Danny Lennon:

Stu, how are you doing?

Stuart Phillips:

I'm doing well. Thanks, Danny. Thanks for having me back on the show. It's good to see you and hear you. Of course.

Danny Lennon:

Yes, it's great to be having another conversation here and this time, of course, we're going to be talking about questions that our regular listeners have sent in, but before getting into the specific questions that we've had, I thought it might be really useful to frame this for everyone. That's going to be listening with a few definitions of key terms that often get raised in this area that we'll mention throughout this conversation, but that sometimes maybe we need to have a more precise understanding of, I think can be really helpful. So I suppose, from an overview level, how would you define or describe to someone what exactly muscle protein balance is?

Stuart Phillips:

Yeah, so muscle protein balance is determined by the difference between two processes. One is muscle protein synthesis, or that's the anabolic or muscle protein "making" side of the equation. And the other is muscle protein breakdown. And I think,, the analogy that works most aptly is to say,, your muscle is a brick wall bricks go in on one side and that's muscle protein synthesis. The bricks in this case would be what we call amino acids or the building blocks of protein. And then at the other end, there's somebody pulling bricks out of the wall. And so the wall gets bigger. If more bricks go in or it gets smaller, if more bricks go out it sounds inefficient, but if you like it's a constant sort of tune up of the wall. So it's always in its most optimal functional state and the net difference between those two processes determines net muscle protein balance.

Danny Lennon:

And so I think one of the interesting things that often comes up is when people are reading literature in this area. And particularly when we're looking at protein feeding trials and we're trying to, whatever the comparison is that we're looking at, oftentimes that measure that we see discussed is muscle protein synthesis specifically. Can you maybe describe why is it that we have this focus on muscle protein synthesis specifically as opposed to anything else in terms of these outcomes?

Stuart Phillips:

Yeah, well, so probably one big reason, I'll be honest, to put my hand on my heart and say that it's much easier to measure muscle protein synthesis than it is to measure muscle protein breakdown. So I think that that's one reason. And which is not to say that muscle protein breakdown has not been measured. It has. But it is the less responsive of the two processes to the main stimuli that we think determine net muscle protein balance. And those would be protein feeding and exercise and in particular loading exercise. So when we look at the response of protein synthesis to those two stimuli they change sort of four to five fold, whereas protein breakdown sort of you get a 20 to 30% increase. So it's a far less responsive process of the two. And really it is only when you take someone who's quite sick or you can imagine somebody in an intensive care unit, then muscle protein breakdown would be pretty high in those people, but young, healthy folks. And even in older age, it's, it's really not as big a deal as protein synthesis is the much more sensitive and regulated process of the two.

Danny Lennon:

Once we have a measurement for muscle protein synthesis in some of these trials, that gives us a picture of what muscle protein balance is likely doing. Now, one thing that people will maybe be thinking is, hold on for some of these trials, what we're really interested in is maybe muscle recovery after about of exercise or the impact on muscle growth. So what is it that we're using muscle protein synthesis for? Because it's clearly not the exact marker. And can you maybe describe for people because there's lots of commentary in this area of, well, how good of a proxy measure is muscle protein synthesis for some of these other things that we care about?

Stuart Phillips:

Yeah, so in fairness, the measure]that we care about is how much muscle you have and then maybe others would say, "well, if even if you have more muscle, is it, is it something that's making me stronger, bigger, faster, et cetera.?" So pulling it back, I think what muscle protein synthesis does, is it gives us some insight into the possibility, at least that a particular stimulus could have a beneficial effect. So if it's protein, then yes, protein has an effect. If it's exercise, exercise has an effect, if it's a different type of protein, is it better or not as good as another type of protein is one form of exercise better, it's stimulating more muscle protein synthesis. So you know, to us, it's, it is a proxy measure, but it gives us some insight or confidence that if we did what we do in the short term where we measure protein synthesis, then in the longer term, it would be translated into some sort of outcome that would be indicative of more muscle or greater strength or something like that.

Stuart Phillips:

Now to the second part of your question, then how good of a measure is it? I think it's fair to say that the initial and by initial, I'm talking about the early stages of my now 24 year career here at McMaster, we were pretty confident that it was a good proxy and you know, so we had to prove it to ourselves in one circumstance. And we actually found that the hourly measure that we were doing, where we infused stable isotope, labeled amino acids was not particularly good at predicting training outcome. So we've gone on now to use a different method where we use derated water and we get people to ingest that. And we take biopsies that are either days or in sometimes in some cases, weeks apart. And when we do that, and particularly as people become more accustomed to a stimulus, if they're training, for example then the measure of protein synthesis does relate fairly well to muscle mass.

