

Lawrence Neal: James, welcome back to the membership.

James Fisher: Lawrence, thank you very much for having me back.

Lawrence Neal: You're most welcome. It's a pleasure to be talking again. So, we're going to be going through a couple of studies. The members will be able to all know the topic of this conversation from the heading in the membership. Before I actually ask you about the two studies we're gonna talk about, I wanted to actually ask you a question which is something I just don't know the answer to, and you'll probably be able to enlighten me. I'm a little bit embarrassed to ask, but when you look at a study on [PubMed](#) or anywhere, actually, when you look at a paper and you see all the names of all the people that were involved, who is the lead author? And how do you know, so how do you know the person's, the individual's, input they've had in the study? How does that work, generally?

James Fisher: Yeah, so that's a really good question, and the first thing I'd say is you should go to the first name on the paper and the last name on the paper, and then you should probably look somewhere on there for corresponding author. Now the corresponding author is probably the principal investigator, with some reason. Because they're the corresponding author, they're the person that, if anybody has any questions they would relate back to. That's normally the first author or the last author.

So, for example, if we took, say, Rob Morton over at McMaster University, he's almost certainly the lead author on his research because he's a PhD student, he's doing the research. He is supervised by Stu Phillips and Stu Phillips would be the last author. Now, depending on who had done the lead in that research would depend on who the corresponding author was. So, if it was an empirical study by Rob Morton, I can imagine that he would be the corresponding author, he would be the lead author, and he would be what we would call the PI, the principal investigator. And if there was, say, a review article, then it might be that Stu has come up with the idea of this review article with a number of the people, maybe referred it back to Rob and said, "Rob, you take the lead on this." Rob may have then taken lead authorship because he did the bulk of the work on the process, but actually come submission and come final draft, Stu is the corresponding author.

With a lot of papers like this, so the two that we've got in example, these were Paulo Gentil's PhD or Masters students, in fact, actually, so [Matheas Barballo 00:02:36] was the lead author on the Addition of Single-Joint Exercise paper in European Journal of Translational Myology. And Paulo is the final author so, if we look at that corresponding author ... I would need to double-check this, and I'm just gonna have a quick look if I can see it, but I can't seem to see it there ... It's got all the author details, but it would normally have on there somewhere who the corresponding author is. I've only got the drafts up in front of me right now. But you see my

name falls somewhere in the middle there. Really what that means is I had some input in maybe the study design and/or data collection and/or writeup and/or statistical analyses.

In this case, I think there were some discussions around study design. I didn't do any of the analysis, I didn't do any data collection. I was involved in the writeup and the proof of the final draft.

In the other paper, the lead author was ... let's see if we can find it ... it was again [Matheas Barbalo 00:03:39], and Paulo Gentil was the last author. So what that represents is, [Matheas 00:03:55] was the principal investigator in doing the research, Paulo was the supervisor of that research in this case, and that's quite typical.

The only other variances around that ... so, for example, where my students ... There was a paper I published earlier this year where Charlotte [Stuart 00:04:14] was the lead author, and she was the main researcher, data collection, did most of the writeup and so forth, but I'm the named author at the end of the paper, and I'm the last author, and I'm the corresponding author because I did the submission and so on and so forth.

We've done some work with [Jurgen Giesen 00:04:41], who you know, and in some cases he's done the entire study already, collected all the data, and just now had time to write it up and shipped over to us, and we've done the writeup from introduction to discussion, and then in that

case maybe James has taken lead authorship or maybe [Jurgen 00:03:54] has taken lead authorship, or it might be that James took first author but [Jurgen 00:03:59] took last author, or vice versa.

Those are the two names that you should look out for in a paper. Any other names probably played a key role, otherwise they wouldn't be an author, but they certainly weren't the principal investigator or the lead researcher. So yeah, that's a great question.

Lawrence Neal: That's really useful to know, because I just think a lot of people ... I would say even a lot of the people in high-intensity training, a lot of members, might not know that. And, you know, it's funny to me because a lot of the people listening probably have my podcast with Simon Milov, who was one of the people involved in the study that looked at the reversal of gene expression from resistance training. He was not the lead author. He was not the principal investigator. That was another chap whose name I'm forgetting. I want to say Tom or Dave ... can't remember his name now.

But, you know, in retrospect, if I wanted to talk about that paper in more detail, in terms of the design, the training, all of that, and ... you pulling it up now?

James Fisher: No, I'm gonna have a quick look because in my head is Mark Tarnopolsky.

