DANNY LENNON: Dr. Stuart Phillips, thank you so much for joining me on the podcast today. It's an honor to talk to you and I'm really looking forward to discussing some of the areas that is related to your research. Thanks for taking the time out to join me today.

STUART PHILLIPS: No, absolutely. My pleasure Danny, thanks for having me on the show.

DANNY LENNON: I think a lot of listeners are probably very familiar with your work and have came across it via other people discussing it or through looking at some of the peer viewed research that you've authored over the years. One of the big areas that I think is a probably a big interest area for many of our listeners of course, looking at muscle protein balance, and then in turn how that may influence muscle hypertrophy. And we've covered some different areas on the podcast before, but I think it'd be nice to be able to sow some of these together.

Just from the outset, just to get people clear, we obviously, when we're having these discussions, we talk a lot about muscle protein synthesis and muscle protein balance. What do you think is the correct way for people to think of them in relation to actual changes in muscle? Just how good of a proxy is MPS for tissue growth for example?

STUART PHILLIPS: Yeah, that's a good question. I think from a pragmatic standpoint, a lot of the studies that I've looked at protein turnover, so protein synthesis and protein breakdown, and then net balance give us at least an acute estimation of what the effects would be in the long run. But I'm the first to admit that of all of those studies that we've done, probably I'd say about 75% to 80% of them are relatively predictive of what's going to happen in the long run, but not always. So there's obviously some inter individual variation that comes into the equation and any short term acute study that's done looking at net muscle protein balance should be followed up if it seems that there is a pretty dramatic effect with some type of training study to put it into some real world issue like or pragmatic context. But for the most part to finding stack up relatively well, but they're not wholly predictive.

DANNY LENNON: When we start thinking about trying to at least, if it's going to be a fairly good predictor then at least, theoretically, we should be able to line up things with diet and exercise interventions that hopefully maximize this MPS response. If at least that's most people's goal out of either building muscle or at the very least maintaining current amount of muscle they have. When it comes down to the literature obviously, there's a whole host of different areas we could go with this, but what are the first few fundamental things that you think would be able to shape the rest of this conversation that you're particularly keen for people to understand about muscle protein balance and maybe address some areas that there sometimes can be misconceptions about?

STUART PHILLIPS: I think the basic axiom that if you ingest protein and it's got a fairly high quality, in other words, it's got all of the essential amino acids, they're in a fairly balanced ratio and particularly focusing on one amino acid which is leucine as a key trigger if you like amino acid is really the key. I think that there are some things that people have talked about over the years, they thought were important that we now don't think are as important or not maybe not as important, but maybe not unimportant, but it depends on who you are. One of the things I tell people is that when it comes to protein, it doesn't matter how much you adjust or when you adjusted everything, if you don't

get in the gym. A lot of people will talk about lunch for twice a week in the gym and then talk about their protein. I don't think that that really matters a whole lot. It would probably be better to focus on getting in the gym maybe three or four times as opposed to one or two worrying less about protein.

The only thing I think that's become more and more clear is the timing maybe doesn't matter as much as we once thought. I still favor post exercise because I think that's the time when your muscles set up to build. At the same time, I think the big area of discussion is around dose. How much protein do I need to maximize gains? That's a tough question to ask from some of the acute studies, but the meta analysis that a PhD student in my lab that just published in Sports Medicine shows that if you're going to divide your protein intake up into say three or four meals, it's about 0.4 grams per kilo per meal is where the response tends to pop out. I don't think people really appreciate it. You can eat more and I'm not saying you can't. You can digest more but it's just not usefully put towards muscle protein synthesis or at least muscle protein accretion as far as our meta-analysis showed.

DANNY LENNON: I think that starts to bring up some really interesting areas when we try and look at, well, how much does someone need and like you say, that brilliantly put together paper that you mentioned with upper range of what is probably useful directly for increasing muscle mass in terms a daily protein intake but of course a lot of the work that has came out of your lab at McMaster has been already at the forefront of discussing the distribution of that daily intake across the day and potential differences on how someone distributes it even with similar total daily intakes.

