Prescriptions for Aging Well: Muscle, Strength and Protein Matter

Recorded: September 24, 2025
Transcript

[00:00 Introduction]

Dr. Anthony Levinson: Without further ado, Stuart Phillips joins us today, Canada Research Chair in Skeletal Muscle Health and Professor of Kinesiology at McMaster University. His research explores how nutrition and exercise support muscle health, body composition, and healthy aging. He believes that a little bit of exercise is better than no exercise and aims to encourage more physical activity in older adults. He is a Fellow of the Canadian Academy of Health Sciences. Stuart has published hundreds of research papers and also holds the record for most registration for our webinar series, and for that, we are very grateful and welcome tonight. Take it away, Stu.

Dr. Stuart Phillips: Thank you very much, Anthony, and thank you to everybody for tuning in this evening. It's always a pleasure to speak to McMaster alumni. I'm an alum as well, class of '89 and '91. And so if you can do the math, you'll know that I'm beginning to care a lot more about aging well, and I think that muscle strength and protein matter.

So there's a number of questions I'm going to address in this webinar. The first of which is, why do all living things age? And what can we do to slow aging? Because no matter what anyone says or what you read on the internet, you cannot reverse aging. You can just slow it down.

I think that the tissue that's particularly important is skeletal muscle. It's probably underappreciated. And if you talk about muscle, you obligatorily have to talk about dietary protein. And then putting it all together, I'll hopefully give you the perfect active aging formula. We'll talk a little bit about protein, the good, the bad, and the ugly, just to maybe put a few myths to rest, and then finally, to put it all together.

[00:01:45 Why do all living things age?]

Dr. Stuart Phillips: So the first thing, why do all living things age? Currently, we probably have about 13 or 14 different theories of aging. They really come down to cellular processes that as we age and cellular reproduction, something goes wrong. And when it goes wrong, the cells in your body don't function as well as they should. Collectively, then the tissues and organs don't function as well as they should. But we can accelerate those processes through choosing lifestyle habits that don't really help these processes. They may even accelerate them. But there's a few things that we can do to push back, if you like, against some of these things.

First, let's talk about an aging myth, and the myth is that aging is some immutable process. There's nothing we can do about it. It's in our genes. The fact is that when we studied Scandinavian twin pairs, and not just Scandinavians, but they're the ones who have done the best research in this area, the difference between twin pairs and longevity is an average of 15 years with a large standard deviation. But importantly, even the variability with within twin pairs is about eight years.

So what do we have to worry about as we age? Now, at this point, if you've heard me speak before, I talk about the leading causes of mortality, but that's holding constant at 100%. So people are concerned about mortality and longevity, and you might hear the word longevity a lot these days. But I think what people really want is not longevity, but as an important quality of life. And when we talk about quality of life, I think it's important to point out that every known chronic disease has associated with it a reduction in quality of life. So if you name all the leading killers of Canadians, we've got heart disease, cancer, chronic lung disease, stroke, Alzheimer's, diabetes, kidney disease. They're all associated with a reduction in health-related quality of life. So the concept is that in the last century, we've added 30 plus years to our life expectancy. But what we haven't extended is our healthy lifespan or our health span. So the concept is to try and compress morbidity, to try and really make those maybe last two years of our life where we experience ill health. And instead of having a health span that is filled with treatment, which is fine to keep you alive, but a reduction in quality of life.

[00:04:33 What can we do to slow aging?]

Dr. Stuart Phillips: So what can we do to slow aging?

Dr. Anthony Levinson: Stu, just a quick point. You haven't shared your PowerPoint yet. I beg you, pardon. No problem. Sorry. Let's try that. How are we doing now? That's great. Just in presenter mode there. Okay, there we go. Perfect.

Dr. Stuart Phillips: Okay, this might make more sense. Sorry about that. Yeah, so in my opinion, one of the non-negotiables is really that we are physically mobile, is that we retain the capacity to be able to be physically active into our senior years. This is obviously a function of skeletal muscle and also a bone, so the musculoskeletal system. And one of the reasons why a lot of people say that they're not active is that they don't have enough time. And when you look at some of the causes of impaired mobility in seniors, they'll tell you, "I have arthritis. I have various chronic conditions. I might have osteoporosis. I have balance issues or there's a lack of physical activity. And what you have to question is whether it's the lack of physical activity that begets the impaired mobility or the impaired mobility that begets the physical activity. And you might have heard some trite phrases such as, "We don't stop moving because we grow old. We grow old because we stop moving." I think if you recognize this famous quote from George Bernard Shaw, you can imagine where this phrase really comes from. Play is really the manifestation in terms of from kids to while we age of physical activity.

[00:06:30 What is sarcopenia?]

Dr. Stuart Phillips: So the key tissue is muscle. And there's a process that we call age-related sarcopenia. Sarcopenia describes the age-related loss of muscle mass, and it obviously has a corollary in bone. We talk about osteopenia as a precursor to osteoporosis. The major difference is there is no clinical endpoint to sarcopenia like there is an osteoporosis where you fracture a bone. And sarcopenia was coined by a fellow named Irwin Rosenberg, and Irv Rosenberg's definition. And he says, here there's probably no decline that's more dramatic than the decline in muscle mass over the decades in life. And he proposed the name sarcopenia from the Greek combination of sarx, which is flesh, and penia, which is loss, so essentially loss of flesh.

