everyone at Pennington Biomedical that is where the study took place, and it's important to mention Pennington, because for listeners that don't know, it's that's like the creme de la creme of these types of studies it's completely, it's inpatient, a part of it, part of the study was inpatient So it's completely controlled when they're at Pennington, like how much they're doing, when they're eating, when they're sleeping, what they're taking in.

[00:35:02] I mean, it's an inpatient setting, everything's controlled. So, it and to be fair, this was the second study where they looked at this. The first studies, same thing, but they did ops one and their performance measures were more clinical oriented, good things we would do with like cancer patients, knee replacement, so like dynamometry, things like that, good clinical measures and muscle strength, but not something that maybe is as applicable for SF guys, something like you're more interested in their ruck time, maybe like a three arm deadlift, vertical jump. When gate, I think we did all that. So that was 1 change. We did from the 1st study. The 2nd studies, we made it more military task specific. And then, as we talked at the beginning, when you and I just talking off air, first day was, I think testosterone amphate, which has got like a one week half life. And there is a little bit of concern about, and reasonable concern about, these guys have to do self administration in the field. Because you got to remember the stress that they're not only physically, but psychologically.

[00:36:00] And so we switched to, Winodecanate, and it's got a much longer half life. And in fact, that's what they're using for TRT now in older adults, right? Because it's one injection, it's 12 weeks they can get out of it. So, those are the two main changes we made in the second study.

[00:36:15] And there's three phases. Phase one is collecting baseline data, right? Their community. And we assess the whole host of those measures I mentioned, body composition, the muscle metabolism, the body protein metabolism, things like that. And so we got their baseline and then we brought them in to the Pennington inpatient center where everything's as controlled as it can be.

[00:36:38] And for 20 days, 21 days, 28 days, I can't remember exactly but that phase 2 was completely controlled. What it was they had something like a 50, 55 percent energy deficit and that's key because. That's pretty

[00:36:52] **Dr Mike T Nelson:** brutal to do for that many days if people have done it like there's a couple one two week studies but to do that for that length of time, that's

[00:37:02] **Dr David Church:** Yeah, I mean we consistent I always say 30 percent because of variants and it's I don't want to get too deep in the weeds on this podcast, but a lot of people say anything or Anything 40 percent and up, you can gain muscle mass while losing fat mass.

[00:37:19] That whole thing. Yeah. And I know where that data is coming from and I agree with that statement, but if you dig a little deeper, you'll see some people that when they're at a 40 percent energy deficit, the variance measures cross over to where they're actually, some of them are losing mass.

[00:37:35] Yeah, so I always like to put it at 30%, but anything over 30, 40 percent with just resistance training and protein and things usually at 1. 6, anything beyond that, you might mitigate the loss of muscle you would if you weren't eating more protein or lifting, but you're going to lose muscle.

[00:37:51] So we have 50, 55%, no. Pretty high. And I think in those, and I'm going to forgive, I think that placebo group in those 20 days, I think they lost over a kilo lean mass, but I want to say they lost like four kilos total, which I mean that's aggressive. So, oh yeah. So, they have the energy deficit and by the way, it's diet and exercise induced, it's not like you're just dieting, like you're doing ruck marches, they're doing pretty aggressive training.

[00:38:18] Cause if you look at some of the previous studies Lee Margolis, who's also at usarium he has a study where the Norwegian training, winter training, and they had to queue these huge 40 percent energy deficits, but they're taking in three, 4, 000 calories, but they're

[00:38:32] **Dr Mike T Nelson:** much higher flux rate too, which I think is.

[00:38:35] Yes, your caloric deficit is the same, but to me, it, the physiology is just different. Yeah,

[00:38:41] **Dr David Church:** so they're expending 6, 000 calories, so, and, so anyway that you got that large energy deficit, but then on top of that, what we

didn't do in the, what they didn't do in the first study that we, we changed in the second study was we added in the sleep restriction component because if you're out on a mission.

[00:38:58] yOu're probably not sleeping in a, you're not going to get your eight hours of sleep right to maximize muscle protein synthesis. So, they did, I think it was like three days in a row. They got only got four hours and then they got two days where they could get a full eight and three days for two, eight.

[00:39:14] And so it was like that for 20 you that don't know I can't remember how many days in a row of sleep restriction will tank test, but it's something I know if you do complete sleep deprivation for a day. You'll be you can become hypogonadal. But anyway, so we did, we just did restriction and so they did that for a second phase and then, after that was that inpatient phase and then what we did after that was like simulate, okay, that was the mission.

[00:39:38] That was the simulated sustained operation, right? It was that for 20 whatever days we did. And then after that, they went home, like you would return from the mission, you would go home and they just lived their normal life, ate what they wanted to eat, could eat whatever they want, no restrictions, didn't have to exercise, could sleep how much they wanted.

[00:39:57] And so that was generally the study. And the major take home points of the study was that excuse me, was that both groups lost the same amount of body mass during that inpatient period, right? But the placebo group. It did not get testosterone lost. I think it was like basically an equal amount of fat, equal amount of testosterone group lost it all as fat mass.