Can you maybe just touch on the distribution piece of this, and at least from the first point of view of theoretically why you started investigating distribution and why it may make a difference at the same total daily intake?

STUART PHILLIPS: I think that when you look at all of the macronutrients that we consume, protein is different than carbohydrate or fat fundamentally because protein,

when it enters your bloodstream and the amino acids is in circulation. Those amino acids have to be used. If they're not used to make new proteins or to make neurotransmitters, a lot of people talk about... this is one thing that is always interesting me. People talk about the other functions of protein and I say like what? They say well to make neurotransmitters. I think the people look at the basic biochemistry, that's an absolutely minute fraction at of protein that happens. People say it is involved in a lot of other things and it's really not.

The main use of protein and amino acids is as building blocks to build proteins, so if they're not used in that capacity, then the nitrogen is removed. The carbon skeleton is sometimes turned into glucose or it sometimes turns fuel but once nitrogen is removed to make urea, then the amino acids are effectively useless to you. You have to use protein on a meal to meal basis. You have no way of storing it. It can't go into some reservoir to be used later, and I reject the notion that some people think it’s in your gut and then somehow is turned over later. I think that lacks any evidence of credibility.

In fairness, it's the meal to meal consumption of protein that is going to be, I think, the critical factor in determining muscle protein balance across the day and then determining ultimately any muscle gain over a long run. Again, acute studies have led us to make that preposition. Training studies tend to hold to that that there's a lot of variability. Training studies have a lot more variables to play. Energy balance is important, timing, sleep, your genetic predisposition, excuse me, probably being one of the biggest factors.

DANNY LENNON: Great. When we start considering at least the current literature we have available to us on recommended doses for per meal servings of protein, where at least in your view does the current nature lend itself to giving us some sort of idea of a figure of what would be a suitable target for per meal serving of protein to maximize the MPS response? Then maybe secondary to that question that ties into it is and how many times per day is likely to be most effective.

STUART PHILLIPS: I think again, to go back to the Martin article, if you take the value of 1.6 and you divide that into say four servings per day, that's four times 0.4 grams per kilo per serve or per meal, whatever you want to call it. If you take the upper end, which is 0.2, then it's about 0.5, I think 0.53 or something like that grams of protein per kilo per meal. That's four meals per day. I'm not sure it's possible to split the meals up to be any smaller and to make a difference or you could make them a larger. I think that that just probably exceeds the maximum capacity per meal. But those calculations are back of the envelope and I think if people are a pretty pragmatic target about 0.4 or about 0.5 at the high end of grams of protein per kilo to hit as a target if you like.

DANNY LENNON: Perfect. One scenario I wanted to ask for your input on is when someone is entering a hypo caloric diet or going into a calorie deficit and therefore, we obviously know that there's going to be a bit more risk of losing lean body mass. People are going to be hopefully trying to maximize the retention of that lean body mass during that dieting phase where during this hypo caloric diet, where does the current literature suggest the effect a calorie deficit may have on muscle protein balance? Is there anything that changes some of the usual things that go on when someone may be eating at a more maintenance level of calories?

STUART PHILLIPS: Yeah, you're definitely right that in a hypo caloric situation obviously, the hormonal stimulus and the lack of energy would favor muscle loss in most circumstances. If you look at the meta-analysis out there about, for most people, about a quarter of the weight that they lose on a standard diet, if they're not exercising is fat free mass, which some of which obviously muscle. From the standpoint of what protein can do, I think obviously adding it up to the higher end of about at least 2.2 grams per kilo so 1 gram for a pound would probably be where I would advise most people. I think you can push it higher. I'm just not sure that that helps in retention of lean mass to be honest with you. I'm not just missing the fact that a lot of people say well, when I'm preparing for a competition, I want to go down very low in body fat, I want to hang on to every last gram of muscle that I have. You've got to put something into the machine.