Stuart Phillips:

So it's been an evolution of our understanding. And I know that frustrates people because they say, well, for years, Phillips was saying this and I'm like, you're right. You know, that was the state of science at the time. And science is not an absolute answer. It's a process. And, you know we've had lots of recent examples of that. But really when we've gone to this more sophisticated method of derated water and gone days between biopsies as opposed to hours. So we get a more sort of indicative window that, that does relate fairly well to a change in muscle.

Danny Lennon:

So maybe the final thing I'll ask, and I think maybe the terminology here might even answer the question to some degree for people, but to be really clear on it, because people will see a couple of different terms. Not only will they see muscle protein synthesis, they may also come across this idea of whole body protein synthesis. Can you maybe just clarify the difference between those two things for people?

Stuart Phillips:

Yeah. you know, that's a good question. I think a lot of people look at whole body and they say, well that's everything that's going on. And muscle has to be part of that. And it's true; muscle is the largest reservoir of protein in our body, it's largest organ arguably in our body. And so it would make sense that it would contribute to whole body protein synthesis or whole body protein turnover, whole body balance, et cetera. And, and it's sort of an odd conundrum. It does; it's probably between 20 to 25% of whole body turnover, which is odd for an organ. That's so big, but it turns over pretty slowly. So I always say to people, it's sort of like the bricks going in and the bricks going out is a relatively slow process, you know contrast that with something like your liver or your intestines, for example they turn over proteins at somewhere north of about 30 to 50 times, faster than muscle.

Stuart Phillips:

So they're small but they have a really, really fast rate of turning those bricks over. So when you look at the measures of whole body protein turnover, it's much more reflective of rapidly turning over tissues like liver and your, what we call your splanchnic region. So that's all of your intestine and all of your essentially organs that are in your gut. So it's tough to translate one from the other. When we talk about muscle, it it's made from a measurement of a muscle biopsy. When we talk about whole body, it's basically putting a box around everything and you don't know what tissues are contributing to what, but by subtraction, we've learned that it's really the non muscle tissues, which I know is odd, but that's the bigger driver of changes in whole body turnover.

Danny Lennon:

So with that, let's maybe turn to some of the questions that some of our listeners had sent in. And I'm going to start with this first question that came in from Tyler Simmons, who asks: "We're starting to see commercially available whey that is being produced by bacteria engineered to synthesize whey protein directly from nutritional substrate. It seems like we should expect this to have directly comparable effects given the identical molecular structure. Is there any reason to think this bacterially synthesized whey will have any different effects than whey from dairy has?"

Stuart Phillips:

Yeah. Wow. What a great question. Entirely correct. Interesting that we've now got to the stage where we've genetically engineered bacteria to produce whey because no bacteria would normally produce whey. So what we actually, or not, we what people actually do is they introduce a piece of DNA into the bacteria that codes for the genes that then make the protein, which is whey. So that's normally a component of if you've got a cow or human or any mammal that they're making breast milk and whey is a portion of that. So I think most of those procedures have been done basically in reaction to a strong move globally around plant-based proteins or, or non-animal based proteins. And so a lot of people view milking cows as it, it's obviously maybe cruelty animals or something like that. And I'll leave the ethics of that alone, but let's just say that these bacteria do produce this whey. You can harvest it from the bacteria and you can isolate it. I would have no really frame of reference to say that that that whey would be different from bovine or cow milk derived whey. The, there may be some subtle differences in how the protein folds, because proteins, aren't just strings of amino acid. They're sort of Bening on each other and they twist and they form. But from a nutritional perspective, I would expect that they would be if not the same they would be very, very minorly different if they are different at all. So but an amazing technology and a really you know, necessity is the mother of invention. People are like we want weight protein, but we don't want it from, from milk. And so you've, you've got a bacteria that you've engineered to do this it's really it's pretty clever.

Danny Lennon:

Yeah. That's awesome. And I'm sure there's no doubt going to be a lot of future research. That's going to look more into this, but

Stuart Phillips:

Absolutely. Yeah. It's not going away and I think you're going to see you're going to see more and more of it for sure.

Danny Lennon:

So the second question I'm going to go to is one that came in from Louis Duffy, who asks: "Does the literature still show that an additional 30 to 40% of plant-derived protein is required to equate a similar response from animal protein? So isolates and sources such as Mycoprotein, could they play a role? How does this increase play out? When looking at the viability of plant protein in older populations is animal protein really still the gold standard?" And we have a whole list of questions that are essentially bundled in here that we can maybe unpack later, but essentially it's starting from maybe the position of at least theoretically, when we looked at protein quality, we looked at different amino acid profiles noted, maybe these differences between animal derived sources and plant derived. And then theoretically to hit this leucine threshold, we would've talked about getting a higher dose of plant. Can you maybe talk about where we are currently in relation to some of these answers around plant versus animal sources and their response?