[00:40:24] Wow. They didn't gain any lean mass, but they basically stayed steady. And if you look at the research on testosterone, that makes sense. Like you take burn injury, which girls may not be interested in, but the fascinating pathology, because it's the most catabolic thing we've ever measured. It's the, it's a hyper metabolic state.

[00:40:43] I mean, just the whole system is go, please survive the state. The point where muscle protein synthesis is actually elevated, like two times higher in burn patients. It's the highest rates of protein synthesis you'll ever measure, but your breakdown rates are elevated threefold.

[00:41:00] **Dr Mike T Nelson:** Yeah. Astronomical. Yeah.

[00:41:03] **Dr David Church:** Huge and you can feed them like they'll put tubes in them and you can feed them all day But they actually do they develop fatty liver. So it's not being shunted correctly. Yeah, it's not it it's not a calorie problem because at that point the muscle is no longer an anabolic organ So the only thing that can save them and get the muscle back to zero just like we did in that study

[00:41:25] **Dr Mike T Nelson:** is testosterone Because testosterone is massively anti catabolic

[00:41:31] **Dr David Church:** I think, I'm gonna go out on a limb here, but we do know that it makes protein senses more efficient, and it probably doesn't mount organs and tissues.

[00:41:41] But at least at the muscle level, we know that it decreases the amount of what, if you read the papers, it'll say it decreases breakdown, but I'm lucky that the guy that did all the work is next door. If you get into the weeds, what the method is, and I tried to bring this up at the conference last year, and I talked about it, what it's actually doing is it's preventing, it's not preventing breakdown by your modified roles.

[00:42:05] The proteins in the muscle can still break down. What is preventing is once those proteins are broken down into their individual amino acids, they're still in the muscle cell, but they no longer go back out into the bloodstream to give it to other organs. Oh. Incorporated into new protein, so it increases like the recycling.

[00:42:26] It's not a futile cycle. It's important that happens. But yeah, so more of it's getting shunted back into synthesis and making new proteins to adapt to the stress being placed on the body and less of it's going back out to support. The kidney, the liver, the brain, the heart. And so, one of two things must be happening, or maybe both.

[00:42:43] One... There's probably improved protein synthetic efficiency in all organs since you, if the other organs didn't, if they mean if the muscles holding onto the amino acids that don't need it, I mean, that's what's cool about the muscle. And so the synthetic efficiency is more efficient, and my guess is that, and this would line up with kind of the results we saw you're getting a more, you're able to, because protein synthesis is expensive, so you're able to extract energy more efficiently for maybe like fat.

[00:43:13] My guess or yeah, there's got to be some type of more favorable, muscle energetics in order to allow protein So this is a little deep in the weeds, but

[00:43:23] **Dr Mike T Nelson:** I tried to keep it as yeah but that would explain some of the anecdotal data and some published data to of testosterone being amazing for body recomp Yeah, it appears to be one of the agents that can my hypothesis here is that natural athletes not using anything you would think in theory, like on paper, right? You're like, okay, so I'm in a moderate caloric. Deficit. Why can't I just take energy from fat? Even a lean athlete has plenty of fat, use that to fuel muscle protein synthesis.

[00:43:56] And it just doesn't seem to work

[00:43:59] **Dr David Church:** that way. And to your point, this is why I think muscle is so cool. Like one paper I wish I could read is Bob Wolf's 2006 paper. It's called the underappreciated of muscle and health and disease. It's an excellent paper and the whole role of muscle.

[00:44:14] I used to always teach my students that the liver was very unselfish and it is, most college students just punish it. Yeah. Yeah. But and that the muscle is very selfish, right? If glucose is out there, the muscle is going to gobble it all up. If the amino acids are out there, it's going to take it all up.

[00:44:28] But it's doing that so that when there's a period of stress. The muscle is so good at giving every other organ the amino acid that it needs, and if you look at the old Belfast starvation studies, Warsaw ghetto studies, where these people, these large communities are fasting for various reasons, what happens is the amino acids, blood amino acids will dip down.

[00:44:50] A little bit in the first three days. And you see this in he's an old Harvard physiologist now, Mr. You just, Oh, George Cahill studies. Oh yeah. Great studies from the seventies. Starvation

[00:45:01] **Dr Mike T Nelson:** stuff. You would never be able to repeat now where you put them on a ketogenic diet and gave them shots of insulin and just watch their glucose just plummet.

[00:45:10] **Dr David Church:** Yeah. Another great rabbit hole for readers go down to is his just entire pub med list. But. He had a quote in, in, in one of his, if you're prolific like that, you always write these big papers summarizing your career. And it was in 2006, he said something like a muscle nitrogen is probably

the predominant predictor of survival of man, particularly in a primitive environment.

[00:45:30] So like connecting that back to the point Bob makes in these, this muscle, the unappreciated role of muscle in health disease is that, after those first couple of days and you see these in Cahill studies, those blood amino acids come back up to basal values. And they stay there, they stay at basal values until the organism dies.

[00:45:49] **Dr Mike T Nelson:** So that's the muscle kicking out more amino acids because it realizes, oh, we need amino acids to run other shit around here. Where are all the stored amino acids? Oop, amino acid pool is depleted. Boop, out they go from the muscle.