I'm not dismissing protein as a macronutrient in that situation, but I think people need to appreciate that by far and I mean by a long way, the most potent anti-catabolic stimulus that you can provide yourself is obviously to perform resistance exercise. That's far more potent than stuffing yourself full of protein in terms of having you hang on to lean mass.

Most people going for competitions are obviously doing a lot of that. In that situation, what I like to say is, you know what, you're doing the biggest thing that you can. A little bit of extra protein definitely helps. Some of our work has shown at least in people who have a lot of body fat to lose, you can even gain a little bit of muscle even in a very deep caloric deficit. It is possible, but I'm not sure how big a role protein plays and exercise is a much bigger factor of what.

DANNY LENNON: That's a huge point for people to take particularly even when we're talking about just a general population of who are trying to get to the healthier body weight and lose body fat. That combination, like you say of primarily resistance training, but also the high protein diet can be a huge way to mitigate loss in lean body mass. In general, probably for most people actually, that's not going to be much of a concern if they're doing those two things. Like you say, we have clear evidence where people have dieted and have actually been able to gain muscle mass. I think there may be some things that people overlook or at least go along with the conventional idea that maybe a dieting block needs to mean loss of lean body mass whereas you can mitigate a lot of that through these strategies like you say, primarily resistance training with some protein.

If we take that scenario where someone has those things in place and they're getting an adequate amount of daily protein and they're training, but they're really trying to maximize everything from a theoretical point of view. For those per meal doses of protein that have been touted to theoretically spike MPS, for lack of a better term at each meal, does being in a calorie deficit change that number of how much someone needs in those per meal or would those typical figures of a per meal dose that are being

mentioned in some of those research papers, would they still apply?

STUART PHILLIPS: It's a good question. We did it a little bit of work on this with John Holly's group, and Hosea Reta is the first author, and it certainly did seem that the doses of protein that we're larger would have more affected in a caloric deficit at stimulating protein census. But I struggle with the concept that you could get more or you need more in a caloric deficit to stimulate the same. I think that protein at about 0.5 or maybe 0.6 grams per kilo per eating occasion. If you bring that in a caloric deficit anyway, then appreciating the protein is a highly satiating macro nutrient if you want to keep a little bit of a lid on hunger than protein does best job of all the macronutrients out there. There's reasons beyond just looking to spare lean mass to think that protein should be one of the macronutrients you should focus on but I can't see it getting a whole lot higher than what I've already recommended to be honest with you.

DANNY LENNON: I think one question many people may have when we have these types of conversations, or at least, if they typically notice when we're having some of the theoretical conversations around protein intake and how that corresponds to muscle mass is that a large proportion of the discussion we have focuses around muscle protein synthesis quite often, and not so much around muscle protein breakdown, or at least that's a general trend that's typical to see. Is there any particular reason why focusing on muscle protein synthesis is either more common or just more useful to think of as a general proxy for muscle protein balance, as opposed to trying to look at both MPS and muscle protein breakdown?

STUART PHILLIPS: Yeah, there's a simple reason. It's much more technically demanding as muscle protein balance. We've published in papers in which we've done it, and there are methods out there that are able to assess protein breakdown, but it's just much more demanding. I think that the more pragmatic reasons but from a biochemical perspective, when you look at the fluctuation in MPB by either protein ingestion or resistance exercise, they tend to be in the neighborhood of at least two to three and sometimes

even four fold higher than fluctuations in muscle breakdown, which really don't change very much on a meal to meal, or even an exercise situation.

I think people are obviously, they're savvy enough to realize that we're only measuring one side of the equation and point that out in their... they're very correct. But I think that you have to realize that until someone's in a markedly either negative energy balance or in a hyper catabolic situation like a burn victim or somebody in an ICU setting, muscle protein breakdown in healthy individuals is not a big deal. It's not this rampant process that causes people to shed lean mass over hours and days, unless they're in a very catabolic situation.

I would definitely say people entering the last phase of competition prep, for example, in a very deep caloric deficit really trying to shred down to low levels of body fat would come into that very hyper catabolic state. In that situation, it might be applicable. But in fairness, the exercise that they're doing at the same time is a remarkably important stimulator of hanging on to muscle.