Lawrence Neal: That's it. Mark Tarnopolsky. Yeah, that's it, that's it.

James Fisher: I know that Simon did lead author a couple of key papers, and there's a key one from 2007. In fact, Simon Milov was the lead author one of them from 2007, which is a paper I've cited a lot of times, and in this case ... I don't know why my computer's taking so long to bring this up now. But yeah, in that case you would probably ... I mean, I would probably go to the lead author, but somewhere on the publication itself, it will say who the corresponding author is, and in that case it's worth just going to the corresponding author.

Lawrence Neal: Yeah, I think this is obviously important for those listening who, if they want to connect to the people involved in research after the fact, then that's important to know. And it's not as though you're not saying that was a waste of time with Simon. Like Simon's a brilliant guy and-

James Fisher: Yeah, absolutely.

Lawrence Neal: ... and the conversation was great, but it's just useful to know the roles that the individuals play in the creation of these studies.

James Fisher: Yeah, sorry to labor the point a bit, a good way to think about this is Jeremy [Lowenecki 00:07:12], who you've spoken to ... So his PhD students over the years ... he's got [inaudible 00:07:15] called, I think it's Brittany Counts or Courts, I can't remember. [Mouser 00:07:28] I think was another one. I'm trying to remember some of the names that I've seen. Samuel Buckner. If you look, Jeremy's name is almost always last, but a lot of them are also listed

throughout, so what you tend to see is the person that was probably the principal investigator in the study as the lead author, but because they're all part of a larger ... what we call a larger project, of maybe muscle growth, resistance training and muscle growth, and that was supervised by Jeremy, he's always gonna be the last author because he's always kind of the supervising author. He's the patriarch of the group in this case.

Yeah, but it's interesting to look at it from a research perspective, because I know that a lot of people talk about research, especially in the HIC community, and actually, you know, when we talk about ... you know, this is not to detract from these people, but Ellington Darden, and research Ellington Darden did, Ellington Darden never did research. He's the observationist. Research is, by my interpretation, peer-reviewed, published research, you know, and we sometimes credit some of these people within the HIC community with something that they haven't really done.

I know Doug McGuff talked about the limitations of scientific research. Doug is an M.D., not a Ph.D. He's a medical doctor, not a doctor of philosophy, not a researcher, and he's got a critical mind over all of this, but he hasn't published peer-reviewed journal articles that I know of. Actually I tell a lie. He's published one with us, years back.

Lawrence Neal: Yeah, I remember.

James Fisher: But you know, so it's interesting that practitioners in the industry can dissociate between, because sometimes we put these people on a pedestal, you know. Maybe Ben [inaudible 00:09:08], Ellington Darden, Doug McGuff. And rightfully so, because they're great minds in the community, but actually we should almost dissociate them from, or differentiate what they do from Ph.D. researchers like Simon Milov, like James Steele, like Jeremy [Lowenecki 00:09:24], [inaudible 00:09:26], so on and so forth.

Lawrence Neal: Like yourself.

James Fisher: Myself as well, yeah, yeah. Yep.

Lawrence Neal: Perfectly put. I completely agree with that statement.

Conscious of time, so let's dig in [crosstalk 00:09:36] to some of these ... That's all right, man. Let's dig into some of this research. So, the first one, just to give a little bit of a commentary quickly, is called [Evidence for an Upper Threshold for Resistance Training Volume in Trained Women](#). The introduction, "The purpose of the present study was to compare the effects of different volumes of resistance training on muscle performance and hypertrophy in trained women." Really interesting study. Do you want to just give a quick overview before we dig into some questions?

James Fisher: Yeah, so this study was in press, or submitted around the time that Brad Schoenfeld recently published his paper showing greater volume for muscle growth, a high number of

sets favorable for muscle growth, but one set as efficacious for strength gains. And it was really interesting to see that paper get published, knowing that we had this paper kind of just about ready to go. And really what we're saying is that there are so many studies that have looked at one, three, five sets, whatever it might be, but that kind of leads you down this argument of saying, "Well is more better?" People say, "More is better, more is better, more is better."

And we obviously argued against that for a while, both from a logical point of view as well as a practical point of view, but there just hasn't been the research to say where is this threshold. So this was a really nice study by Paulo's group of researchers, 40 trained females, trained for a long intervention, 24 weeks.

Lawrence Neal: Yeah, six months almost.