[00:46:02] **Dr David Church:** Yeah, every cell needs protein synthesis, needs protein turnover. And...

[00:46:08] Muscle is a much lower survival priority to organ than your heart, your brain, your liver and your kidneys. So, you see that and there's actually some human case studies you can get into and there's plenty of animal work that shows there's plenty of energy left.

[00:46:22] There's plenty of fat left to your point, there's plenty of fat left to, to provide energy. So, that connects back to Cahill's point of like muscle nitrogen is probably the predominant predictor of survival of a human in a state like that. So, I can't remember what the original point was that got us on that rabbit hole, but I love

[00:46:41] **Dr Mike T Nelson:** this stuff.

[00:46:41] Oh, that's great. And that's some of the data too. Oh, I think he was talking about testosterone. Yeah, so we're talking about testosterone being maybe anti catabolic or it appears to help with recycling of amino

[00:46:52] **Dr David Church:** acids. Yeah, and the beautiful thing about testosterone is that it works in the fasted state.

[00:46:58] Right? Yeah, everything most everything else we have is at the fed state and it's more of stimulated NPS, which is very important It's you probably should stimulate NPS in order to turn over that protein pool and get rid of any damaged proteins that may exist, but You know, as far as I'm aware of, testosterone is one of the few things that works when you're not eating, right?

[00:47:21] So that's, I think, what makes it so potent, particularly for bodybuilders or, in the study we saw. And the big caveat to that study that we did was we didn't see an improvement in performance, but, fIrst off, the control group never got, really got hypogonadal. They stayed in eugonadal range.

[00:47:38] **Dr Mike T Nelson:** And this Which I think is surprising. I would have expected that they're gonna be tanked, they're gonna be so fucked.

[00:47:43] **Dr David Church:** I was shocked. I was shocked. I just got I like, I got asked on a previous podcast, I was like, I can't remember, because in my head I'm like, they should be. They should be right.

[00:47:54] And so I made sure to read it this morning before when they're like no flat out says they never got You know hypogonadal like we saw in Brad Mendel studies in the rangers schools where they do So there might be something about the environment. Maybe we maybe it was too nice being in an impatient place they need to sleep on the ground.

[00:48:10] I don't know but you know So the placebo group stayed you gonadal the testosterone group didn't get Super physiological got right on the high end of normal for a couple of days, which I actually think is the strength of the study. so We're comparing like low and normal, high and normal and then on top of that, like we said, we're talking about 20 some days, and then the important thing too, is that after the 20, 20 some days, the testosterone group had just by getting the high end of normal and preventing them from getting to the low end of normal, they maintain their muscle mass.

[00:48:40] So if we were to go another 20 days, yeah, they might do better than yeah. So, that some people held on to that. We didn't see a performance improvement. So, yeah, I get it. Believe me that's how I train. I'm not a, believe me, I'm not getting on stage anytime soon, trying to look pretty.

[00:48:56] I like to see weight move, but if we extended that a little longer, there's a lot of different ways we could have gone with it. But I still think it was a very important finding. And it's huge to show that, you can do this lack of sleep. Which, I forget the lead author, but I know Stu was involved where they show that sleep restriction lowers muscle proteins and they can get rescued with HIIT training.

[00:49:17] Yeah.

[00:49:18] **Dr Mike T Nelson:** That was fascinating. It's what? So

[00:49:20] **Dr David Church:** crazy. Yeah. Who'd have thought muscle contraction is good for you. Yeah. Yeah. Yeah. Darn. Yeah. So, you take that and then we take something like 50, 50 percent energy deficit or whatever we had them on. It was high. And you can still rescue. The loss of muscle mass just by getting on a high end.

[00:49:38] So I don't know. I think it's a lot, it's a lot more interesting finding when you dig deeper into the details than if you just read the title there, it was a really fun, study to play a very small part in, like I said, big push from people that have been trying to get a study done for years.

[00:49:54] **Dr Mike T Nelson:** Yeah. It also makes me think of, I think so often, at least in training, trying to get greater gains and body comp, all this stuff, we're always thinking about what can we do, what are things we can add. But I think we tend to forget that over the long term, if you can just be a more resilient organism you can handle more stuff at a lower cost, which is something I always think about, is okay, if you can If we look at like high level athletics, right?

[00:50:25] So you probably need a bigger aerobic base. You probably need to be stronger, you need good sleep, you need good nutrition, but all these things are to make you more resilient. So once you're in season, you're gonna make it through the recce, the season, right? You're gonna go down, but you're not gonna go down as much as to someone who's like completely untrained and has rhabdo on day four.

[00:50:45] And they're fucked . Yeah.

[00:50:47] **Dr David Church:** Yeah. I work mostly in the clinical space now and, my little area is better than most when it comes to an academic medical center. There's a reasonably good appreciation for the role of muscle, but it's, it can be difficult to convince people that, hey, this is important to study clinically.