I think even most body builders would admit that some point, they shed a little bit of muscle in an attempt to obviously get down to that last little bit of body fat. But for most people, most male models in the gym and even looking to change body composition, muscle protein breakdown isn't a very big deal. People need to make the distinction between papers that are talk about protein breakdown, that is measured on a whole body basis, because there's lots of papers that do that and it's not muscle. People say, well, it must reflect the one tissue but that may be true. But the burden then is on the person who's making that claim. I've yet to be convinced that one relates be strongly, or even in that predictive sense to the other.

DANNY LENNON: Perfect. Before I move on to another area of your research that I'm particularly fascinated by, just a couple of curious things that have came up in different pieces of research over the past couple of years that I wanted to ask for your thoughts on. One is on a paper that came out of, I think the university of Illinois that

was looking at, I think whole eggs versus egg whites and in that post workout feeding that, I think they found a greater MPS response in whole eggs. Can you maybe touch on any thoughts you had on that particular paper if it still comes to memory, and do we have any good explanations for why this might be the case in a protein matched setting?

STUART PHILLIPS: I'm very familiar with the article. I actually wrote a little editorial for that. I thought that was a terrific article and I'll give a shout out to Nick Bird whose lab it came from because he's a former master trainee, PhD student of mine. This type of work, and the way we're moving in the fields here now is to obviously use the methodologies that are able to get away from the acute measures of muscle protein synthesis over hours and to look at things over days and to look, in that case, the article you talked about real foods. There's a lot of work done on weighing and casing and soy etcetera.

I think the important point is that we're now beginning to understand that there's probably a whole lot more to whole foods than we previously realized. So what are the factors that are responsible for some of the whole egg being slightly better than egg whites for example? Is there something in the yolk, is there either vitamins or minerals that are having probably, I think previously either completely unappreciated or at least underappreciated effects on some of the outcomes.

There's some actually, I think relatively older work now on... Kevin Tipton was involved at the time with Bob Wolff looking at the balance of amino acids across a leg was a following whole milk consumption. Around 3.5% milk fat versus the equivalent amount of either energy of skimmed milk. Obviously a lot more protein is skimmed or low fat milk. For some reason that we'll be able to unlock the whole milk had a greater effect. So we're seeing effects of these food matrices that is probably something, like I said, I don't know if it's unappreciated, but definitely underappreciated as opposed to isolated proteins.

DANNY LENNON: Thanks for that explanation. And like I said, I'm keen to touch on a slightly different area of research that

I'm extremely fascinated by, and that's anything related to sarcopenia and this age-related loss of muscle function and muscle mass, and this underlying theme that you discuss quite a lot in those papers of anabolic resistance. Before we get to any specifics, can you maybe explain to listeners what exactly we're talking about with this term anabolic resistance and some of the core fundamental things to understand about that?

STUART PHILLIPS: So in a state of sarcopenia, this age-related, as you said, muscle mass and decline in muscle mass and decline in muscle function. Our findings corroborated a lot of labs like Rasmussen's lab in Galveston and it would be the concept that if you give an older person a given dose of protein, or if you give them a given dose of training that their response in terms of anabolism (the processes of muscle protein synthesis and muscle protein breakdown) would be less favorable. In other words, 30 grams of protein for a young person and 30 grams for an older person of similar body weights. You get far less of a stimulation in older people.

I think the concept I've used over the years, and I think most people get this is a younger person who's building their muscle up, and if you think of their muscle as a brick wall, then they're pretty good at putting the bricks in. Whereas an older person with the same amount of bricks being delivered is less able for reasons that we're not entirely sure about to put the bricks into the wall so to build their muscle up, and that's what we refer to as anabolic resistance.

DANNY LENNON: So with that then comes what maybe practically do about that four of these people. I think maybe the first thing that often pops to people mind as well, do we overcome up by just ramping up protein and these other anabolic stimuli we have? And then, I think before when this was I remember discussing this with Brendan Egan a couple of years back, and at that time, there were still some quite equivocal, at least research out on things like fish oil, H&B and so on. Over the past few years, I'm just wondering how some of the research has progressed and where the current evidence-based understanding is in terms of practical strategies to overcome this barrier.