Stuart Phillips:

Well, clearly your listeners are tuned in because that's an outstanding question. I think you know, like I said, I've been doing this for 24 years here at McMaster and longer. If you add up all the years, I was in grad school. My position on this has changed a little bit; ask me 20 years ago. I would've said and it's still fundamentally true. Animal proteins are superior in quality to plant proteins. And there's two reasons for that. So first animal proteins are more easily digestible and that's really a function that plant proteins contain anti-nutritional, non-digestible components, the chief of which is dietary fiber. So if you take the fiber out of the plant protein, and so this is you're processing the plant protein. And so we take a soybean we remove all of the outside, we take the meal that's inside and we through chemical processes, remove the fiber and you've got a soy protein.

Stuart Phillips:

And if we don't mess around with it too much, we call that a concentrate. If we purify it even further, it becomes an isolate. So now what you're really saying is that the digestibility issue is a non-issue because there's no anti-nutritional or anti-digestible components of the plant protein. So I'm using soy as the example, but we can insert pea, rice, canola, hemp et cetera. So now the comparison really comes down to which has the better essential amino acid profile. And again, in fairness animal proteins on average milk being probably the best tend to have a superior blend of essential amino acids. Some of that's changing now, we've, we've got plant-based proteins that I think are coming closer because they're just unusual sources, but now we're actually harvesting them or we blend plant proteins.

Stuart Phillips:

And like it's an amazing thing. If you travel around the world, how is it that everybody's figured out that a grain and a legume together are better? You know, so it's red beans and rice in the Caribbean, it's corn and, and black beans in south America. It's soy and rice in, in Asiand everybody's figured that out. And so there must have been some evolutionary pressure to make that an understandable thing on a global scale. So if you take a grain protein and you blend it with a legume protein, you can get a plant protein source, particularly if it's concentrated or isolated, that's not much different. So, and, and in truth again I know this frustrates people, they're like, "oh, Phillips once said...", And I'm like, well I, what scientists would I be if I didn't change my mind when presented with some data to suggest otherwise?

Stuart Phillips:

So we collaborated with a group in Brazil and essentially trained some young guys with the same protein intake level, but all of it coming from animal or all of it coming from plant. And we didn't see any differences in, in muscle mass gain or strength or anything like that, but the way to compensate for inferior, if that's the right word, plant protein sources is to eat a little bit more now to the 30 to 40% question. I think that that is that's an estimate that's on the high side based on what we call unrefined and exclusively plant based sources. So by unrefined, not fermented not cooked, not boiled, not prepared, sprouted all of the things that are pretty common if you are, if you talk to vegetarians or vegans that are done in the preparation of plant foods. So I think when all of those things are considered and we've we're entering a phase now where you can go into a grocery store and there's a lot more plant choices and I'll admit it, it it's processed, but if that's your thing and you want plant and only plant, then I think you're looking at foods that make that choice in the availability of the amino acids and protein a lot closer than it once was. So is it 30 to 40%? I don't think so anymore. I think it's much more like, sort of 10 to 20%, if it's that if we go to isolates and concentrates and blends, then I think the difference becomes pretty trivial.

Danny Lennon:

Yeah. I, I mean, when we look at plant protein, maybe as as a group within that, there's a lot of, of difference when we look at the products that are available now. And like you say, particularly ones that are processed types of foods, but that can include things like concentrates and isolates. That's different from going back and saying, oh, if a significant portion of someone's diet comes from wheat protein, is that going to be comparable? Right. So there's still these differences to, to tease out. And so if people are in that position and let's say they are consuming a plant exclusive diet, and they're trying to make sure, okay, I want to theoretically make sure I'm getting enough quality protein per serving. Let's say, how could they do that general calculus? Is it coming down to the total grams of protein or do they actually have to go and look at well, what is the content of these different amino acids?

Stuart Phillips:

So I think one of the truisms is when I, particularly, when I talk to people who are, who are vegan is you do have to be a little bit more judicious about how you plan your protein. So there's a bit of thought that goes into it. Most vegans then tell me, I find it easy. And I'm like because you're vegan and it's part of your psyche all the time. And most people I talk to where they they're dialed in. They know they could probably tell me the content of leucine of something et cetera. But there are odd circumstances where like corn protein is an example is for reasons we don't fully understand it's very high in leucine in there's the trigger amino acid that we've talked about before that leucine trigger.

Stuart Phillips:

But you know, nobody thought about corn protein before because everybody thought we had enough protein now it's it's a bit more of a concern. So I think one of the things that again is true when you sort of pull back is the primary driver. And the big picture question is, are you getting enough total protein in the day? And, and then within that, there are subtle nuances about a per meal feed and how much leucine per meal and those, those questions are the the, the effect that those have are buried a little bit within, are you getting enough in a given day? So first we talk about trying to hit at least 1.2 grams of protein per kilo per day. So that's 50% above the current RDA or RNI, and which is around 0.8, depending on where in the world you are.

