DANNY LENNON: Ciaran, welcome to the podcast.

CIARAN FAIRMAN: No problem at all. Many thanks for having me.

DANNY LENNON: It's a pleasure. I really enjoyed reading through a lot of the research in this area that you've been involved in and make you want to weigh through it because not only is it interesting to see where that field is going and a lot of it is quite novel within this field of exercise oncology, but it's one where maybe it's good to see more conversations start to pop up in this area. But maybe before we get to any of the research specifically, let's start with your own background and really how you got to be involved within this area of research and maybe just let people know what you are actually doing right now.

CIARAN FAIRMAN: Yes. So born and raised in Dublin, I was a soccer and gated player growing up. All throughout high school I didn't find much of it interesting and I was your typical student in school and kind of came towards the end of the leaving and finishing high school, didn't have a lot of options and was looking up to find out about this course that was aimed at getting lads all over to The States. They essentially talk almost a 100 of lads from all around the country and got us involved in doing our SATs, got us trained and started to help us get away in terms of getting scholarship, so we trained and all that stuff for a year, we all went

over and played a showcase over in Memphis, Tennessee, and I was looking up to be one of the ones who are selected for the scholarship.

So came over to the states in 2008 on a football scholarship and same attitude I kind of had in high school I was more focused on football than I was on academics and I was just kind of messing about for a couple of years and sophomore year of college my mom got breast cancer and wasn't able to go home and be with her, but I was kind of hearing everything she was going through over the phone and just dealing with the effects of chemo and radiation and just the diagnosis cancer in general and kind of had the thought that everything she was going through, the positive effects of exercise mimic a lot of the negative effects of what she was facing. So I was kind of saying I will do something here.

And at the time, I was starting to get involved in some of the exercise physiology classes and I just loved it, absolutely loved it. I had a professor Jason Cromwell who really took a personal interest in me, saw my passion and really helped kind of direct me towards the field of exercise, physiology and showed me that you can have a career in this, and so then kind of started to get a little bit involved in undergraduate research, set up cancer rehab clinic during my senior year in college and then went onto my masters where the focus was a little bit more on sports nutrition and human performance, but again, I still had that clinical side to me and did an intervention in breast cancer survivors for my master's thesis and then 2014 came up the last date to start my PhD and just I've been absolutely loving it ever since, really getting deeper and deeper into the field of exercise oncology starting to explore how we can manipulate different exercise protocols to optimize various outcomes in cancer patient survivors and here we are at the end of the journey about to graduate in a year, so we will see what's next.

DANNY LENNON: Yeah. It's really interesting hearing that background of not only your – the initial interest in sports and how you also had that kind of personal background of what had happened within your own personal life with your mother and how these kind of two fields

have now kind of merged into what you are doing now. To maybe start off this kind of conversation, I suppose maybe a good place to start would be to think of historically what has maybe been done with cancer patients and cancer survivors in terms of recommendations because I am sure a lot of people listening who haven't looked into exercise oncology think it might be kind of counter to what they would typically see people doing, right. Someone becomes sick or they start going through treatment and it's all about getting them to rest and not due too much to put a stress on them. Can you maybe talk about what maybe have historically been done and how then that has maybe started to shift over the years?

CIARAN FAIRMAN: Yeah, you are dead right. I mean, the biggest challenge we face is convincing patients and survivors that it is okay to exercise and, I would say, the first couple of stories that came out were way back in the 80s, blaming a couple of nurses who looked at just this brief exercise program during chemo and found some decent improvements in symptoms of nausea and fatigue. Between that and probably the late 90s, there wasn't a lot done, and then the late 90s really started to take off, and a guy called Kerry Corinea up in Canada, started doing a lot of work in behavioral interventions and looking at the psychology of these patients and how they work in terms of getting them to exercise, getting them to adhere to exercise. And then in 2003, the American Cancer Society finally recognized that hey, this maybe – we may be onto something here. They released the first general guidelines but it was very basic and it was basically trying to avoid bed rest starting to move a little bit more, and then that kind of really started to take off, it started taking off, a lot of people started to research different elements of this.