[00:51:06] Yeah, I make that, we saw it in the burn patients, but as soon as we gave him testosterone I didn't do this work. I was like six years old, but you know, Arnie and Bob, when they gave testosterone to burn patients and they're able to save the muscle mass, they saved the organ and there's just a paper that came out six months ago where they see, I think 18 months prior to the diagnosis, prior to diagnosis of pancreatic cancer, they get this giant drop in muscle tissue and muscle mass.

[00:51:31] I think they measured it by BIA and we can talk about BIA, but from a clinical perspective, it's probably reasonable. Like being in the ballpark. Yeah. BMI is probably reasonable on a population level. Yeah. aNd the fact is you saw a giant decrease. It's it's not measurement error, like it consistent.

[00:51:49] And so it just goes to show you that the more muscle you have, the more resilient you're going to be to injury illness. Whatever may be taking you out from this optimal, state, I think is a good way to to take it. And I'm always trying to, I think that, that pancreatic cancer is a good one to look at.

[00:52:07] It's man, if the muscle mass starts going down and nothing else has changed, we got a problem. Yeah. Something's going on. So I've always tried to make that

[00:52:15] **Dr Mike T Nelson:** point. Yeah, that's great. Is there anything else other than testosterone that does similar effects?

[00:52:24] **Dr David Church:** Not to that degree. Yeah,

[00:52:27] **Dr Mike T Nelson:** I haven't seen anything, but I'm always curious because I keep in the back of my brain I'm like there's a mechanism there.

[00:52:33] It's exerted. It does it by using this thing But are there other things that could get a similar result and I don't have anything

[00:52:42] **Dr David Church:** you know what improves? Like net balance. There's something else that'll improve the net balance of protein status by reducing breakdown without really increasing synthesis.

[00:52:56] And it gets a little messy, but it I forget the lead author, but it's actually an older study where they infuse beta hydroxybutyrate. Oh, okay. Yeah. But I think there, what you're doing is you're just decreasing flux. And so you're getting a, but that would make sense. If you think about how we evolved, if beta hydroxybutyrate is out in the system, we're probably in a survival state, we're probably looking for food.

[00:53:22] So it would make sense to decrease the flux rate of protein metabolism in order to conserve it as much as possible. And it could be found I'm shooting from the hip there, not well known. There's I believe church Tyler Churchward Vane is actually looking at this exact thing. If you want clinicaltrials.

[00:53:43] gov, I think he has a study looking at ketone ester ingestion and protein metabolism. So I'm really interested to see those results whenever they're available.

[00:53:53] **Dr Mike T Nelson:** Yeah. It's funny you mentioned that because as a full disclosure, I do help with some clinical studies for Tecton who make a ketone ester, which actually doesn't taste like shit.

[00:54:03] It actually tastes pretty decent. All the other ones are just absolutely horrible, but one of the little experiments I was going to try based on that data and some of the data that it has maybe a mild appetite suppressant effect is if I got crazy and did one or two days of fasting and just had some.

[00:54:24] essential amino acids and BHB, would I make the fasting easier? Would I have enough amino acids and maybe BHB to prevent any sort of breakdown of muscle tissue while still cutting out a high amount of calories during the day? I don't know. I mean, this is all like we're super far out on the, limbs of trees here and stuff, but Yeah,

[00:54:48] **Dr David Church:** like disclaimer anyone listening.

[00:54:49] We're having

[00:54:50] **Dr Mike T Nelson:** fun right now. Yeah. Yeah. Yeah, like this is not a clinical study that's been completed

[00:54:54] **Dr David Church:** Yeah, we're not saying that this is gonna work. This is just right This is just like fun stuff. We like to do and we're nerds, but I think that's cool Like I said, I know that i've seen Like I said, I know tyler churchford vane has that study at least on clinical trials.

[00:55:10] It's there. I've seen the study where they infused it. And then there's another study like that came out in 2018 ish, 2017, 2018, some one of those frontiers journals, they showed some type of potentiation of mTOR, but I think it was like cell culture. So I'm not hating on cell culture, but man you put anything directly on a muscle

[00:55:31] **Dr Mike T Nelson:** cell, probably it's not the same.

[00:55:33] Yeah.

[00:55:35] **Dr David Church:** And anyone that does cell culture work, we'll tell you that, but look, I mean, testosterone is like a, that's like a shotgun, everything else we're talking about, like a little hammer, not that the other stuff isn't important. I still think the most important thing for muscle protein turnover is resistance exercise or, physical activity and then some type of muscle contraction.

[00:55:59] It's by far the most potent stimulator muscle protein turnover is just having strong muscle contraction If you have your physical activity, that's great. Get your 10, 000 steps in a day. Lee Brain's group from Birmingham Has shown with I think it's Lee, Paul Morgan, James McHenry, those guys They've shown that particularly I think they use obese individuals Or people with obesity as a model and they show that if you have this step reduction You get decreased rates of muscle protein synthesis and therefore, bad effects.

[00:56:32] But, there's a study a dime a dozen from Stude and Nick Bird to, all the stuff they've done with Eucerium. This is some of the stuff that one of my other main colleagues that I work a lot with during my postdoc, one of my battle buddies, was Dr. Jess Gwin at Eucerium. And, we most studies when they do these trials, they do these period 1s, period 2s your fasted kind of state and your fed state.