The question I'm asked all the time is, when does sarcopenia start? The depressing answer is it probably starts a lot sooner than a lot of us believe. When we look at men and women and their changes in muscle mass, you begin to see this inflection and notable measurable decline in muscle mass beginning at about age 45. I think in recent years, and this is a relatively old paper now, we can actually push this back probably to age 35. We're beginning to see individuals in their early 40s with notable muscle weakness, and that's probably simply a manifestation of their lack of physical activity. When we look at grip strength, which is the measure of strength on which we have the most data, you can begin to see that it peaks and begins to decline at the point where I'm showing you before. It's about age 35 in men. It's relatively similar in women, and obviously, they're a little bit weaker. It's not the grip strength is some bizarre predictor of mortality or morbidity, although it is, but we do have a lot of data, and it's really a proxy for a whole-body muscle strength.

So why should we care about muscle? And the concept is that at some point muscle will decline to such an extent that it hits a threshold below which certain activities of daily living become very difficult to do. And I think while cardiorespiratory fitness, heart and lung health is great, the activities of daily living that a lot of older people begin to struggle with as they age are actually related to muscle strength and then ultimately muscle power.

So what is it that causes sarcopenia? This is a schematic diagram showing a cross-section with an MRI or a CT image of a person's muscle at age 50 and then at age 90. And you can see that the muscle is shrunk and there's a lot more fat in here. And the processes are, well, we really don't know. It could be related to hormones, it could be related to vascular function, something within the muscle. But there are two degrees of freedom over which we have control. The first is nutrition, and the second is exercise. The problem is is that as people age, they begin to develop a condition that we've called anabolic resistance. And I'll explain to you, essentially, what that is.

[00:10:01 The importance of dietary protein and how much you really need]

Dr. Stuart Phillips: So let's talk a little bit about dietary protein. And I'm going to borrow heavily from a paper that a former postdoc of mine, Dan Trayler, wrote, where we took a look at all the summed evidence around the protein, what is called recommended dietary allowance or RDA. And the current recommended dietary allowance is set up at 0.8 grams of protein per kilogram of body weight per day. So for an 80-kilogram individual, that would be 64 grams of

protein per day. Now, that may not mean much to some of you, but I can tell you that that's not very much protein.

So without going through all of the studies, I'll just do some quick math for you, is that we have three studies that use a method called nitrogen balance, which is the current way of estimating protein requirements. And then we've got three studies that estimate protein requirements using a different method. When we look at these studies, and if we took all of the values at face value and adjusted for the amount of participants in each study, we end up with a protein requirement that is actually much closer to about 1.16 or almost 1.2 grams of protein per kilogram body weight per day. So 50 % greater than the current recommended intake. And in fact, there are several evidence-based reviews showing that the minimum protein intake for healthy people, particularly in people, usually they define aging as over age 65, is between 1 and 1.2, and could be even higher in situations of chronic disease and even higher, again, in severe illness, injury, or marked malnutrition.

Now, there are some important points to make when we talk about protein and aging. First of all, aging is per se associated with a reduction in food intake, which predisposes older people to energy and protein, if not malnutrition, definitely undernutrition. We know from several experimental studies that when we feed older people the current recommended dietary intake, they lose muscle area and strength. So this, at least, is some proof of principle that the protein RDA maybe sufficient for some processes, but it's not likely sufficient for muscle. So the point to be made is that older adults need more protein than the RDA. It should be, I think, closer to about 1.2, and despite what you will hear when people talk about protein, older adults are not consuming these intakes. Now, if you use the marker of 0.8, then you would consider that actually a lot of older People are getting enough. But when you use the marker of 1.2, we get far less individuals that are intaking that amount.

So I'm going to give you a quick crash course in what we call muscle protein turnover. This is what my lab studies, and it's really looking at the processes of what govern why and how we gain muscle mass. So there are two processes that go on simultaneously. One is muscle protein synthesis, indicated here by the yellow line, and one is muscle protein breakdown. You can imagine that your muscle is a brick wall, and the bricks going into the wall come from protein synthesis, and then bricks being taken out of the wall are from protein breakdown.

When we wake up in the morning and we eat breakfast, and assuming there's some protein in our breakfast meal, we stimulate the rate at which we make new sections in the wall to a greater extent than the rate at which we're breaking them down. We get this green area of gain in muscle. But you can see that the stimulation doesn't last very long, and it comes down again to a nadir that's right around lunchtime. And we've got this area now of net loss, which is shown in this shaded white area here. And it's about the same size as the green. But then we eat our lunch and we get a net gain. And then we eat our dinner and we get a net loss before we get this final bubble. But there would It's going to be a big gray bubble at the end of the day. That is when we go to sleep. And obviously we're not consuming protein in the middle of the night. Now, what happens in older people, and this is the experimental evidence that our lab and several others have generated, is that instead of having this what we call robust stimulation of

protein synthesis, new wall being made, we have a flattening of the response. And what we do know is that this flattening is due to the size of the protein meal. So if we eat more protein, then we can actually overcome this. And I'll try and show you exactly what I'm talking about. So nobody really eats protein like I'm showing here. I drew these figures. It's easy to draw sine waves. And so I need talented graduate students like Sara Oikawa's figure right here to show you what things really look like. So what most people do is eat a small amount of protein at breakfast. It averages about 12 grams. It's mostly from wheat gluten because most people eat a very carbohydrate-based breakfast. And we get a small stimulation of protein synthesis, and we get a small net accretion of protein. But then we go for a little bit of time before we eat our lunchtime meal, which tends to be a little bit greater in protein. We get a bigger bump. Before we eat the largest meal that contains protein in our day, and about 40 grams of protein at the dinner time meal. We might have a pre-bed snack, but what Sara's has done is she's shown you that overnight bubble here before we wake up and begin this process again.