STUART PHILLIPS: If we take the nutrition task first and we talk about things like protein is probably the first one that people would suggest is that there is work. And again, it's not ours, but it's ours and Luke's and Blake Rasmussen, and a few other labs that would suggest that dire protein dose, it can't and to some degree has overcome some of this anabolic resistance. And there's been a number of trials that are focused on trying to give people higher, either quantities or higher quality in particular, higher quality representing obviously a higher leucine content, and they've met with, I think, some limited success in that scenario.

Most of the trials that have been done in older individuals are quite underpowered to see the effect. When you do power the trials sufficiently, then I think that there are probably two or three key nutrients. One is obviously protein, the content of leucine probably matters. It appears that levels of vitamin D, they need to be of a sufficient nature. Around the fringes of some other nutrients, omega three fats being obviously one that has received some attention. And then HMB. I'm still not convinced about that. I think that the best that it can do as a metabolite, because it is a leucine metabolite is about the equivalent of leucine. There's little evidence that as far as I'm concerned, this HMB is better than leucine or protein. Then it drift down from there. There are probably a few other pieces of nutritional information but I think that those are the top two or three in minor estimation.

From the other side of the coin, and you talk about what could you do from a physical activity perspective, and it's clear that retaining muscle mass and when we get into the later stages of our life, to retain strength and obviously power, which is probably more critical of, some people would argue, then you've got to be practicing some type of resistance training and put those two together. Then I think that that's basically, it's biological aging that you have to overcome. We have to find the key to that, try to maximize the quality of the life that you live obviously, and that would be slightly higher protein intakes focused on some nutrient dense protein sources and make sure you practice a little bit of

resistance exercise, particularly as you get a little bit older.

DANNY LENNON: Fantastic advice given that the kind of clear research we have now just on not only the amount of muscle mass, but just muscle function and strength, how they are associated with all sorts of positive outcomes later in life on our predictive, I suppose in so many ways, or at least on the flip side, we have a very clear research shown those kind of people and I suppose, the lower percentile for strength and muscle mass team to have pretty bad outcomes in comparison. So yeah, it's an interesting area and it's fascinating to see more and more of that work come out.

Stu, just before we start wrapping things up, there's just a couple of other bits of pieces related to protein that I wanted to ask your thoughts on that are maybe outside of this direct theme of today's conversation. One is related to a concept that there seems to be quite wildly conflicting views on as some people not looking too much into or not seeing this as something that's all that valid, other people thinking a bit more so. This is an older concept of the protein leverage hypothesis. This kind of idea that where humans need to eat a physiologically desirable amount of protein and what kind of keeping in order to try and get that. Do you have any thoughts on that hypothesis and what would your current views on the validity of such a hypothesis be?

STUART PHILLIPS: Yeah, it's interesting. I definitely say that, and it's the Simpson, Raubenheimer type concept that below a certain threshold, if you're not consuming enough protein and people engage in food or energy, if you're seeking behavior to make sure that their protein intake is sufficient. I think that when you look at particularly the evidence as you build it up from insects, rodent studies, everything, it seems to hold true. At least the studies that I'm aware of in humans would suggest that there is some, I think, merit behind the hypothesis.

I'm not sure how far it extends above, let's say above 15% of energy coming from protein. In other words, if you're below 15%, then the theory tends hold true. People tend to eat a little bit more food, maybe in an

effort to seek more protein in their diet. Everybody sure says why don't we just eat some more protein-containing food. Almost every food we eat contains a little bit of protein, even some plants. But beyond the 15% threshold, it's not like if you went up to 20%, then you dial down some of your caloric take. There is a little bit of evidence to this but it's for most people, I think the effect begins to wane, but interesting concept and people have never heard of it or interest in reading more. It sits in S. Simpson and D. Raubenheimer are the authors and it's definitely worth a peruse in terms of some of the papers that right there because it's remarkably interesting. I'm certain that below a certain threshold it works, above that 15% threshold, I'm a little bit less convinced, but it's an interesting paradigm for sure.