And then in 2009-2010, both ACSM which is the American government body and ASO which is the Australian government body, both released these guidelines for exercise in cancer patients and survivors, where not only was it this general recommendations and that looks like about a 150 minutes per week, but they also started to get a little bit more specific in saying, well, if you've got breast cancer, here are some considerations you may want to

look at for designing your exercise program versus prostate versus lung cancer. So we started to recognize that while exercise globally has a positive effect. There's also some specifics within different kinds of sites amongst different treatments and how we can design exercise appropriately. And then since 2010, it has just accelerated 10-fold and we are actually coming out next year with a new set of guidelines by the ACSM that again is just going to add to what's already been done.

But to give you an overall picture, I mean, we continuously compare it to cardiac rehab. I mean, 25 years ago what wasn't really accepted, people with some sort of heart failure or cardiac event were still recommended bed rest and exercise wasn't really recommended whereas now it stands to care and we are going to stand the value of exercise and assume as you go through that event, the quicker you get back to exercise, the more better you are going to be. And so we see that with exercise in quality and that we are now starting to recognize the benefits of exercise during – before even during and after treatments. Now, we are at a point where we have to convince people that it's worth painful and it's worth establishing as a standard of care. And I think it will ultimately be a case of when, not if, it just happened that patients would stick it out till we get there.

DANNY LENNON: Yeah. So just talking about some of the outcomes that maybe we can have an influence over, I know you mentioned things around nausea and fatigue are kind of common ones. And there's probably kind of two sides to it as well, there's just simply someone that goes through the illness is probably a lot of time going to have maybe some time whether it's going to be immobilized or at least less active than they used to be, that can cause some knock-on effects. But also there can be effects with the cancer treatment itself, right. So maybe to outline from the start, what are some of the main adverse effects to suppose of going through a cancer treatment that would be relevant to this discussion at least around exercise?

CIARAN FAIRMAN: Yeah. So, I mean, just to give you an overview of different treatments radiation typically is a 20 to 40 minute, they go five times a week. So the effects of

radiation would be more acute and targeted where the radiation is occurring. For example, head and neck cancer will get a lot of radiation to the head and neck region. So a lot of the side effects are extreme difficulty in swallowing, eating, you know they lose a lot and you cross a line and so there's a lot of damage there or radiation to the chest for a lung cancer or breast, again, a lot of scar tissue there. We hear a lot of people say they feel like they are on fire, they feel like they've got extreme sun burns, a lot of pain there. Chemotherapy in comparison is typically done in cycles across months, and so a lot of protocols we will have at a dose of chemo or an infusion, one day, every week or two, and essentially chemo is a toxic substance, so they will give you some sort of steroid before you do the chemo. You go through a few hours of infusion and then that kind of led the body slowly rest for a week or two before they hit the next infusion.

So that pattern of how they do the chemo essentially causes a pattern of fluctuation, fatigue and nausea because the steroids almost mask some of the side effects initially. But then steroids start to wear off after about 48 hours and you start to get extreme nausea, a lot of fatigue, because you've just got this toxin running through your body and it takes a lot to clear it. So during treatment that fatigue and nausea, they fluctuate a great deal. But then you've got global side effects such as particularly coupled with inactivity chemo can cause reductions in bone marrow density, muscle mass, physical function, body composition. So it depends on the type of treatment. I mean, you go to prostate cancer, androgen deprivation therapy is one of the most common treatments for prostate cancer and androgen deprivation essentially drops testosterone to castrate levels. So immediately, you are looking at a loss of muscle mass, reductions of bone marrow density, physical function and risk of causing fractures, all of which are compounded by inactivity as well.

DANNY LENNON: Yeah, some of that stuff that centers around both the inactivity and I suppose the decrease in likelihood of moving around during the treatment at least due to fatigue, etc., etc. That kind of seems kind of logical in most people's mind that someone is going through

this treatment or has just been diagnosed, there's probably going to be a drop-off in what they've typically been used if they have previously been exercising. Do we have any kind of research that looked at what their exercise maybe goes towards after the completion of treatment and they get through this thing, do they ever get back up to those usual pre-diagnosis levels or do we see kind of long lasting effects I suppose is the best way to think about?

CIARAN FAIRMAN: As far as the research goes, generally you see – it's an initial and severe decline in activity as they are just getting used to the treatment. And then slowly as they come towards the end of the treatment and start to regain some of that activity back, and then they are progressing to normal life, as kind of months after treatment is over, they start to go back into the normal function, a lot of the short term side effects of treatment that's subsided and then we start to get back into things. But generally, we don't really see them reach the same levels of activity.