Now, to give you a sense then of what I would recommend is that instead of consuming protein in this large meal at the end of the day, is to make this meal right here, the breakfast time meal, higher in protein because it's the meal that actually patterns this process for the whole day. So, I spend a lot of time conducting studies and talking to older individuals about how to get more protein in their breakfast meal. And we show them pictures like this one. The one on the left is a typical breakfast. There's oatmeal because, of course, that's a heart healthy breakfast. There's two slices of toast, there's orange juice, and some strawberries. This is very carbohydrate-centric. It's relatively high in fiber, so that's not necessarily a bad thing, but it's quite low in protein. I include the two slices of bread over here. I make sure to emphasize to people that eggs are no longer on the dirty list. They were probably the most maligned breakfast food in the history of food because dietary cholesterol that's contained in eggs bears no relationship with the cholesterol that's in your blood. And then what we've got here is Greek-style yogurt. It's about three quarters of a cup. When we consume a breakfast like this, we end up getting closer to 25 grams of protein as opposed to 10 to 12, all of which comes from wheat gluten, which is a particularly low-quality protein.

What then can protein do? I want to emphasize that this is a study that's observational in nature, but it serves to illustrate what probably counters a lot of, I think, misinformation out there is the protein is associated with, and we'll get back to it a little bit more. I like this because it's a large study. It's a Nurse's Health Study cohort. It's based out of Harvard. They recruited 48,000 participants. They were all women in 1984. I could show you various different studies here as well. The Men's Health Participant Study. The results are almost identical, but I'm going to use this one because they had a little bit of a wrinkle in here.

What they did was they fast forwarded to 2014 and '16 in the same cohort, and they looked for people who were aging in a healthy way. In other words, they were free from 11 major chronic diseases, and I'll show you what those are. They're a laundry list of what you'd expect. And they had good mental health, and they did not have impairments in either cognitive or function. So this is a pretty exclusive list, and you can do the math here, and you can see the time difference between here. This is about 30 years. And you've got these 11 chronic diseases that these people are free from. You can look up and down the list. Remember that

cancer is the leading cause of mortality in Canadians. And we've got heart disease, and we've got people who are undergoing heart procedures, congestive heart failure, stroke, lots of things in here that we would like to try and avoid. But they also looked at subjective memory, physical function, and an assessment of health status.

Now, the odds ratios that I'm going to show you here are essentially the chance that you have of being this healthy aging person related to the amount of protein that you're going to take in. So first of all, for each 3% energy increment in protein, healthy aging, the odds ratio is about 1.05. So you get about a 5% benefit with the more protein that you take in. You got about a 7% benefit when they looked at animal protein. You got about a 14% benefit when they looked at dairy source protein. So that would be milk, cheese, as well as yogurt. And you got about a 38% increase the more plant protein you consumed.

So I think that this is an important point to pause where people say, well, protein is the bad guy in the whole story here. And my point would be is that at no point are any of these sources of total animal, dairy, or particularly plant, associated with an adverse health outcome. In fact, they're all positively correlated with the absence of those diseases. But plant protein was associated also with higher odds of an absence of physical functional limitation and good mental status. This was adjusted for a number of factors which may confound the fact that people who consume more plant protein also have, I'll call it a halo of good lifestyle habits as well. But something maybe that we could talk about in the question and answer period.

So I guess the question is, is there a specific time of day? And I think it's really at this breakfast time meal that older people should begin to pattern their increased protein intake to avoid this phenomenon of what we call anabolic resistance.

But I'm going to tell you that there's one particular lifestyle activity that you can undertake that actually, I don't say it reverses, but it definitely helps mitigate this anabolic resistance. That's to engage in resistance exercise or loading. As the graphic indicates here, somebody's under a bar. And what happens when we lift weights or we load the muscle, we actually get a greater anabolic response and a reduced catabolic response. And younger people, when you do this over a period of time, this is going to sum up to give you more protein inside your muscle, and that's going to make your muscle bigger. Now, I'm not saying that older people can't gain muscle. They can. But really, what we're talking about is the mitigation of loss with age as opposed to the gaining of muscle.

[00:22:36 The ‘perfect’ active aging formula]

Dr. Stuart Phillips: So this brings me then to this perfect combination, the one that we've been researching in my lab for over 30 years, and it is this perfect aging formula. Now, I posed these questions to you before, but I'll ask them again. And it's ridiculous, it's almost embarrassing to talk about. But if you had a treatment to lower risk for all chronic diseases, it works regardless your age, sex, race, or pre-existing risk factors. Large evidence base from which to draw could save the healthcare system billions, cost comparatively little. And instead of the off-target effects being side effects that we're not overly excited with, we get these what we call pleiotropic

effects. In other words, things that we don't really know how or why they happen, but they're beneficial, like better prognosis for a variety of unrelated elements, including depression, dementia, and suicide incidents. No secret, physical activity. I used Ron Davis's quote here. "If we had a pill or surgery that contained all these benefits, it would be the most prescribed drug in the world."

So just so we're clear on the difference between the two, physical activity describes any movement of the body, by skeletal muscles that result in energy being expended. So, as soon as you get up in the morning, you get out of bed and you start moving around, you're being physically active. Obviously, there are various doses of physical activity that probably get better and better health results. But exercise, on the other hand, then is physical activity that is planned, structured, and repetitive, done with the express purpose of aiming to improve or maintain physical fitness or muscular strength.