James Fisher: Yeah, absolutely, and that's really good that you can recruit and retain people through a study like that. And they did either five sets, 10 sets, 15 sets or 20 sets of exercise per muscle group, so not per exercise, per muscle group. And it was nicely designed. The way that kind of fell was they trained three times per week with a split routine, and they did between one and seven sets per exercise, which then worked out between five and 20 sets per muscle group through the week. Yeah, so it was nice, and they were tested for bench press, leg press, pull-down, deadlift.



Lawrence Neal: So, just before you elaborate, this is one of the questions I had, is on the study design. So, I don't quite understand that. So if you look at, say for instance, the group that did five sets per muscle group per session. What does a session look like? I mean, in a bit more detail, like just a typical session?

James Fisher: Yeah, absolutely. So, for example, one of the measures was the ultrasound measure of the pec major. So the Monday workout for this protocol was two sets of bench press, two sets of inclined bench press and one set of military press. And arguably, we could debate whether those three exercises are appropriate for the chest, but they essentially are appropriate for the chest and the triceps, so that's your five sets for pecs, triceps, deltoids, so on and so forth. The Thursday work out with the lat pulldown, a cable row and an upright barbell row, which would be your five sets. Two sets of lat pulldown, two sets of cable row, one set of barbell row. That would be your five sets for the biceps, for the lats, so on and so forth.

For the higher group set, of the higher set groups I should say, they did, for example, four sets of lat pulldown, four sets of cable row, two sets of barbell row, or going right up to seven sets of pulldown, seven sets of cable row and six sets of upright barbell row. So this is where that kind of volume changes are not quite ... There's a really nice table in there, Table One in the study, shows how the number of sets were performed for each exercise on the different training days.

Lawrence Neal: And it's 10 repetition max. So does that mean that ... was that a self-selected number of repetitions, like they predicted? Or was that ... how did they figure that?

James Fisher: Yeah, so 10-rep max has become ... I mean, I'm quite a big fan of this. A lot of people will use one-rep max testing and that's fine. You come in the lab today and we do one-rep max test. That's a measure. That's a snapshot in time of your one-rep max. Tomorrow it might be slightly more or slightly less, or the day after, slightly more or slightly less, but there's generally pretty good reliability. We've tended to lean more towards 10-rep max because one, you can still calculate an estimated one-rep max from it. But we also find the 10-rep max doesn't tend to have the same variation, or doesn't tend to, you know, sort of guess nine reps or 11 reps. That doesn't provide the same variation as if they get five kilos more or five kilos less for the one RM.

We would also, or I would also argue that people never do maximal exercise, or maximal intensity, or maximal load ... sorry, I should say ... exercise in the real world. They might do maximal effort, but that generally would consist of performing repetitions of something. So I tend to think that if you use a one-rep max test, then anybody training with a heavier load is gonna be more favorably skilled at that test, or anybody practicing at that rep range and so forth.

So, it's just a variation on it. I think that there are pros and cons to both. I quite like the 10 RM, as did Paulo's group in this study, so ...

Lawrence Neal: And when they were doing the protocol you described just now, in terms of the two sets ... So, for instance the five-set group or the 10-set group. You know, they were doing a couple sets per exercise. How did they determine the number of repetitions? Or were they training to failure? Like that kind of thing.

James Fisher: Yeah, so they followed ... they trained to failure in, I think it was in an eight to 12 rep range. I'd need to double-check that from the study, which I've got here. But yeah, we generally work with an eight to 12 rep range, or use what's called kind of a linear periodization, where basically you start with a lighter load and a higher number of reps and progressively work to a higher load and a lower number of reps.

Lawrence Neal: Bless you.

James Fisher: Excuse me, Lawrence. It's really difficult with this kind of study, because again we also said, and we were quite clear, we wanted them to train to failure, because that's something that we believe is important to create parity between the groups. But in the real world, you know, when you've got a group doing 20 sets of exercise ... I mean, can you imagine doing 20-

Lawrence Neal: No.

James Fisher: ... the 20th set? Exactly, exactly. So, you know, I think you have to take this ... They were supervised sessions. It was in supervision of at least one to five, if not one to fewer than

five, and I think the ... Here we go. We used a non-linear ... I say they used a non-linear periodization model, so that was in various weeks they used, yeah, a lighter load, a higher number of reps and a shorter rest interval, progressing to or varying to a higher load, a lower number of reps and a longer rest interval between sets.

Lawrence Neal: Right, okay.