[00:56:54] We were putting the exercise in the facet state and the nutrient just in the fed state. So we could just look at the nutrient status. That, that exercise, the exercise elevates it. And she picked up on it. I had to be like, Oh, I went back and looked in literature and you're totally right.

[00:57:08] And the exercise just increases the rates so much, so. Resistance exercise is very potent. So I always say, we take testosterone on equation, physical activity and sleep like those right there, some type of resistance exercise, although that's not hating on aerobic training, right?

[00:57:26] We just, we wrote a whole love sonnet to aerobic training to start this thing off. And it's important to know that the stress we've, Nick Bird's got a great study from a while back where he shows that You got to look at the different fractions too, when you're talking about the training, like aerobic athletes get a huge increase in mitochondrial protein synthesis.

[00:57:43] Yeah. They don't get this, they don't get as large of an increase in myofibular the sarcomeric portion, whereas the people that are doing resistance exercise, they get this larger increase in the sarcomeric portion, but not as high

in mitochondria. So it's all going up. It's just where the where amino acids need to go based off the stress given.

[00:57:59] So, so, yeah, you get that stuff and get the resistance exercise and then after that, it's like total protein intake. In a day, and then after total protein intake, you really are starting to split hairs. I would say it's, I would say it's supplementation. In fact, I think you might have been in the conversation that Dan Warren and I had at ISSN.

[00:58:17] **Dr Mike T Nelson:** Yeah, we were there after the president's dinner. That was fun. Yeah,

[00:58:21] **Dr David Church:** and I was like, I think it's supplementation. He's you sure it's not distribution, right? And so I mean, there's, I have a study that shows supplementation twice a day increases the daily NPS rate by 25%. And when I look at the distribution studies, you do this small effect of evenly distributed, but it's not 25%.

[00:58:41] So, I don't know. I mean, we could, but my point is now we're really starting to split hairs. After you get your activity in, you sleep, you eat enough protein and you exercise after that, do what you want. Yeah, even if you're hitting, yeah, what can you take away strength, that type of stuff, but after that we really start splitting errors,

[00:59:04] **Dr Mike T Nelson:** you're eating a significant amount of protein, right?

[00:59:09] So if I translate it to the English system, because nobody understands metric, right? You're looking at what? 0. 7 grams per pound of body. We're in there on the low end, maybe up to the mythical gram per pound of body weight. I don't know if you would agree with that. And the second part would be. If you're eating that much protein, you, by definition, are probably having to distribute it out over maybe four meals anyways.

[00:59:36] You get the distribution there when you titrate the dose high

[00:59:40] **Dr David Church:** enough almost. Yeah, I would agree. Yeah, I mean,

[00:59:45] **Dr Mike T Nelson:** I mean, yeah, you can do some math and work around and eat, 21 ounce t-bone for dinner or something. But it, you are not gonna do .

[00:59:54] **Dr David Church:** Yeah. No, I agree. And I think your range is probably reasonable for most people.

[00:59:59] I unfortunately do fall on that metric system of 0.8 to 1.6, but that roughly correlates with the nice number. It correlates about the same. Yeah. Yeah. I mean. I think the one gram, I think one gram per pound is that's 2. 2 grams for Chloe, but good luck by the way, it's harder than you think.

[01:00:16] **Dr Mike T Nelson:** Oh, it's way harder than

[01:00:17] **Dr David Church:** people think. Yeah, I've done it, in fact, I want to be, have a pretty noninvasive, not that I'm against biopsies, but I try to save my biopsies on my leg until it's something more interesting. But I really want to do a day where I do something egregious like. Four grams per kilo and look at my whole body protein turnover, like we a rough, not rough.

[01:00:39] It's a pretty, it's better than nitrogen balance is a step above that, but it's not like it and so I want to look at something crazy. Like I said, like four grams per kilo, which is that's close to two grams per pound. So that'd be a lot of fun, but we're doing a study right now where we're actually looking at time restricted feeding.

[01:00:57] That was the thing I was pointing to here. Okay. And it's on clinical trials, so I can talk a little bit about it. But, we got like the RDA versus double. So 0. 8 versus 1. 6 grams per kilo. And then what we're going to do is we have a group doing like 3 meals, 3 discrete meals, so to speak versus a group that we, I wanted to go as extreme as possible.

[01:01:19] So I've worked with a lot of like pretty good scientists that do my mice work and something that always struck me that they said is if you don't know the right dose, make sure you blow them up and get a response. And so I've taken that. It's what's the most, what's the most extreme form of this distribution thing?

[01:01:34] It's like that it's the one meal a day, but I don't want to get into that. I did the six hour, 18, six hour feeding, 18 hour fast. Yeah. Yeah. One group's the three discreet and the other group. So we've got four groups. The point I'm trying to make with this is that those that get like the, those that even just get the RDA and they're doing the six hour feeding, 18 hour fast, they're struggling to get all the food.

[01:01:58] Like it's hard to eat that much food and then you get to one point. I mean, I'd have no issue. I can eat. And by the way, the other funny thing about that study is that, We use a great local meal service here. I forget the name of it. I should probably know. So you get them some free PR, but I'll figure it out later.