Now, on an anecdotal level, I mean I've worked with, for example, Matt Lambson is in the MLS, he's a professional soccer player and he went through extreme chemotherapy, but he's back playing at an elite level. So I think, the research paints a picture of the dangers of going through chemo or going through cancer treatment and what may happen to your activity levels, but on an anecdotal level I can tell you that it's not a dead sentence in terms of what you like to do. We kind of talk about how we research really specific things but our advice globally is if you like to snowboard, if you like to ski, if you like to bike before, that's the same stuff you should maintain during, you know, there's some considerations based on what type of cancer and treatment and all that type of thing, but in general, you can still do all the stuff you love. And if we are saying, you need to stop skiing or you need to stop snowboarding, and instead you need to stay in an elliptical and walk for 40 minutes, that's not going to work for a long term adherence. So it's really important to find that balance of what's going to work physiologically but also what's going to fit with the lifestyle.

DANNY LENNON: Yeah, 100%. When it comes to – I think you'd already mentioned that, we have at least over time had this general recommendation to not be completely at rest and have some more physical activity, and maybe there's been some quite generic recommendations about being more physically active but I think where the real interesting thing is and like you mentioned this maybe explosion in research and application over the past number of years has been looking at some of the different, specific types of recommendations we can make based on, I think there are probably three or four you had mentioned previously. One was obviously we have specific cancer type to think about and we can maybe dive into that. There may be the different phases of the treatment obviously when they are going through it versus longer term stuff, some of the outcomes that we just talked about whether we are looking at improving their quality of life versus physical function, etc., etc. And then I suppose the big one is probably the specific types of exercise we could use. So with that in mind, maybe we start making our way through a few of those things and to go back to the first one, what so far have we looked at in terms of what types cancer have been examined, is it pretty much across the board now that they've all been looked at or is there a few that we've had centered most of this research around?

CIARAN FAIRMAN: Yeah, most has been focused around breast, prostate and lung, and it's kind of because they tend to be most common cancers. So, there's a lot more patients to pull from, so recruitment is easier, research is easier to do. But we are more recently starting to look in – I mean, there's been studies in terminal cancer, in patients with bone metastasis, in head and neck, in germ cell, in leukemia. So we are starting to explore these kind of less common cancers but there's so much more evidence in kind of the main ones. And so that's where a lot of the research is focused on both. We come back to the statement that globally exercise has got across the board, that's just once you dive into each specific cancer, then there become some certain recommendations.

DANNY LENNON: Yeah, perfect. So I think in terms of exercise and the types, we know that generally more exercise in general is probably going to be a good thing, but is there

anything that's showing us that there are maybe particular benefits for certain types of exercise, number one, that may lend itself to in at least in certain situation, with certain types of cancer, this type exercise program, might be better, if that makes sense.

CIARAN FAIRMAN: Yeah, absolutely. So there's some really cool stuff with different types of exercise. For example, Lee Jones – and I practiced this with a lot of what I am about to talk about, has been done in mice, yet to be done in humans, but some really cool theoretical foundation and we see some substantial benefits in aerobic exercise, in breast cancer, lymphoma, prostate across the board. Lee Jones is a really phenomenal researcher with Memorial Sloan Kettering who has looked at some of the mechanistic effects of this, and part of the problem with chemotherapy is, and its efficacy is to deliver your chemo. So tumors have this abnormal vasculature and some of the veins are closed, they can't get to certain parts of the tumor, and then that can cause some of that metastasis. So a lot of problems in chemo are not necessarily down to the type of drug but more how it's delivered.

So, Lee has actually taken a lot of mice through mimic in an exercise program, aerobic exercise program and found that this aerobic exercise can actually modulate that vasculature, normalize the vasculature and that can bring – it can increase the efficacy of the chemo. And then you kind of bring that back into the human trials and there's been a couple of trials in 2007, 2009 in breast and lymphoma respectively that found aerobic exercise have had a higher chemo completion rate. And what that means is that typically doctors will a dose of chemo at you, and based on how you are responding to it, they will have to modify it whether they lower the dose or you miss a couple of treatments because you are not recovering well. So when we talk about improving the chemo completion rate, that can mean weeks or months that you are getting through chemo quicker, you are not experiencing as high as or as great a side effect and you are getting back to your regular life, you are getting back to work, you are getting back to work your family and all that type of thing.