Stuart Phillips:

I think there are benefits associated with going higher than that, but I think the system tops out at about 1.6 grams of protein per kilo per day, in other words, twice the current recommended intake. And I know then a lot of people being kind get a little bit like so what about 2.4 or 2.2? And I'm like and people are, are a little bit maybe confused. They say, well, I thought you said only 20 grams of protein can be absorbed. And I'm like, Woohoo, hold on 20, more than 20 gram, a lot more than 20 grams can be absorbed, but you know, protein is only usable in small bolus. You only have a finite capacity to store it. And people sort of think that you can stock it away for later and you can't. So let's just say big picture, at least 1.2 grams. If you're vegan, maybe 1.3, 1.4, plan your diet well pick diverse sources of plant protein, grains and legumes paired. Good idealways. And you know, go from there. I hear from lots of vegans, I, then they say, I find it easy to hit 1.6. So my assumption is they're, they're pretty dialed in.

Danny Lennon:

And I guess that's just a great example of the difference between when we become too reductionist. And if we were to say, okay, is there a difference between 20 grams of this in acute feeding versus 20 grams of this other protein, we might see differences, but let's, if we go with that theoretical maxing out that you said around 1.6, and if we go with that, suddenly those changes over the course of the day, maybe start to wash out.

Stuart Phillips:

I mean, it's one of those things like the analogy I use a lot, and I think people understand it is to say that if you dip a cloth in water, the first time you pull it out and twist it, you get a lot of water out. And I'm like, that's your total daily protein intake. And then the second twist, you get a little bit more and I'm like, that's maybe the protein quality piece, the third twist. Now you're not getting much water and it gets a little bit more convoluted. And then it's like, that's even protein distribution throughout the day. And the last twist, when you now the cloth twisting in on itself, I'm like, that's the losing content per meal. So you're a young, healthy guy, you're eating a lot of protein. You're taking a protein supplement and you're taking branch chain amino acids, and you're going to the gym and I'm like, dude you can't get anymore water out of the cloth. You're there. And they're like, if I hit 2.5 versus 3.7 am, am I okay? And, and I'm like, I'm, I'm pretty sure you're good. You know, so that the devil may be in the details. But I think that the big picture is hit your protein targets on a daily basis. And, and you'll be good to go.

Danny Lennon:

The next question actually speaks to maybe some of that per-meal dosing. And it comes in from Thomas Davis who asks: "During post exercise conditions, does protein ingestion stimulate MPS for longer than the usual two to three hour period reported in resting conditions?"

Stuart Phillips:

Yeah, the, the short answer is yes. They sort of hit the same amplitude. So in other words the meal and the resistance exercise tap the amplitude of the response, but what resistance exercise does is prolong the response. So protein synthesis in response to a bolus of food, goes up, goes down that's you know, credit to Phil Atherton and his lab at at Nottingham for "the muscle full effect". But if you exercise somebody, you prolong that response. So it just goes on for a little bit longer. It probably goes on for as long, depending on the intensity of your workout and everything else for as, at least as long as I'd say 12 to 24. And if you're a novice, it goes on for up to, I think, about 48 hours. So it's a pretty substantial effect.

Danny Lennon:

The next question comes from Charlie Beestone, who asks: "Considering the growing interest in fasting protocols, both time, restricted feeding, and longer fasting protocols, what would you recommend in these circumstances for the preservation slash growth of muscle mass? Would it differ between intermittent fasting time restricted feeding, and then longer, for example, one to three day fasts?"

Stuart Phillips:

I mean, I've done time restricted feeding. I've tried intermittent fasting, mostly, it's the sort of the five and two protocol. So two days a week, I have my last meal and then I won't eat, I'd say dinner time, and then I don't eat until the following day at dinner time. So there is one feed per day. If you do it longer than that, two days, three days, you are one tough individual because hunger, and for me, the big thing I found was it interrupted my sleep. Like I just woke up and I was starving and I, wasn't obviously starving, but I was very hungry enough to wake me up. So first I think we need to understand that those are protocols to ostensibly lose body fat. Lots of people promote them for their you know, health span, longevity, et cetera, benefits.

Stuart Phillips:

And if you believe the rodent data and everything else than, okay, fair enough. I think what we're talking about here though, are individuals who are trying to get lean losing body fat, but trying to retain muscle. So to be really, really, and I mean really clear the primary driver of hanging onto muscle in any of these situations is, is lifting weights or doing any form of exercise. And it wins like by a country mile over anything you could do nutritionally. So I've heard of people you know, people have said, oh, I take a branch chain amino acid supplement. And I always say, well you're not fasting if you're doing that, that's, that's breaking your fast. And they're like, well, I don't want to lose too much muscle. And I'm, and my question is always, how much muscle do you think you lose in a day?