[01:02:19] They they, we, we like do the study. We we feed these people coming in. Like these things are expensive for those that don't know. Like we feed them for two days and then we bring them in and fix all this. And isotope tracers aren't cheap. Like deuterium is like a thousand dollars a liter right now.

[01:02:34] So yeah, it makes gas look cheap. But and and like I would, they bring the food here and then we give them the participant and they're like bringing in the food. And I'm like, I felt bad for their delivery people. They look like the Amazon driver coming to my house at Christmas. That's how much, like these giant bags.

[01:02:50] And so, it was like, like it was like beef and rice and they could do like Brussels sprouts or snap peas or broccoli or all of it was like, Very nice and like berries and strawberries and blueberries and stuff like that. There was not a cookie in sight. You know what I mean?

[01:03:08] And it's just a huge volume of food and our participants are just struggling to eat it. And so it was one of those wake up calls like what we're talking about here. It's if you get to high enough protein intake one, the distribution thing solves it. And then secondarily. If you just didn't eat Twinkies, so to speak.

[01:03:29] I'm not being mean. I had ice cream last night. I got a, my wife is like superhuman. Like I can she, like we moved in together and I gained 20 pounds off the bat because she can have like cookies and stuff in the house and it doesn't bother her. Me, I'm like, Oh, that cookie's there.

[01:03:44] So I have a weakness for it. So I'm not hating on anyone. I get it. I understand the struggle. But it's it was like a wake up call to me. I was like, Oh, I guess if I just didn't eat cookies, I probably wouldn't have anything to complain about. Cause I just, they couldn't, they struggled eating the food.

[01:03:59] So yeah, I, to your main point, stories aside, high enough protein intake, you're going to solve the distribution problem. So you fix that protein intake, then you fix the next level. And most of us. Probably have some type of

supplement anyway, so that problem is solved too. So, I think a lot of it becomes a moot point.

[01:04:18] I think the more interesting stuff is how do we, what I'm more interested in nowadays is the clinical side of things. Like I'm looking at head and neck cancer, where they struggle with swallowing, dysphagia, and things like that. But also how we can enhance the anabolic response during suboptimal scenarios.

[01:04:35] So there are these compounds that you're talking about, something like testosterone, but something that's a little safe for safety profiling women, right? And it's not that it's unsafe this is important, um, because testosterone can be very hard to study because of the perceived Bias against it and it's earned it not to its own fault, but really because of meatheads, And yes, it was a I say that as a bona fide meathead.

[01:04:59] Oh totally. Yeah, and It's unfortunate because if you look at like I think it was a study in cancer patients Which makes sense since that's what I'm working on. It actually showed like improved cardiovascular parameters. So it's actually good for cardiovascular health. But that's in a diseased clinical population.

[01:05:19] And if you look at when they use it to treat obesity, if you get high enough obesity in men, a lot of them become hypogonadal. And they see improvements in this part of it. Like they see, the obesity, it's better, the class levels go down with obesity. And then on top of that, they see improvements in blood pressure and all these other cardiovascular parameters.

[01:05:35] So it's not that it's a dangerous drug. It's dangerous when it's abused, just like anything else. And so, yeah, it, but my point is in women, it's got these secondary characteristics that they're not always appreciated. So it's what can be done? Can we find something, that we could use that may not have these secondary characteristics.

[01:05:56] And I think that's an interesting area. Although it's failed miserably so far, right? Yeah. Some are myostatin inhibitors. I mean, it's a tough, it's a tough area. But, I

[01:06:07] **Dr Mike T Nelson:** think it's interesting. Yeah, totally. As we get closer to the end here, what are your thoughts about, you mentioned supplements, about, do you have like a hierarchy of supplements?

[01:06:20] I always think of whey protein, and maybe if someone's a vegan, like some of the mixed forms, you can get enough amino acids and then you're down to essential amino acids and then branch chains. I don't know if you have any sort of hierarchy or how do you think about

[01:06:37] **Dr David Church:** them? I mean, I'm like I'm on an advisory board for stuff. My company is called shift. So you can look them up. I don't care. I don't make any money off you buying. So I get paid a flat rate, and I do consulting work for people that are trying to make supplements. And it's funny, cause I like to make sure this is known, but and you probably know this, 99 percent of the time, my job is to say, yeah, that's not going to work. Like my job

[01:07:02] **Dr Mike T Nelson:** is, yeah, my job is, nobody likes you in the room because you're the person who just pisses all over their leg. And

[01:07:10] **Dr David Church:** so, yeah, I it's not a great role. So it's I'm not out here to make their product look like a million bucks, but yeah.

[01:07:18] So anyway, they so I don't make any money from some of this. I just like to make sure that said, before I start recommending, I. Yeah, totally. Like I said, I make no money off it and usually I'm like, Yeah, that's not gonna work, so good luck. But, yeah, I'm with you. I like whey protein or some type of crystalline essential amino acids.

[01:07:36] I think they have different roles. Right now I'm doing this there's this product it's That company, right? Because why wouldn't I buy it from them? But they have 10 grams of whey protein isolate and 10 grams of crystalline essential amino acids in it. So you get 15 grams of EAs, 5 grams or not.