James Fisher: And that's quite ... So, for example, in Table Two it shows Week one, five, nine, 13, 17 and 21, they did a rep range of 12 to 15 rep max, with a 30 to 60 second rest interval between sets. Weeks two, six, 10, 14, 18 and 22, they did four to six rep max with a lot heavier load, but they had three to four minutes rest between sets. And, you know, like I said, it's difficult when you say about training to failure.

I think that we've kind of ... myself and James Steele have talked about this a lot, and obviously we advocate this within both the research and the practical training environment. In reality people are going to do multiple sets, then the need to train to failure might diminish a little and the practicality of training to failure, it probably becomes more real-world setting. You know, I wouldn't bet my mortgage on the 20th set for somebody in a lower body workout after they've done seven sets of leg press, seven sets of barbell squat and six sets of deadlift. Is that 20th set really to true muscular failure, or is it just when just can't stomach any more?

Lawrence Neal: Yeah, absolutely. So, okay. And then you mentioned that training frequency was three times a week, that's the other question I had. So, okay, so interesting study, and the outcome was that ... or the conclusion was that five to 10 sets per week might be sufficient for attaining gains in muscle size and strength in trained women during a 24-week resistance training program. There appears to be no further benefit by performing higher exercise volumes, and since lack of time is commonly cited as a barrier to exercise adoption, that it supports resistance training programs that are less time-consuming, which might increase participation adherence.

Now, I don't know, because you've got a full paper there. Can you see, you know, when you looked at that, the smaller volumes were sufficient? What was the result in terms of percentage of growth?

James Fisher: Yeah, so I have like a percentage of growth, but I'll tell you now about the statistical significance, which is probably the more important part. A lot of people look at the delta and look at the mean change and so forth, but the five-set and the 10-set group made statistically greater increases in strength compared to the 15 and 20-set groups, for lat pulldown, leg press and deadlift. Surprisingly not for bench press, actually. The 20-set group ... or that was more than the 15. The 20-set group made lesser increases than all the other groups for all exercises, so the 10 to 15 seemed to be the threshold. The 10 arguably is the threshold that they're

still making positive adaptations, no more than the five, but certainly it doesn't seem to have passed the tipping point.

Lawrence Neal: Okay.

James Fisher: The 15 seemed to have passed the tipping point for three out of four exercises. By the 20, people were making a lot lesser gains.

Lawrence Neal: And that's just what? Due to recovery, or ...?

James Fisher: Yeah, it's probably due to training volume. You know, I mean, if you do that kind of thing. I know you've talked to [Philippe Dumas 00:20:47] before, and I know that you've talked about the repeated bout effect. It's not a single workout that kind of stimulates adaptation. It's kind of repeated bout effect, and I think that when you go to the gym and you're doing 20 sets per workout, you know ...

This is a really nice study design in the fact that it was a press, a pull and a leg [inaudible 00:21:09], which is quite a typical split routine, amended in three full body workouts. And then on a Friday after that [inaudible 00:21:13] then they had full a Saturday, Sunday to rest, and then Monday was a press day. Tuesday, Wednesday they rested. Thursday was pull day. So, they didn't train their legs again till the following Friday, but I can imagine they probably struggled to walk most of the weekend.

You know, like we said, we questioned ... you know, we could question muscular failure, but they were supervised,

so let's, for argument's sake, and I know what Paulo and his guys are like, let's for argument's sake say that they came as close to muscular failure as anybody's ever gonna get in the 20th set. Well, they're gonna struggle for the rest of the weekend, and if you do that repeatedly week in and week out, I can imagine it probably doesn't get much easier. So I would say that yeah, a lot of it is down to a lack of recovery. It's down to ... the common in the HIC community is the inroad is too great, there's too great an inroad into the body's resources, both potentially peripheral but also central.

It's interesting that the bench press was one that didn't have the same deleterious effects on the group that trained with the 15 sets. And what's more interesting, actually, is that the group that, from a muscle thickness point of view, the five and 10-set groups made better improvements than 15, and 15 made better improvements than 20. But for the pecs, the five-set group made better improvements than the 10. So even though the bench press performance seemed not to be such a factor from a strength point of view, the pec major seemed to be a bigger factor for the lower set group. Does that make sense?

Lawrence Neal: Yeah, yeah it does.

James Fisher: So, you know, I think that what we're showing here is ... and bear in mind, most people in the exercise community would still call the five-set protocol used a very low-volume workout. You know, if you're going to the gym and do five

sets per workout, training three times per week, that's 15 total sets per week. Well, I probably do more than that; you know, if I do 10 exercise in a workout, I train twice a week, that's 20 sets. If I then apply drop sets or pre- or post-exhaustion or anything else like that, I might end up with a higher volume. So to do three workouts of only five sets is very, very brief workout, especially training each body part really only once per week, albeit for five sets.