Stuart Phillips:

And they're like, oh, I don't know, like a hundred, 200 grams. And I'm like, no, like 2, 5, 10 grams at most. And so it's you can't even detect it on a scale. It's very little. And if you have it with the anabolic stimulus of lifting weights, then there's very little that you can do nutritionally to improve upon that. It is important in the refeed period, whatever that is. If you're time restricted, obviously in the meal that you choose, or if you've gone for two to three days to emphasize protein, for sure. It's the primary driver, of course, but at the same time, just appreciate that the loss in and I put loss in quotation marks of muscle that you're experiencing is it's, it's very, very small. Now take a bodybuilder. Who's going into competition and getting down to four and 5% body fat, that guy, or that, that woman is losing muscle. No question you can't drive your body fat down that low without losing a little bit of muscle, but hanging onto it is as big a function of lifting weights. In fact, by far over anything you can do nutritionally. So we've done some work in this area. You can talk about as high as 2.4 grams of protein per kilo per day, if you want. I don't know that the protein effect is that big, the lifting effect is much bigger.

Danny Lennon:

And I think the extra layer of nuances added that as you noted, oftentimes when people ask this question is in the context of they're going to go through a calorically restricted period of time where they're aiming to bring body fat down. And then, so even if you add in resistance training, like you said, and then on when you are going to consume food, make sure you have protein, the amount of muscle mass loss for most general people is going to be relatively low. And then beyond that, you could say, well, what about the worst case scenario? Even if you did lose some amount of muscle, how quickly would that be gained back once that person is back at caloric maintenance or into a hyper caloric diet and eating protein and training properly, again, it, it probably will come back relatively quickly relative to building it in the first place I'm

Stuart Phillips:

Presuming. Yeah, no, absolutely. And I, like I said, I think it's, it's just sort of understanding what is the main driver of losing muscle? So let's use the worst case scenario. We get somebody who's really sick. They're in the intensive care unit they can't eat, so they've got a feeding tube, or maybe they don't have a feeding tube and we're using TPN to feed them. So they're getting their nutrition through their, through their vein. The biggest driver of why they lose muscle is people say, oh, it's nutrition. I'm like, no, no, no, it's inactivity it's being unloaded and being in bedrest is so if you can get, if you could get that person to do some form of physical activity. So if we stimulate their muscles using electrical current, or we get them special in bed cycling therapy, or we get them up and even if they're ventilated walk them around the ICU they do much better. And, and so it's, it's the inactivity or the lack of loading. That's the primary driver of loss, just like it's the primary preventer of loss, if you're an able bodied person. So the protein effect, the nutrition effect, the branch change that people take to potentially stop the loss of muscle masses. It's a trivial concern in my books.

Danny Lennon:

I mean, you see a similar situation happen when people, particularly athletes get an injury and let's say it stops them from doing their usual sport. And they think, "oh, I'm just going to stay consuming protein. And, and that will be enough." <Laugh> it's like, if you're not going to be moving the way you normally do particularly let's say they have a leg injury and they decide, okay, I just can't do anything right now. That's probably not the best way to go. Because again, that inactivity is going to cause the muscle loss. Yeah. And not the drop in protein.

Stuart Phillips:

It's a great scenario. And you know, full credit to to Ben Wall, a good friend of mine at Exeter. And when he and Luc Van Loon, another good friend of mine at Maastricht, wrote essentially a paper on saying what would you do for high-end athletes to try and get them to hang on to muscle and hang on to strength. And obviously the salaries, these folks are getting paid. It makes everything makes a difference. So nutritionally, if you can't move. Yeah. I threw the kitchen sink at these guys to try and get them to hang onto something. They're, they're worth it. But for most mere mortals who are if it's injury, then you know, that's tough take the time off. But if you're bent on trying to hang on, yeah. Get creatine, take omega-3 fatty acid, take protein, take just like take something to do, but to your point, it's the rehabilitation and the loading and the retraining of the muscle where you get the recovery aspect. And so it's, it's the primary driver by a long shot.

Danny Lennon:

So with that, let's turn to our next question. This comes in from Silvia Hua, who says: "Is it a waste to take too much protein powder at once because some of it won't get absorbed?" Again, this speaking to this large question that has been around for a while around protein absorption, and many misinterpretations of what maybe people might say. So I've no doubt that you've maybe discussed this before, but what is the best way to tackle this protein absorption question?