[01:07:52] And I really like it. And I, it's just a little easier on my gut. I guess as I'm getting older, I'm getting a little sensitive. But whey protein isolate is fine. It's just I feel like I can take it in the morning. And there's just, there's no bloating at all. You know what I mean?

[01:08:06] There's nothing, you barely even feel it. Cause it's. It's mostly crystalline amino acids. There's no digestion that has to occur. But then for some reason I and this stuff is in its infancy. This all starts off as you said the word earlier, what's it called? We're like, it's you and I noticed it, but it's not in the literature yet, but there's been a bunch of us where it seems like there's a little bit like we feel a little cognitive boost, so to speak, like a little, Like maybe not an executive function per se, but some type of focus improvements when they, when we take it.

[01:08:38] So we're like, Oh, we need to, so we're trying to get some studies going actually on looking at the role of these amino acids in cognition. But yeah, I mean, so yeah, I'm really excited about that stuff PhD work was on cognition. So I think it's really cool. And anytime I feel that little effect, I'm like, cool, what's going on here?

[01:08:57] So it's I don't know. We'll see and there may be nothing. It might be placebo But so yeah, I like a whey protein or you know Even that product I mentioned and I prefer isolates just because like I don't like to feel much in my gut but creatine, I think there's actually more, same line.

[01:09:13] Actually, there's better evidence for creatine and brain health than maybe muscle mass and performance. But I think it's 10 grams a day is what you got to take for the brain health. So creatine, protein. I like my caffeine, I think I'm some days I'm up to a gram a day on caffeine.

[01:09:28] So, I take mine in espresso form and tea. I'm, I do not bias against the forms in which I get it. But then after that it starts, I mean, if you want beta alanine, sure. Some people like it if you want trying to, some people like that.

[01:09:45] Some people like citrulline malate, like I got a friend that he's all about citrulline malate. He loves that feeling. He loves the pump. So good for him. There's all this stuff down there that seems like there's pretty reasonable evidence for where it's if you want to take it, go for it.

[01:09:59] And then, like astrogen I think is there too. I'm trying to think of the other. The other stuff that's in the product I took right before this podcast. I'm trying to think what's in it it's a good example of you like beetroot juice, right? There's Yeah, nitrate. Yeah, it's good evidence on that but it's like That's it's there's some specificity there.

[01:10:17] Same thing with beta alanine. Like it definitely increases carnitine, but carnitine is a weird effective range as a buffer. It's not like you're not really going to get it when you're lifting and you're not really going to get it when you're doing long distance running, but yeah but then there's another, then below that you start getting into stuff.

[01:10:32] Like my thesis was on your solid gas, There's a few studies on your salt gas. It pretty interesting compound, but nothing like strong there. Is a pretty interesting compound, but there's some new studies there, but nothing it doesn't have the body of evidence that, like, essentially malleate or would have, but, they even fail in comparison to like.

[01:10:54] Whey protein and caffeine. So, I think it's probably a very traditional hierarchy of supplements. And then I

[01:11:00] **Dr Mike T Nelson:** think probably through BHB ketones into the mix potentially. Yeah, what you're looking at.

[01:11:06] **Dr David Church:** Yeah, that's getting really interesting because there's a study I think it was in journal of physiology just came out that showed like an increase in blood dopamine levels,

[01:11:14] **Dr Mike T Nelson:** which

[01:11:14] **Dr David Church:** Yeah, really cool.

[01:11:15] And then I have one that we didn't touch on but it you know, it's pandora's box right now is Is the probiotics You know, and I think if you're, you mentioned vegans and vegetarians, I think if you're a vegan, vegetarian, probiotic is something to

[01:11:28] **Dr Mike T Nelson:** really consider

[01:11:28] **Dr David Church:** to help with the digestion of the plant protein.

[01:11:30] So, I think that's a really good that's like an example of how can we enhance a response? How can we enhance a suboptimal profile or delivery format? I think that's an interesting area of probiotic.

[01:11:44] **Dr Mike T Nelson:** Yeah, awesome. And then last question, if you're using. An essential amino acid product. One thing I've noticed, it appears that the label may say like 10 grams or 6 grams, but if you look at the individual amino acid breakdown, maybe it's just me and I've just looked at too many different products, but it appears like it's The wild west of these are all essential amino acids, but they don't show up in the same amounts.

[01:12:12] There appears to be a large variability of which ones they stick in there. Yeah. Is that just whatever the menu, or

[01:12:24] **Dr David Church:** I don't know. I think part of it is because There's a little bit of the wild west there. I've seen, they'll do the if they do one of those combo products, or if they do an EA product alone, like you're talking about, sometimes I'll see it like in the composition of egg white protein.

[01:12:37] I've seen it in the composition of whey protein. All those types of things. And I'm sure some of that's to get around patent law or this, that, and the other. I bet that's part of it. Not something I'm an expert on. I'm just a physiologist. I bet as long as it's in the profile of something we consider a quality protein source and it's got two and a half grams of leucine, preferably three.

[01:12:59] Probably fine.