In terms of resistance training, again, it's real cool stuff, particularly as I mentioned with prostate cancer. I mean, this should be a standard of care and prostate cancer care because androgen deprivation almost immediately drops anabolic hormones to castrate levels, a ton of issues with most of the mass, bone marrow density, body composition. So there's Rob Newton over at Edith Cowan, he's doing a great job of really talking about exercise as medicine, and how do we dose resistance exercise appropriately and it needs to be at an intensity that's sufficient to cause certain adaptation. So, I mean, we see even as little as 12 weeks, we see substantial improvements in most of the mass and physical functions, some improvements in bone marrow density as well in resistance training with prostate, some really interesting stuff for head and neck cancer, a lot of the issues for head and neck is again, as I mentioned, because of the treatment done and the location.

A lot of the issues with head and neck is that they very – a lot of difficulty eating and swallowing. Along with that, it takes them two or three hours to get to 4 or 500 calories. So they've got very low energy status and they've also – you are reducing the time they have to work out. So when we are trying to look at exercise to help them, aerobic exercise, obviously would expand a lot more calories and energy than resistance exercise. So, we are now looking at resistance exercise as the low energy cost way to maybe combat some of those effects again, because they are getting so little of radiations to the head and neck, they have – cancer cachexia is a big problem with them. They are losing all the muscle mass. So how come we find this kind of low energy cost way of combating that, and resistance exercise comes into that.

And then you've got some other stuff like just some Scandinavian research is looking at – they call it FC prostate which is a football team and prostate cancer patients. Again, looking at just overall, you get – the idea is that we get really specific in resistance training aerobic, and they are kind of saying, well, maybe it's some lifestyle activity, we've looked at rough planning, we've looked at football, we've looked at yoga – these kind of activities that more mimic what people may do on a day to day basis. And again you see some

improvements in physical function and the biggest thing across the board no matter what the exercise is, is the quality of life. Over and over and over again you see improvements in mood, you see improvements in fatigue and nausea and overall well-being. Because you are just around people, you feel better, you are getting your energy back and it comes back to what you were saying where working out when you are in such a fatigued state, the people are lying in bed saying I can't get out of bed, why should I go for a walk and it takes a few weeks to see that kind of fatigue diminish with exercise, but over and over again we see the power of aerobic exercise in particular to diminish those symptoms of fatigue.

DANNY LENNON: Yeah, I think the quality of life piece is such an important one because not only are we mentioning some of the kind of psychological factors that you talked about there but also if we are seeing cases where there's either cocaxial or there's just muscle atrophy, because they have been mobilized. Not only is that going to maybe decrease like the quality of life even if they survive the cancer and have made a full recovery from a medical standpoint, but presumably that's going to set them up maybe for issues not even with the recurrence of another cancer but for other chronic issues down the line, I mean, sarcopenia or sarcopenic obesity, these types of things. Are we seeing that that it's not only just at that time point during the treatment, but the long lasting effects I suppose of decreasing the likelihood of worsening health over time?

CIARAN FAIRMAN: Yeah, absolutely. I mean, there's a couple of things there. First of all, the five-year survival rate of most cancers has really increased dramatically to where an early stage breast cancer you are looking at 90 plus percent of survival. And ACS and these various societies are really proud of the work, and they should be because it's a testament to advancements in screening and treatments, but it doesn't talk about the quality of life as you said, and we are of the mindset and once if you are surviving 5, 10, 15 years, what is the quality of those years. Surviving 15 years, if you are bedridden or if you can't play with your kids, if you can't do your regular activities, the quality of that life has to be there.

And, as you kind of hit the nail on the head there, a lot of people who were diagnosed, particularly in the early stages of cancer and dying from the disease anymore, they are not dying from cancer, they are dying from comorbidities down the line, largely because, if they've been active before, maybe they dropped their activity. If they are previously inactive, they stay inactive. And so you lead to really poor outcomes in terms of body composition, physical function, as you said, sarcopenia is massive, dramatic drop offs in strength and physical function. Again, they all just kind of – it's a vicious cycle but they compound each other. And you pick anyone over the age of 50-60 and you have some sort of bad knee and well that kind of workout, because my knee is hurt, I am gaining weight – you know, it's just kind of this vicious cycle of knee is hurt, can't work out, I gain weight, I can't work out because of gained weight and it just goes around and around. And those things will compound each other and that's what leads to complications down the road.