In Canada, we talk about We have 24-Hour Movement Guidelines that is sweat, step, sleep, and sit. And as the four components here, and we divided them up for young infants, to children and youth, adults, and then adults over age 65. And the wedges are essentially trying to convey that we'd like to have you sit or even standing is being reclassified now as a sedentary activity as little as possible. Sleeping is obviously variable, and that's the line here. As a non-master of the sleep activity, I'm probably like the top half of the curve here. But we would like you to be stepping or being physically active and sweating or exercising in proportion to the sizes of these shapes here.

So what do the guidelines say? And I'm sure you're familiar with some of them, but I'll just highlight what they are. So first, move more, and by default, then reduce your sedentary time. We're beginning to realize the impact that sleep has on overall health. And you've probably heard that we need to accumulate 150 minutes per week of what we call moderate to vigorous physical activity. That speaks to the aerobic side and then muscle strengthening activities of major muscle groups, at least twice a week, and obviously, physical activities that challenge balance, and we'll talk a little bit about that.

So what can we expect if we follow these guidelines? And I think you've probably heard me talk about this before, but most people are familiar with the 150 minutes per week of aerobic activity. And I've shown this figure before, but just to reiterate again is that we have lots more information about being aerobically fit, so being heart and lung fit, if you like, than we do about strength guidelines. But we're beginning to get a relationship for strength as well, and it looks exactly the same as this. So what the figure shows here is a hazard ratio for mortality, and it shows a declining hazard ratio. So in other words, your risk of mortality going down with an accumulation of leisure time physical activity. So this is not exercise, but we could translate it into exercise using this conversion factor here. And then what the authors have done is plotted the inverse of this, which is essentially the years of life gained with increasing amounts of leisure time physical activity. And the physical activity guidelines fall right in this about here.
So don't worry too much about the units, but if you completed 150 minutes a week, this is the type of benefit that you would get. It's about a 30% reduction in mortality risk. It's a gain of about three years of extra life. Now, everybody can see that the curve continues to go up, but the

steep part of the curve is really, in fact, the steepest part of the curve is when you take someone who does nothing to doing something. I can't emphasize this enough, you get a 20% reduction in risk by completing just 60 minutes of leisure time moderate to vigorous physical activity in a week. So that's a far cry from 150 minutes, which everybody says they don't have time for. But 60 minutes, if you look at it, six days a week, that's 10 minutes a day. So I think you really have to begin to think about just how little, if that's the way you want to think about it, you have to do to see significant benefit. That's about a 20 % reduction in risk or almost two extra years of life. To put it in perspective, I say to somebody, if the headline in the paper was new miracle drug, when you take it, it gives you an average of three extra years of life, we'd all be rushing out to find it. And so it's not that if you do more, you don't get a little bit more, but the curves definitely flattened off. And this represents 150 minutes. Doubling it out to 300 minutes gets you maybe an extra year thereabout. So it's a diminishing return. But without showing you the data, you'll have to take my word for it.

We have evidence-based recommendations to support aerobic or physical activity or higher moderate to vigorous physical activity for lowering the risk or an improving prognosis of heart disease, that probably doesn't surprise anybody, 13 of the 26 most common cancers, type 2 diabetes, Alzheimer's disease, other dementias, and the list could go on, but these are the big five for which we've got very good evidence.

So the question is then, what about strengthening activity? Phillips is saying this is important. What can we expect here? So what can we expect if we do the two days a week of muscle strengthening activities? And I wish I could show you the same type of graph for strength activities, but I can't. I don't have the data enough. But I'll show you a figure that we re-graphed from the data that was available to show you what happens if people follow both the moderate and vigorous prescription as well as the strength activity for all cause mortality and various chronic diseases, and strength alone. So this is moderate strength physical activity, a moderate to vigorous physical activity, and then this is the combination of the two. This is the hazard ratio for all-cause mortality for strength alone. You can see it's already down. It's almost 15%. It's lower if you do aerobic, but it's even lower if you do both. So we've got about a 40% reduction when you combine the two. You get a greater benefit in terms of cardiovascular disease mortality. Cancer, really, the two combined is much more robust than either individually. Type 2 diabetes, it's a substantial reduction, almost 60%. And oddly for some of the metabolic syndrome-related diseases, including obesity, metabolic syndrome, and hypercholesterolemia, you get actually a small nudge in terms of benefit for doing the strength work. But it's always when you combine the two, you get a little bit more than doing either one alone.

So the suggestion is this is not necessarily just a phenomenon of more work. It is a phenomenon where what we're beginning to realize is that there are unique health benefits associated with strength work that are dissimilar from aerobic work, but that they overlap a lot more than they are different. In other words, it's not enough to just do the aerobic. You have to do the strength, and yet it's better, obviously, to do both.

The question at this point, that most people, because everybody can go out for a walk, everybody understands that, or go for a run if you choose and improve your heart and your lung capacity, but how do we lift weights? There would be a myriad of variables that I would have to talk about to try and give you a generic prescription. Do we use machine weights? Do we use free weights? Do we use body weight? Do we use elastic bands? I'm just going to show you some research that two really bright PhD students of mine did as part of their thesis, but to show you that resistance training variables become largely redundant. This is John McLeod and Brad Currier. Both have since graduated and gone on to bigger and better things, but they essentially conducted what we call a network meta-analysis. I'll show you what it looks like in pictures, and I know a lot of people say, 'Wow, it looks like some macrame figure or one of those, put the twine around the pins', and really what it was, was 13 different conditions or 12 different conditions that we could identify with respect to how much you lift it, when you lift it, whether it was heavy or whether it was light compared to a control. And then when we analyzed all of these conditions, what it came down to was that actually there was no significant difference between any of them, but all of them were favorable in terms of improving both strength and muscle growth. As a corollary, when we looked at some of these effects and related them to health outcomes, they were also associated with beneficial health. So literally every form of resistance training worked. And this ruffled a few feathers because I think a lot of people expected for heavier weights to do one thing, lighter weights to not be that effective. But there, in our hands, at least, was no statistically significant difference between conditions.