[01:13:00] **Dr Mike T Nelson:** Yeah.

[01:13:01] **Dr David Church:** Probably fine. Yeah. Probably going to work. I had something. Oh, and yeah they'll say they're calorie free sometimes they're not right. Yeah. Each gram is 4k. The thing is there, they tend to be less calories than like a whey protein drink. Yep, that's that they do to and you see the same thing with the clear way and I think it's just they're able to Flavor it better and whatnot, but they're they are less calories than that Then I go whey protein not that there's anything wrong with whey protein It's just they're the point is if you see zero calories on any a product there it's either not an EA product or it has

[01:13:36] **Dr Mike T Nelson:** calories Yeah.

[01:13:39] And I wasn't able to try it. I think it was Probev. That's one of the nuclear way from a company here. I've just been testing out and that was amazing. Like they got the flavor profile on one of them, like really good. And it had zero of the, cause I have some clients who don't like the milk, even with the isolate, like it literally tasted completely different.

[01:13:59] It was like 20 grams of protein. I was like, holy crap. This was, it was pretty amazing.

[01:14:05] **Dr David Church:** Yeah, and another, here's a good little trick I learned from a RD Rikki Keene. I hope I, I hope she doesn't understand her name. She was with the she was with the Orlando City soccer teams at the time. She was doing, Orlando's hot, right?

[01:14:19] Yeah. This last thing they want is milk. Yeah. That's the last thing they want. So, that's a good use of the crystalline EAs. Or she was doing BCAs, but I think you're better off getting, like, if you're going to just do the EBAs and what she would do to make it even more palatable is she made it a popsicle, which I thought,

[01:14:38] **Dr Mike T Nelson:** Oh, nice.

[01:14:40] That's brilliant.

[01:14:41] **Dr David Church:** Yeah. That's why I want to give her credit for it. I hope I'm not giving away her tips and tricks that make her competitive. If so, I guess we'll figure it out. But yeah, I mean, I thought that was genius. So, like we're, I'm in Arkansas, it's hot here. And so that's a nice little trick.

[01:14:55] Sometimes a little EA popsicle. It's refreshing. I like that. Yeah. And you can do that with the ProBev. I've had that ProBev beverage. I think you could do the same thing with that. So, yeah.

[01:15:05] **Dr Mike T Nelson:** Yeah. That's a good idea. That's a good idea. Nice. Thank you so much for all your time here today, really appreciate it.

[01:15:12] Where can people find out more about you? I know you put out a fair amount of studies on inserts in a while you're in that weird Twitter x space, but you get a lot of cool stuff I see that goes out there. Yeah,

[01:15:26] **Dr David Church:** I I do post on Twitter more, that's just because it's easier under Dr.

[01:15:29] Myohead and, you, so you can see me there, but I am trying to I keep saying this every podcast, but I really am committed to trying to post more on Instagram. I just, I need to figure out. Oh,

[01:15:39] **Dr Mike T Nelson:** nice. That's good. We need intelligent people like you to.

[01:15:42] **Dr David Church:** Thanks, but you can attest to this.

[01:15:45] I do respond to my Instagram messages. I will go on there. You do

[01:15:48] **Dr Mike T Nelson:** actually I don't know if you want to make that publicly known, but yes

[01:15:52] **Dr David Church:** if too many of you start if I get too many then I won't but generally just go hide Yeah, generally speaking people are nice and respectful. Yeah, I'll respond but you know, I get some rude ones Every now and then I just I don't respond to that.

[01:16:04] But yeah, people are nice and respectful. I'll respond so I see it I don't live on social media and I've cut out even more of it even in the last couple months, but I see it and I try to respond particularly if it's like someone asked me a question because I've been there. Dr. Myohead.

[01:16:21] **Dr Mike T Nelson:** Awesome.

[01:16:23] Awesome. Thank you so much for your time. We really appreciate it. Thank you for all the continued research at your institution there. So Arnie, thanks and everybody down there for just all the, and all the stuff I've read, just a lot of the seminal work has come from there. So it's very cool to see that and appreciate it.

[01:16:40] **Dr David Church:** Yeah. We appreciate people talking about it. Really do.

[01:16:44] **Dr Mike T Nelson:** Awesome. Thank you so

[01:16:45] **Dr David Church:** much.

[01:16:47]

[01:16:47] **Dr Mike T Nelson:** Thank you so much to Dr. David Church for being on the podcast today. Really appreciate it. I appreciate all the research he has done over the years. Like I said, it was always great. To chat with him at ISSN every year really fascinating stuff that he's doing and like yourself, he's also a meathead who enjoys doing research, lifting weights making it also practical for you too.

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[01:17:57] Without destroying your health in the process again big. Thanks to dr. David Church make sure to check out all of his stuff on the socials as typically, dr. Mayo head Always wonderful chatting with him. I can sign up to my newsletters. I mentioned Mike T Nelson comm forward slash podcast Thank you so much for listening to this podcast and making it all the way to the end really appreciate it and we will talk to all of you again Next week See ya!

[01:18:27] You know something? That was a sweet number. It sure was. You know something else? What? I hate sweet numbers!

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