Stuart Phillips:

<Laugh> Well, I want to thank you first for having me on the show and giving me a forum to be able to address this to, I know you have a big audience, and so let's be absolutely 100% crystal clear. We, men, women, doesn't matter, humans can absorb a lot of protein and by people say what's a lot. And I said, a hundred grams that is sitting 150 grams and people go, no, like, how's that possible? I'm like, well, the more protein and the more food you stuff into your stomach, your, your stomach slows everything down. And it just sort of dribbles the, what we call the digesta out into your intestine for, for digestion. And people go, oh, but 150 grams. And I said, think about your last I always say Christmas dinner or your big feast or whatever it is.

Stuart Phillips:

And you probably ate about that much protein. And I said, I'm sure you think that most of it gets absorbed and it doesn't go all the way through and you end up it's in your feces. They're like, well, I'd never really thought about it. And I'm like, well, most of it gets absorbed. So you can absorb a lot of protein. The major thing that people have to understand is that it's your capacity to use what you've absorbed. That is the rate limiting step. In other words, we absorb carbohydrates. We're ridiculously good at that for better or for worse we can store them. We can put them in muscle as, as glycogen, we can store it in our liver as glycogen. And then the system sort of, after that, it goes into overflow mode and we begin to turn carbs into lipids de Novo, lipid synthesis.

Stuart Phillips:

We can absorb lots of fat. And unfortunately, we're very good at that. And that just goes into fat cells. Protein is a substrate. And so there's a, there's a use for it. When it goes in, we make new muscle, we make new liver proteins, we make new, you name, whatever proteins they are. And then people go and other things. And I'm like, what other things they say, neurotransmitters, I'm like microgram quantities of, of amino acid, like just literally trivial. Like, so when we talk about other, I always ask what process the amino acids would support. And then people say, oh, hormone biosynthesis. I'm like milligram quantities. So when thousands of a grams, so the majority of protein is used. And if it can't be used, you pull the nitrogen off of the amino acid. If you're a fish, you make ammonia and excrete it out of your gills. If you're a bird, you make uric acid and you poop it out. And if you're human, you make urea and it goes into your urine and that's where you excrete it, you can't store protein. You can't stock it away in some lay pool and, and call it back at another time when you want it. Despite what some people have in terms of a notion that you store in your gut protein or something like that, you could maybe amp it up a little bit, but in, in humans, there's no storage form of protein other than your muscle and your muscle doesn't make extra protein above and beyond. So "is it a waste?" To answer the question, sorry got on a soap box. There, is it waste? In a sense, maybe if you view the production of Eure and you're not using you know, everything that you take in, you could view it that way. I do think, however, that some of these stimulation processes that we talk about even in muscle actually require doses that are higher than we would normally otherwise think. And so we think it's 20 to 30 grams of protein that you can reasonably use, but you can eat 120 grams of protein and absorb it, but you will only use 20 to 30 grams. So and a lot of other people like I I've, I've grown tired of trying to talk about this on Twitter because it's not a productive use of my day. And my wife says and you need to keep your blood pressure under control. So I'm like, okay, I get it. You know, but it is, it's an odd message that has been perpetuated based. And, and we in part were responsible for the hype on Dan Moore's paper in 2009, and we said, 20 grams, and somehow that's been taken as you can only absorb 20 grams. And it, in nowhere in the paper, does it say that?

Danny Lennon:

And I think, yeah, that might actually could be a good point just to dive into a small bit more just for people who maybe are, are first coming across this, or maybe we're confused about this question, because I think this how much protein can you absorb? What I think the confusion comes from is oftentimes people just stumble across that classic chart of muscle protein synthesis in acute feedings. And they see three times across the day and this 20 to 30 gram range, like you mentioned, and there's this peak in muscle protein synthesis. And then we hear, well, this has to come back down before it peaks again, later, multiple hours later. And so then the thought is, well, that peak of muscle protein synthesis is the same thing as the most amount of protein I can absorb at that meal. But what you've just outlined is those two things are distinctly different and understanding them then eliminates all the confusion with this question.

Stuart Phillips:

Exactly. And, and I think, again, it comes back to our whole body versus muscle. And so this is the, that's the muscle compartment. And everybody thinks, well, where else does protein go? And I'm like, actually three quarters of it goes to other tissues. It turns over tissues in your gut. And, and I'm, I'm going to use my buddy, Luke van loons. I won't, I won't try and put on his Dutch accent, but he always uses the, he says look at your arm. And if you could, x-ray through to your muscles and you looked at your arm in two to three months time, it's a whole new arm you've completely degraded and turned over all of the muscle protein in your arm. And I say, yeah, if you could, x-ray your gut. And look at your intestines in your liver.