So I don't want to walk away and just tell you any weight will do and don't worry about it. But I think one of the messages is that the how-to part of resistance training can be lots of different things dependent on your ability, your resources, and what your goals are. But just remember the message I gave you before. When you take somebody who is doing nothing in terms of resistance training to doing something, that's when we see the big benefits. It could be body weight-related work. It could be with a personal trainer, as shown here, or it could be body weight-related work that you're doing on your own that involves something as simple as a chair. Rising from a chair is probably the most functional lift that all of us need to do. It could be that you use weights. It could be that you use resistance bands. And resistance bands have changed a lot. If you haven't seen what they look like recently. They're not all therabands anymore. We have resistance bands that have handles on them. And you can see that some of them are a little bit thicker, indicated by different colors. Some of them are for people who don't have as much strength. But as we get stronger, one of the key and fundamental principles of making yourself stronger and providing more of a stimulus is to apply a greater load. If you're doing it with resistance bands, which are remarkably effective, you can do it with simply a thicker band.

Now, a lot of people have asked, Well, I don't have access to a gym. I don't have the resources for a personal trainer. I don't really like going to gyms. I'm going to share a resource from a good friend and colleague of mine named Ashley Gluchowski, who's a Canadian, but she's over in the UK at the University of Manchester, or excuse me, Salford University in Manchester. She's developed a program called Stronger at Home. All the videos are free. The QR code, if you scan it here, will take you to her website. But there are lots of other videos on YouTube that essentially recapitulate this. But the program here actually teaches you how to lift

weights in a very easy to understand manner. I think it's one of the best ones out there and a tremendous evidence base behind it as well.

So not to be outdone by the aerobic side of the guidelines, we have evidence-based support for strengthening in the lowering and risk of mortality and improving prognosis for cardiovascular disease, for type 2 diabetes, for cancer, for osteoporosis, which is something unique to resistance exercise or strengthening exercise, for osteoarthritis, which is probably contrary to what a lot of people believe is that they will aggravate their osteoarthritis by lifting weights, it's actually the opposite, and for fall risk. I put falls up there because that's a watershed moment for older people. Now, you need to add balance training to this to make the fall risk reduction effective.

[00:37:47 Myths and facts about protein]

Dr. Stuart Phillips: I'm going to finish up with a little bit of protein, the good, protein, the bad, and then the ugly side together before we put it all together. What can protein do? You've already seen the Nurse's Health Study data, but we have data that shows that higher protein consumption is associated with greater lean mass, some of which is muscle, with greater hand grip strength. We have data to show that people who consume protein in a more evenly distributed fashion as opposed to that small amount, moderate amount, and then a large amount at dinner with greater knee extensor strength. Those are the muscles that allow you to kick out. And obviously, those are the muscles that allow you to kick out. Obviously, those are the quadraceps muscles that support you when you're walking around. It's also associated with higher gait speed. In other words, the ability to move around. Gait speed is a ridiculously good predictor of morbidity and mortality. And there's a particular amino acid, and I won't belabour it too much, but associated with lean mass retention.

The last part then is to give you a public service announcement to tell you to tune out from myths where people will claim that higher protein causes kidney problems, and sometimes people throw the liver in there, and I can't really ever figure out why, but it's really a kidney issue. I'll say this quite simply, there are no data that link higher proteins to the development of renal disease. In fact, there are no even interventional data that show this. This is a 60-year-old hypothesis put out by a scientist named Barry Brenner. Most of the data came from animals, but don't just accept my word. Look at the World Health Organization and what the current Institute of Medicine has to say. So that this is the IOM, protein content of the diet is not related to progressive decline in kidney function. And the WHO, the decline in glomerular filtration rate or kidney function within advancing age can be attenuated by reducing protein in the diet has no foundation. So it's not just Phillips coming out there and saying that. But these are two very well done meta-analysis. One comes from our group, one from a group in the United States. And the conclusion was, is that the change in glomerular filtration rate, which is really kidney function with dietary protein, had no effect. So these are intervention trials. So I think we can dismiss that. It's been 60 years that Brenner's hypothesis has been around, and I'm still waiting for data to prove that it's actually the case, but it persists.

The other is the protein causes your bones to become weak, and the actual truth is that the opposite is true. As long as you get sufficient calcium and sufficient vitamin D, then protein is actually a bone-supportive nutrient because 40% of your bone mass is actually protein. Your bones are not just a stick of chalk. So I think it's important to emphasize that the current evidence shows no adverse effect, although there are some positive trends at bone mineral density at some or most bone sites.

The last and the new kid on the block is that protein is somehow shortening your life through mechanisms that really are unclear at this point but seem to work in fruit flies and short-lived mammals like mice. When you compile the data in humans, these are five very well done meta-analyses and experimental trials. And you can see one is positive, and I show you the Nurse's Health trial, and the other are effectively neutral. There's nothing here that is negatively or it gets the red light for protein and longevity or shortening your life.