I think it's a nice study. It's sort of the replications what people might do, you know, a chest press, a pec fly, dips, tricep extension, pullover, pulldown, whatever it might be. You know, it's stimulating the muscle group in probably a similar format to some people within the HIC community. I know some people doing a Big 5 would do a lot less than that, even that.

Lawrence Neal: Yeah. And what was the statistical significance in the group that got the best results, over and above the others?

James Fisher: Yeah, so the group that trained with five sets got greater muscle thickness adaptations in the pecs compared to all the other groups. For the other muscles measured, the biceps, the triceps, the quadriceps and the glutes, the five and 10-set groups got similar adaptations, but they were better than the 15 and 20. Hence, the conclusive comments in the abstract, that training five to 10 sets seems like it's optimal. I mean, from this I would argue there's no need to do any more than five sets per muscle group. If I would say that you're probably at around that tipping point, if you look at



all the muscle groups combined. You know, doing more than that is probably gonna start to tip people into the negative end.

Of course, you've got to remember there's some variation around this, and I know that you talked to Ryan Hall a long time back, and he talked about people's adaptation in volume and in rep ranges, and I can imagine that there were some people in the 20-set group that made really positive adaptations, but that's probably quite few and far between. So I think, when you look at the population that we used, trained females, you apply it that population and say, in trained females this is what we can expect. So it was a nice sample size, so it is a really good study design.

Lawrence Neal: Would there be some ... I'm not sure if this is the right bias ... but is it selected user bias or healthy user bias because they're trained women? So they do some sort of strength training anyway?

James Fisher: Yeah, I mean, well ...

Lawrence Neal: Are they more likely to, perhaps, respond better because of that?

James Fisher: They might be more likely to respond compared to completely untrained people, and you might find that people train because they get adaptations, rather than because they enjoy training, but you might find that they train because they want adaptations rather than because they get adaptations. You know, it's this whole thing about, are

basketball players tall because they play basketball, or do they play basketball because they're tall? So, in this case, you know, they're trained. That's the population group we've got. That might be indicative of their motivations. That might be indicative of responses in trained people. We might not expect the same from untrained people, but the flip side of that is that in untrained people you might expect a lot better response because it's a novel stimulus. But I can't imagine taking anybody who's never trained before to the gym and putting them through 20 sets.

Lawrence Neal: Oh, no. I understand that. I guess, and maybe this came across and I'm not understanding it fully, but what I mean to say is, if you took a group and you controlled for those that were trained. Say they came from a group of women who perhaps don't take to strength training naturally ... and again, I don't know how you would possibly discover that ... you know, taking the optimal, like parsing out the optimal responders from the average responders, and then just taking the average responders who are trained, and then putting them through the same study and seeing if the outcomes were different. I mean, it's a big ask, but-

James Fisher: Yeah, normally studies like this are controlled for outliers. So anybody who achieves normally one or two standard deviations above or below the mean, is considered an outlier, and there was none in this case. I tend to look out for that in most of these studies when we get the data back. Whether you should remove an outlier or not is a question in and of

itself, but I mean the Habal paper from 2005 was a key paper that showed that there is a large variance in adaptation. Now, whether we should take that out of studies is questionable because that's the population, so it's representative of the population. You know, some people might get that much stronger, irrespective of their normal habits.

It's an interesting question, certainly. I'm sure the practitioners listening have had people who, you know, are making credible increases in adaptations and other people who are poor responders.

Lawrence Neal: This is really good, because I think this is another piece of research, another study that adds to the weight of evidence to show that smaller volumes can work really, really well. So, for those listening, I know that a number of members are holding seminars soon, so this might be a good one to talk about, potentially in a seminar, in terms of demonstrating the tiny ... tiny's the wrong word ... but the small amount of volume that is necessary to produce positive adaptation. So one to think about.

James, I'm just aware of time, so I'll tell you what. What I think we should do is perhaps arrange a second session to cover off the other study another time, if that makes sense for you.

James Fisher: Yeah, we absolutely can do this. There's not a huge amount to this study, so we can blast through it in five minutes if you want. It's completely up to you.