Stuart Phillips:

In three days, you've turned over the protein in there. So that's where a lot of this protein goes, but there's no hypertrophy, well, not good hypertrophy going on in your gut or your liver. But you're constantly renewing the, the proteins in that region. And that's where a lot of the protein is used. So don't fool yourself into thinking that it's, you know muscle is sucking up all the protein. It's actually about 10 to 20% of the protein that you absorb goes to muscle. Thank you for giving me the platform. Once again, it's sort of if there were a list of Phillips frequently asked questions, that would be one. But I, I never grow tired of hopefully busting the myth that I want, I feel bad because I think we helped kind of create the myth by drawing those, those charts, as you say, and everybody was like, oh, you can only absorb 20 grams. I'm like, no, no, that's not what we

Danny Lennon:

eah. That's not what this chart is. Please read the axes.

Stuart Phillips:

Yeah, yeah, yes, yes. Read the manual. I know. It's, it's tough. It's tough.

Danny Lennon:

So with that, I'm going to turn to a question that comes in from Katie Feeney. And she asks: "Does protein powder lose some of its quality if boiling water is added?"

Stuart Phillips:

Yeah, so denaturation of proteins through cooking, it's done all the time. So you know, egg is the easiest one. You crack an egg, you look at it, you've got this runny yolk, you've got a runny white, and then you cook it. And all of a sudden it goes solid. And, and the white becomes actually white. It's not clear anymore. That's the naturation of protein. It's the easiest example I can give you. It doesn't change the nutritional value of the protein because your body breaks all of those things down into amino acids. Anyway it certainly does change the digestion kinetics a little bit raw eggs. You know, if that's your thing you know versus cooked eggs, cooked eggs are absorbsed slower. They're tougher for your body to digest on a full, but that's, I think part of the cooked egg-satiation process, in other words, you eat four or five boiled eggs. And, and a lot of people go, I eat way more than that. And I'm like that. That's okay. I I'm don't have an issue with eggs. Eggs are good, very nutrient dense, very affordable, [dietary] cholesterol's not going to kill you versus say five raw eggs. Then the liquid is digested. The liquid eggs are digested much easier than the cooked eggs, but the denatured cooked eggs are, are by no means nutritionally different as far as your body is concerned in the amino acids. So whey protein and boiling water, not really, <laugh> my idea of a great snack, but it would denature the protein. It could do a few things to the physical chemical properties of the protein, but from a nutritional value it shouldn't really alter to an appreciable extent what you would get from the protein.

Danny Lennon:

Right. And I think this would be really useful because I've seen variations of different types of questions around this of if I add my whey protein to my bowl of oats before I put it in the microwave or after does that, is that a problem? Or if I shake up some whey protein and then leave it in my gym bag for a few hours, is that worse than shaking it and drinking it straight away? Or I, if I put it in, if I bake a certain whey protein into something, is this going to be a problem? And I think, again, it's just misconstruing that we're seeing whey protein as maybe something different from what we do with normal foods. We don't see cooking them as necessarily a problem with protein or at least the, what we're trying to get from protein, let's say, but I've seen variations of this, of if I heat or cool or do something with protein, is that going to make it less likely to have the benefit for muscle mass or muscle repair, et cetera, that I'm trying.

Stuart Phillips:

Yeah. I understand the question and the, and I you presented a lot more scenarios than honestly I'd even considered, so forgive me for laughing, but I was just like, I've never thought of that. But you know, the short answer is denaturation is a normal part of, I mean, you can eat raw fish or raw meat. But when you cook it, it it's fundamentally different. The, the proteins will be denatured, but it doesn't change the nutritional value of what you get. Changes taste, changes mouth feel, changes a little bit of the digestion kinetics, but nutritionally you're still going to get the benefits. There may be some subtleties to that about certain proteins that you digest them differently around dying tripeptides, but that's really getting into the weeds, I think, with respect to where this is going, but for bulk question nutritionally, pretty much the same thing.

Danny Lennon:

Yeah. And I think it's just a matter of terminology of people hear denaturation they correlate that with destroying the protein in some way, and now it's no longer usable or it's not going to contribute to MPS or et cetera opposed to understanding what that process is.

Stuart Phillips:

Yeah. Understood. Yeah. Yeah. And, and some vitamins go down in content in certain foods when you cook them. And so people are like, wow, am I destroying something? Or if they're frozen vegetables versus fresh, and those, and the differences are, are relatively small, but I understand the ethos of where the question's coming on. For sure.

Danny Lennon:

This question is from Ekaterina and she asks: "Would you please share your opinion about how you evaluate protein status in the body? Do you consider serum proteins, like Albu bloom as a reliable indicator of protein, sufficiency, or insufficiency, or to indicators that people absorb all the protein they consume or Armino acid profiles better at indicating protein status?" So I think we can even pull that into more general question of different ways that protein status can, can be evaluated. And maybe if you each get like pros and cons of those or anything that comes to mind when you hear that type of question.