[00:41:45 Putting it all together]

Dr. Stuart Phillips: So what about putting it all together? Well, it would be a little bit odd for me to come here and tell you that the key to longevity and the key to aging well and improving health span was simply about exercise and diet, but it's not. This is a graphic and a message that I've been trying to impress upon people, that it's about moving every day through exercise and physical activity. It's about eating to support, at least in my mind, muscle and metabolic health, and that goes along with a lot of other good health. But it's also about prioritizing sleep, and it's about maintaining social connection and mental engagement. If the pandemic did anything, it shone a big light on this, particularly for older people, and about living your life with good connections with relationship and purpose. I think if you put a lot of these things together, or at least three out of the four of these things, then you're going to have a great life. You're going to live a long life, and hopefully with good health span.

I'd like to say thank you very much, even for not sharing my slides for the first five or seven minutes. And hopefully we can answer a few questions. Thank you.

Dr. Anthony Levinson: Thank you so much, Stu. That was excellent. And we've got some time to go through. There's a lot of questions. There was also an issue, I think, with one of the technical issue with getting some of the other questions. So there's more coming in. But let me go through this.

[00:43:18 Plant versus animal-based protein]

Dr. Anthony Levinson: You talked a bit about the plant-based protein versus animal protein. Can you say a little bit more about plant versus animal? And some of the questions that came in were also about what are some of the best examples of plant protein? Are there some sources better than others?

Dr. Stuart Phillips: Yeah, it's a great question. Actually, it's something I've changed my mind on. I mean, science is a process and not an absolute. So 20 years ago, I'd have been like, “Oh, no, animal protein is superior for muscle. There's no question.” And then the work that we've done recently indicates that the plant protein now is much closer, I think, in terms of the benefits. It's probably also associated with a greater dietary fiber intake, which is another health-promoting nutrient, obviously. But it could be something to do with the ratio of amino acids that are in plant-source proteins. So I think most people are sort of anything that's not animal, even bread, contains a little bit of protein. So there's protein dotted in just about everything. But when we talk about plant protein sources, it's people probably know about soy and tofu, but we've got sources of plant protein now, like quinoa, like grains that you can soak. There's lots of different sources that actually the quality scores are remarkably good. And now we're beginning to see products where they're made not with animal protein, but they're plant protein substitutes. Now people will say they're processed foods, and I agree, but I think in the end, there are processed foods that probably aren't that's not great for you, but the plant-based ones are probably pretty good for you as well. So I think there's a story to be told there that's beginning to emerge.

[00:45:11 Protein supplements]

Dr. Anthony Levinson: That's great. A couple of related items related to protein requirements and timing. If you don't get enough protein from your food, is it okay to take protein as a supplement?

Dr. Stuart Phillips: Yeah. Well, we do a lot of work work in supplements, mostly in younger people, more than in older people, but we've done some work in older people, too. I don't have an issue with supplements. I mean, the standard line is you know food first, if you can do it that way. Supplements are convenient, and they can be useful and helpful in certain cases, particularly if people have issues preparing meals or they're pushed for time. Certainly in athletes, we find that it's just a big time saver. So long as they don't replace too much out of your diet and you're losing other nutrients, then I have no issue with supplements. The only thing is they're not cheap. So just bear that in mind.

[00:46:12 Timing of your highest protein meal]

Dr. Anthony Levinson: The data that you presented around time of day and the graphs around that, there was a question, if you had to eat one big meal, which I think you might discourage, but if you had to eat one that had a large amount of protein, is there an optimal time? Would it be morning, noon, or evening?

Dr. Stuart Phillips: Yeah. So there are a group of people, they call themselves, they practice OMAD, One Meal A Day, and that's what they do. I couldn't do that myself personally. But I think if you only eat one meal a day, then that meal is always breakfast. That's when you always break your fast, right? So I don't know how long I could go before... Noon would be about my hard deck, but I think the earlier in the day, the better. And people who practice what

they call time-restricted eating, compressing the amount of time that they consume or they intermittently fast, then they'll probably tell you that sometimes it's better later in the day because they feel better before they go to bed. I think it's very individual. I don't think there's one great time, but I'd always say in the morning if I had one to push.

Dr. Anthony Levinson: I think to your point about most people, especially older adults, getting not enough protein that probably most people will need to space it out over a number of meals.

Dr. Stuart Phillips: That's the way it works. Yeah. And I mean, I think the system is that sinusoidal type pattern. That's actually how it works. So if you do one big meal, it can last longer, but you lose it for them the rest of the day. So the system works better to be pulsed with about three meals per day, actually.

[00:48:02 How can a sedentary person get started with strength training?]

Dr. Anthony Levinson: Let's shift a little bit to some of the strength training and exercise. And I did want... there were some people who missed the resource that you mentioned, Ashley's University.

Dr. Stuart Phillips: Sure. Yeah. So Ashley Gluchowski, she's, I think, a senior lecturer at Salford University in Manchester.

Dr. Anthony Levinson: And the name of the resource was, was it Stronger at Home?

Dr. Stuart Phillips: Yes, Stronger at Home (strongerahome.com). Yeah. Okay. Yeah, I can put it back up if you like. But I think, I mean, there are lots of programs on YouTube, and you can go in. And if you've never done it, you're like, there is a bit of coordination. It's like, how do I do this or whatever. What Ashley's done is literally taken people from step one and said, 'You've never lifted a weight. You've never done any strength work. This is how you do it. This is why we do it this way. This is how to do it safely.' She really steps people through. That's the reason I can see Christine saying she can include it in the follow-up.

That's great because that was actually one of the questions that came in is, how can someone who's always been sedentary start strength training? It sounds like there are resources to help with that.