DANNY LENNON: Thanks for that. Just before we start wrapping up, in terms of the research that's going on in your lab over the next a few years, what is a particular area you're either most excited by or you think there are some really interesting research questions to answer that you're hoping to look at over the coming, say 5 to 10 years?

STUART PHILLIPS: We're excited about a couple of things. First of all, we're very excited that we've now been able to get what's called a durative water ingestion method. In other words, basically ingesting larger doses of water that's labeled with deuterium, then labels amino acids. Then amino acids get incorporated into it and that's allowed us to make measurements of protein synthesis over days. So it incorporates everything people would think; hormonal, sleep patterns and everything. For years, we obviously did a lot of work with the acute muscle protein turnover with tray serves, and people were hooked up to pumps. We were very pleased obviously with those data, but realizing that it lacks some external validity because of the increased control and short time period.

Well now this water method has allowed us to make a longer glimpse into the effect of certain things, age, activity levels, sex, hormonal status, protein intake, etcetera. It's been quite rewarding. We're looking forward to doing a little bit more work in that area. The primary thrust of where we're heading, I think

probably like a lot of people and dictated as much by interest but also by a grant-funding question is around aging and on the demographics I'm familiar with in Canada, and obviously the United States and rest of North America, but in Europe are exactly the same. The estimates are that by the year 2036 more than a quarter of the population of Canada will be over the age of 65. Now we had better figure out what we're going to do for these people in terms of keeping them physically active and stopping some of the more deleterious aspects as we talked about of sarcopenia for example.

DANNY LENNON: It's such an important an area that can't be understated and like you say, those statistics only show that even more so. Before I get to the final question, just if people are interested in either finding you on social media, contacting you, looking for more of your work, where's the best places online for them to do any of that stuff?

STUART PHILLIPS: I'm on LinkedIn. Stuart Phillips and McMaster's University's leaders will tie in. There is another famous Stuart Phillips out there. He has a hair salon in London. I understand he's quite a good hair dresser, but that's not me. I'm on Twitter at @mackinprof. I'm on Facebook as well, and I'm happy to try and engage with as many people as I can on social media and shows like this obviously help out as well. All of those.

DANNY LENNON: For everyone listening, I will link to all of that stuff in the show notes if you do want to check out any of that. Stu, that brings us to the final question we always end the show on, which can be to do with anything completely outside of today's topic as well. And it's simply, if you could advise people to do one thing each day that would have a positive impact on any area of their life, what would that one thing be?

STUART PHILLIPS: It would have to be exercise. Everybody wants to know, I think what kind of exercise, for how long and everything else. A pragmatic part of me says that it really doesn't matter so long as it gets you out the door and it gets you moving. I think that that's against the backdrop of realizing that the amount of dietary living that most people do is absolutely shocking. And

also the, obviously, the observational data that it's when you take people from that, that do nothing to doing something that you see the biggest reduction in risk.

If everybody even got out the door and walked for 10, 20, 30 minutes a day, then I think that they would, after a while began to notice an absolutely measurable effect on their health, their outlook, no matter what it was, maybe not on their body weight, which is of course, what everybody wants to focus on. But I've given up on weight loss to be honest with you. I could spend the rest of like career doing weight loss research. We've done a few, but what disappoints the most is the way the rate of recidivism at the end. For most people, it's the lost leader that brings them in the door but I really hope that focus would be more on being physically fit. If you're so inclined and obviously in my world of being strong as well. Do whatever gets you out the door and do it all on a consistent basis.

DANNY LENNON: Wonderful message to leave people with. With that, I want to say thank you so much for your time today. It's been an absolute honor to be able to talk to you about some of this stuff. I really appreciate not only the information but you've given up your time to do so. Thanks for being part of the show.

STUART PHILLIPS: It's my pleasure Danny. Thanks for having me on. I hope some people took a few nuggets away.