Stuart Phillips:

Yeah. so I mean, I think the answer to the question relies a little bit on understanding two concepts, which a lot of people, I mean, they've been around in nutrition for some time have maybe never heard of, or heard of, and then were like forgotten about, and one is adaptation and the other is accommodation. So we have a capacity, let's say we're stuck on a desert island. And the only thing we've got to eat is a coconut. It's the, I imagine there's a little bit of protein and coconuts, but probably not much. So you're eating this coconut and the, and the question is at what point if I were to do take a measure would be an indication that you're either deficient or you're sufficient you know, something like that.

Stuart Phillips:

And, and the most sensitive would be blood-based proteins. No, no question. They turn over much more rapidly. And clinically albumin is sort of the go-to protein that if a person's protein status is compromised because they're sick, they're malnourished, et cetera, or both it's much more sensitive than other indicators. So we, but we can adapt within a a range. So if you don't, if you don't eat protein for a week, you don't die. But you're going to affect some of these markers. So we can adapt within a given range. Accommodation then describes that you've effectively now dipped into some sort of reserve. And you're pulling, let's say from your muscle, you're breaking your muscle down to supply the amino acids for proteins that are deemed to be much more essential for your daily living than, than muscle. So like albumin, for example so a long term, adaptive process is we've run out of the ability to adapt.

Stuart Phillips:

We've accommodated by breaking down some muscles. So that's it's a pathologic adaptation, and you can see somebody's muscle mass decline that would indicate that we've we've accommodated. Another common example is very high end female athletes will lose their menstrual cycle. That's an adaptive process to conserve energy and also protein, et cetera, because you're not supplying your body with enough energy, not supplying with enough protein, and you're doing too much. So your body just shuts off a, an unnecessary process in, you know your regular menstrual period. You get a stress fracture. Well, that's an accommodative process because you've been so long in this low estrogen state that your bones are now too soft, and you're doing too much. And you know, you've gone into pathology, but blood proteins are the the best indicator that we have out there, blood amino acid levels, maybe in the long term or in deficient states where you're not getting one particular source of protein, but they are pretty, they're pretty laid. They go up and down and you could break down muscle and muscle's a great source of amino acids and not be anywhere near aware that somebody's in a protein deficient state.

Danny Lennon:

And with that, that brings us to the very quick, final question that I'll throw in before we wrap this up, that comes in from Daniel Frett, who says: "I'm now over 60 and left heavy twice a week. What would a reasonable body fat percentage for me to aspire to?", And probably more pertinent to what we're discussing here today... "How much daily protein should I be targeting in my diet?"

Stuart Phillips:

Yeah. well, first, if you're over 60 and you're lifting heavy twice a week, two thumbs up, you're doing a lot more than the average person out there. And I know a lot of people go, what are you talking about? And I I just remind people that resistance training has a ridiculously low participation rate, at least based on self-report, it's probably around 15 to 20% of the population says that they do any form of resistance training. So north of 60 twice a week, first of all, two thumbs up on that one a reasonable body fat I don't like to get too specific, but if you can keep it around 15% and then people say, oh, well, what about 20%? I've been like, oh, I'm okay. With 20% lower than 15. Good for you. Lower than 10: I think you're trying too hard. <Laugh> more than 20 I'm like, mm, okay. Maybe not a great idea, but so somewhere between sort of 20 at the upper end and, and maybe 10 at the lower end but beware any device that says it can measure body fat accurately, because most things in the gym are not particularly good, but let's just leave it there. I think from a protein standpoint, I still come back to the, the 1.2. So 1.2 grams of protein per kilo per day is that's the minimum buy it, I think for, particularly for somebody in their sixties go up to 1.6. I think you can experience some benefits. I think particularly at the breakfast time meal, it's okay to have an egg you know it's okay to drink a glass of milk. It's okay to eat a a high protein yogurt at breakfast, and maybe don't overdo it at the dinnertime meal with a big piece of fish, chicken, steak, whatever. But yeah, 1.2 to 1.6 twice a week lifting, you're living the good life in my books.

Danny Lennon:

Brilliant. So with that, I want to say to professor Phillips, thank you so much for joining us today for answering people's questions. And then for everything that you do to continually not only push research forward in this area, but your science communication of that is also very noteworthy and very much appreciated, not only by me, but I think many people listening who have told me how much they've read and your work, and also listened to you many times over the past. So thank you for giving up your time to come and do this.

Stuart Phillips:

It it's my pleasure. Those are very generous words. And, and I do I don't do this lightly. I take it very seriously. It is a chance for knowledge translation. So thank you to you and your listeners for giving me some feedback that people do actually care about. Some of the things I do. And I I appreciate the forum. Thank you.