It is. It's always been a question. In the past, I'd be like, Oh, I don't know. There's some stuff on YouTube. Then Ashley's created this resource, and it's amazing. She gave me in her permission to share it, and I said, Yeah, there it is on the YouTube link. Thank you, Jessica. Yeah, it's really, really good. If you've never done it, she steps you through things and does it in a very safe and very systematic manner for sure.

[00:49:51 How do the different types of resistance training compare?]

Dr. Anthony Levinson: So you did talk a little bit about some of the work you've done with respect to different types of strength training and resistance. And one of the questions that had come in earlier was, do resistance bands work as well as free weights? And I think you answered that. But is there, a couple of other questions? Can body weight exercises be enough? And these other ways of loading your muscle, there are some people who clearly hate deadlifts, but I guess it was like, can body weight be enough? And is there some minimum effective dose for strength training?

Dr. Stuart Phillips: Yeah. So it seems like the two days a week is actually that's doing a good job. I mean, One always better than zero, two better than one, three, and it's sort of that large part of the curve where you're beginning to flatten off. Three, maybe a little bit better than two. So I'm going to say two stick with that. It all depends. And I point out to people who walk, I said, you're doing so much good for your health. There's no question about that. And then other people say, oh, I jog. And I'm like, so much good for your... And then other people run. I'm like, so much while other people bike and everything else like that. So to me, resistance training is a continuum and a suite of things that you can pick from. And some people like to lift heavy weights. The mistake that's made is people say you need to lift heavy weights, and that's not true. They're sufficient, but you don't need to lift them. Then we go, well, what is enough? Body weight work, people tell me about their yoga and their pilates and everything, and there's a lot of body weight maneuvers in those two types of activities. I'm like, ridiculously good exercise, so good for you. But just realize that at a certain point, your strength is going to be held up by your body weight, and you're never going to get much stronger than that. That may be enough for some people. That may be all they're interested, and the strongest they want to be is to support their own body weight.

To do more, you have to use another stimulus. That's a weight. It could be a resistance band. And resistance bands, we just finished a big study, it's about to be written up using them. More effective than I actually thought they were going to be, for sure. So, very useful.

[00:52:21 High-Intensity Interval Training (HIIT) and heart rate zones]

Dr. Anthony Levinson: A couple of questions around endurance and the other side of exercise and training. One was is talking about the question around High-Intensity Interval Training and its effectiveness. The other one is sort of related, talking about this idea of heart rate zones. Can you comment on whether zone 2 training and whether there's newer data talking about it to be more beneficial than zone 3 or 4? You might need to explain some of that, too.

Dr. Stuart Phillips: Yeah. So High-Intensity Interval Training, you've got the wrong guy here. You need my colleague, Marty Gibala, for that one. So what Marty would say is that high intensity is something that you can do for a very short period of time, maybe a minute at most before you have to back off. And even during the minute you're getting fatigued, and then you take some time off and then you push yourself up. These efforts can be maximal. They can

be something that takes you to an eight out of 10, maybe a nine out of 10 in terms of your perceived effort. Zone 2 is something that you could do ostensibly for hours. It's above rest and it's above walking and it's this low zone, but you could do it for a long period of time. There's a time and a place for both of those. I like to say that if you don't use the top gear every now and again, that high intensity, then you lose the top gear. I think that that's true. So nothing against doing zone 2 training and holding your heart rate at a fairly low level for a longer period of time. Just realize that to maybe get the fuller benefits, there's times where you need to push that. You want a great place in Hamilton to do it? Try the stairs. Going up those stairs, it's a natural resource of, it's this huge challenge to cardiovascular fitness. Coming down the stairs is actually a pretty good leg workout, too.

Dr. Anthony Levinson: Are you okay to hang out and answer questions for about 10 more minutes? We have quite a few more questions.

Dr. Stuart Phillips: Yeah, go for it. Okay. Go for it.

[00:54:42 Collagen for muscle and joint health?]

Dr. Anthony Levinson: We had a few other questions related to mobility and exercise and muscle and joint health. So what is your opinion about collagen for muscle and joint health?

Dr. Stuart Phillips: Earlier today, I was sitting in a webinar with probably the leading guy, a good friend of mine named Keith Baar, in the world on protein supplementation. He uses collagen supplementation in some pretty high-end athletes. He works with some very, very good athletes. His analogy is similar to mine, and I'll say it plain and simple, is that, the lifting of weights and the exercise, that's baking the cake. All of the nutrition stuff and even the protein is a thin layer of icing on top. He would say that that's what the collagen does for connective tissue and bone. Is that the movement and the loading and everything else like that is what really helps bone health. Then the collagen adds this thin glaze on top. There's nothing convincing. It makes me sad because as somebody who's probably looking at two new knees in his future because of his misspent youth in sports, I would love for collagen to be more effective than it is. There are some people who tell me it's really rescued them and everything, and I'm super happy for those people. I'm always a little skeptical when there's a lot of noise, and I'll say social media noise, and in the spirit, the McMaster spirit, there's not a lot of evidence. In other words, when we conduct evidence-based reviews, we're in the low to very low quality of evidence and effects that are statistically significant, but they're marginal in terms of where they sit from a beneficial standpoint. I'm still a little skeptical about collagen, to be honest with you.
Related to that, I guess, question came in about, how can I strengthen muscles without worsening my arthritis? And similarly, what options are there for someone with joint pain or poor balance? Yeah, It's interesting, actually. And I understand this. The message around osteoarthritic pain, whether it's knee or hip or whatever it is, is actually if you can take the body weight out of it, so in other words, if you do something like a leg press where instead of you're standing up and you're supporting the body weight and going up and down, but you put it horizontal and you begin to push against the plate like that, is that that type of work actually reduces osteoarthritic