Lawrence Neal: Yeah, actually, okay. If you've got time, let's do that. So, just quickly, this study is called, [Does the Addition of Single-Joint Exercises to a Resistance Program Improve Changes in Performance and Anthropometric Measures in Untrained Men?](#)

James Fisher: Yeah, and again, this is a really nice study from Paulo's group of researchers over in Brazil. Again, a little bit of involvement in study design, but this is pretty simple, it's pretty repetitive now. It's typically a group that does multi-joint exercises only, and a group that does multi-joint plus single-joint exercises. So, for example, the workout, it was kind of two different workouts, each performed twice per week.

So the A workout was bench press, military press, lat pulldown or seated cable row. So both groups did that. And then the multi-joint and single-joint group also did cable tricep extension and barbell biceps curl. And the B workout, which was also performed twice per week, consisted of leg press, seated knee flexion and calf raises, and then the multi-joint plus single-joint group also did knee extension as well. So you can see there that basically there were four exercises and three exercises per workout, and then a couple of additions for one and one addition for the other.

Typical kind of thing that we've just looked at. 10 RM bench press, biceps, triceps pulldown and leg press and knee extension were tested, as well as flexed-arm circumference, which I think is gonna take a bit of hit in the research, but I'll talk about why I really like it in a second. And biceps and triceps skin fold. And the only difference between the two groups ... it's an eight-week study. It was untrained men, 10 in each group. The only difference was about 1% difference improvement in flexed arm circumference in the multi-joint plus single-joint group.

Lawrence Neal: So there was a 1% difference, statistically significant but perhaps not meaningfully, practically significant. So what's your thoughts on this? Does this study say that we should be doing single-joint? Or is it not that clear?

James Fisher: Yeah, so I would say this study supports the rest of the literature around multi-joint and single-joint. If we go back to the five, 10, 15 and 20 set study, what this study shows, in light of the previous one, is that you don't need to add single-joint movements to your workout. Or, adding them is going to get you very little in the way for return. In this case, certainly nothing from the point of view of knee extension or triceps strength, that is, but perhaps a little bit more in flexed arm circumference.

And I said I'd mention why I think that's a nice measure. You know, we as scientists typically use the scientific measures that we've got, whether that's muscle biopsy, where we look at the actual muscle fiber size, MRI or ultrasound to measure

cross-sectional area or muscle thickness. MRI, sorry, to measure muscle volume maybe. But actually, we talk more and more about what that actually means in the real world. So does that actually translate to a meaningful change in the physical size of a muscle that people can see? And in this case, a flexed-arm circumference, putting a tape measure around somebody's upper arm when they contract the biceps and triceps, is kind of a key measure because that is, after all, what most people are probably interested in. And what we saw was a difference of 1%. So a 5% increase in the multi-joint plus single-joint, and a 4% increase in the multi-joint. It would be really interesting to see whether that's discernible by the eye.

Lawrence Neal: I highly doubt it.

James Fisher: Absolutely. I agree.

Lawrence Neal: So just one last thing, and we need to wrap up. Would you say, at the moment, the weight of the evidence kind of says that, you know, you're getting what you can get from a ... If we're just looking at muscle hypertrophy, because let's be honest, that's what most people care about. If you're looking at that, you're getting probably, pretty much all the results you want from a program consisting of multi-joint, and that single-joint, if they're preferable for the user, great. But they're not probably going to produce greater results.

James Fisher: Yeah, I think that's exactly true, and the way I tend to pitch this is that I would get multi-joint at the start of a workout

because I think they're the more important exercises to do, and then if you've still got the time at the end and you want to throw in a bicep curl, a knee extension, tricep extension, a single-joint movement, then throw that in towards the end where it's maybe a supplementary exercise. And I think most people would do that logically. If you could only do one exercise, it would almost certainly be multi-joint. If you added a second, a third, a fourth, so forth, and with some people it might be the sixth or seventh exercise that they then said, "Actually I quite like to do lateral raises, bicep curl," whatever it might be, and they would add a single-joint. But other than that, I think most people ...

This adds to what we already know, as practitioners and as trainers, that we get the big movements done, get as much muscle mass as we can targeted in the early exercises, then get out of the gym and try to recover.

Lawrence Neal: Absolutely. James, thank you so much for your time. Really appreciate it.

James Fisher: Thanks for having me, Lawrence.

Lawrence Neal: You're welcome, and I'll be in touch soon to help you do some more.

James Fisher: Absolutely, thanks very much.

Lawrence Neal: All right, take care of yourself. Bye now.

James Fisher: Bye-bye.