pain. It doesn't increase it. And in fact, it's on par with the pain reduction that you get with analgesic drugs. I'm talking about over the counter analgesic. So not drugs that are maybe prescribed. Which is the opposite of what a lot of people who have severe OA will say, 'You know what? I don't want to exercise because it does this.' And usually what they mean is 'When I do a lot of walking, my knees flare up.' And that's true, but that's body weight support and repetitive low-intensity work. I'm like, 'Well, I'm going to take you and make you horizontal, and I'm going to get you to do some strength work.' And when you do that, the muscle and everything else around the knee and even the joint, actually, it gets better and your pain goes down.

So there are OA programs that are out there that are focused on making you stronger, improving your mobility that actually reduce knee or hip or shoulder or hand OA. Look those up. One big one is called GLAD, G-L-A-D.

Dr. Anthony Levinson: Actually, our rheumatologist colleagues are often saying, 'Motion is lotion'.

Dr. Stuart Phillips: 'Motion is lotion'. 'Rest is rust'. They are big on it.

Dr. Anthony Levinson: And actually on the Portal, we do have a e-learning lesson talking about physical activity and exercise for OA of the knee and hip.

[00:59:22 Protein and strength training for bone health]

Dr. Anthony Levinson: Question about gender differences in bone health. Do women need a different protein strategy?

Dr. Stuart Phillips: Yeah. No. I mean, hand on heart, I can say this is that we're as guilty as a lot of other people in focusing almost exclusively on men for lots and lots of years. We're doing a lot of work recently to redress the balance of that. We've got four big cohort studies going in women right now. We've got another one planned in perimenopausal women. Everything that we've seen to date shows that if there are differences, they're relatively small. I point out to people is that humans as a species are much more similar than they are different. There are important pathological pathway differences, I'd admit that. But from everything I've shown you, the way you lift or the way you consume protein or the source of the protein or anything else like that, there's nothing that indicates, at least in our hands, that women are any different than men.

Dr. Anthony Levinson: You mentioned that the protein, there was a myth about protein being somehow bad for bone health. How does strength training help bones and not just muscles?

Dr. Stuart Phillips: Yeah, that's a great question. I'm not a bone expert, but essentially, bone has, bones not like muscle, but it does remodel the protein. But inside the mineral, there's a system of cells which are responsible for making bone. And there's another system of cells that are

responsible for breaking it down. And when you load bone, bone is mechanically sensitive, like muscle. When you load it, what you do is you shift the balance towards the making side as opposed to the breaking side. Then what that does is it just enriches what they call the micro-architecture of the bone.

As a treatment and preventive strategy for osteoporosis, resistance exercise is pretty good. I mean, there are medications which are a little bit more effective, I'll admit that. But if you get the resistance exercise right and you're consistent, like a lot of other things with physical activity, it's pretty good.

[01:01:54 The role for creatine in muscle and brain health]

Dr. Anthony Levinson: Why don't we have one final question, and then I have a couple of other resources to share with people. But there was a few questions that came in in relation to creatine as a supplement. I'm wondering if you can talk a little bit about the evidence behind creatine, creatine plus or minus strength training.

Dr. Stuart Phillips: Creatine has been around for about 40 years now. Two people, Roger Harris and Eric Hultman, basically did the original studies. I don't want to say anything, but I was there at one of their first seminars listening to them. The original studies were done on muscle because of the storage of creatinine in a form called phosphor creatinine muscle and showing that it improves sprint capacity. Then people have shown that it improves your ability to gain muscle. It makes you a bit stronger. Again, it's a small nudge in all of these categories.

The excitement around creatinine recently has been with the recognition that creatine is stored in your brain. There, it's stored as phosphor creatine as well. It's actually a buffer against changes in energy status in your brain. The thought is that it might be able to offer some relief and mitigation of symptoms of neurological dysfunction, maybe even dementia, and Alzheimer's dementia.

People today... I have a short supplement shelf. I don't take many supplements. I do have protein powder on it. There's vitamin D, particularly in the winter. There's some omega-3, but I take creatine, but I don't take it for muscle anymore. I take it with the hope, I'll admit, that maybe it could help brain function. But strong safety record, relatively low cost. The stuff you buy at Costco is just as good as the stuff you buy anywhere else. So don't feel the need to buy the most expensive stuff. But look for some more science coming on the on the brain side of things for sure.

Dr. Anthony Levinson: Interesting. Well, I want to thank you very much. I want to finish off by sharing one of the courses that you and you mentioned Martin had produced. So this is a free course available through Coursera that Dr. Phillips and his colleague put together. And you can learn how to get fit.

For those of you who are not familiar with the McMaster Optimal Aging Portal, I'll just give you a quick tour of what's available there. I know Jessica put the resource related to our e-learning, but we have all evidence-based content on a wide variety of topics for health and social aspects of aging. You can sign up for our free weekly email alerts that tell you about new content that is added to the portal, including e-learning content, videos, blog posts, and evidence summaries. We have a wide range of enhanced multimedia content or videos that are available on the Portal, e-learning lessons, for example, on topics such as cognitive health, brain health, and osteoarthritis. The exercise in osteoarthritis link is there. We also have shorter little nuggets of wisdom, like weekly email-based micro- learning that you can sign up for.