DANNY LENNON: Yeah. When it comes to some of the types of exercise programs we can implement, maybe if we dive into that a bit further, because I think it's really interesting to consider where are we right now in terms of recommendations that can be given – do we have like standard protocols that would be recommended, are we still at the kind of stage of here are some generic guidelines, where should we be putting most of our focus on, I suppose, general sound bites for people to hear of how to go about implementing this, and this probably even ties into the stages of the cancer itself that we get into. Do we have differences even in that of what might be recommended at different time points along the way?

CIARAN FAIRMAN: Yeah, and it's probably one of the most frustrating areas we need to talk about because you do fall back on giving these general recommendations, which are typically 150 minutes of moderate intensity activity per week, and then you've got weight training two or three times a week of one to three sets, 8 to 12 reps, total body exercise. And this is the problem with cancer care is that we throw these, we give a pamphlet to cancer patient survivor and say here you go, work

out more. And they are going, I've never weight trained in my life, what I am going to do with this. And so, that's the general recommendations, but then when you start to dive into it, as you said, you talk about, well, where are you in treatment. Theoretically, the fitter you are before treatment, particularly something like lung cancer, where they are going to get for example a lung resection, and you go through lung surgery, the fitter can get yourself, and that's where aerobic exercise comes in, the better your outcomes are going to be after the fact.

Then you move into, well, what should my goals be. During treatment, the goals aren't to see substantial improvements in fitness. Sure, we can buffer some of the side effects in terms of nausea, fatigue and energy and mood disruption. We are not going to see huge improvements in muscle strength and bone marrow density during treatment. The goal of exercise during treatment is just to maintain where you are at, because the groups or the people that don't exercise get so much worse, and it's such a steep decline that if we don't be proactive about how we explain those goals, people get disappointed. Because they are coming to us for four to six months of chemo and saying, I am busting my ass but I am not seeing any improvements. And we are saying, that's a huge achievement, the fact that you are staying where you are at is massive, that you are not seeing drop-offs in bone marrow density and physical function, because that then becomes your set point. As soon as you finish treatment, right, the short term effects are starting to dissipate, now we can get a little bit more aggressive with our exercise protocol and start to really push it again back towards regaining all the function and things like that.

DANNY LENNON: Yeah, I am just wondering, from maybe something you would have heard anecdotally with some of the people in the studies or even if we have qualitative stuff of around the psychology of even having that training program during the treatment that like you say, they are probably not going to see much in terms of a progression in terms of fitness or strength, but do you at least you report it to you from these people that it's something that at least from the outside it might seem to me that it's something that they can do, they

have some control over that they are saying, okay, I am going through this treatment, but here's something that I am doing to either improve my health or improve my chances of long term progression and that in and of itself is a psychological positive, right?

CIARAN FAIRMAN: Absolutely. And you hit the nail there with saying the idea of control, because a lot of times cancer diagnosis is completely unexpected and then you've got to say, well, now they expect me to drive to this center five times a week and get radiation and they have to get chemo once a week with other stuff two or three days after, how am I going to schedule that, how am I going to get to the facility, how am I going to look after my family. All these things that just get thrown up into the air, and it can be very distressing for some of the patients. And again we come back to exercise again, but why is that quality of life, overall well-being, but speaking to survivors anecdotally, they keep coming back to control, particularly ones who have been active before and they are saying, I am not letting this take over all aspects of my life, this is one thing that I get to do, I get to come in and work out and do my own thing and I still feel like myself. Because body image isn't a huge thing with cancer patient survivors particularly when surgeries involved particularly – you look at breast cancer, getting into mastectomy can be a huge hit to breast cancer patients and how to perceive themselves and so given an outlet to where they have control over some aspect of their physical and psychological well-being is huge. So, yeah, it kind of comes back to what you are saying, the idea of just having something stable and something regular that they can go to is massive for them.

DANNY LENNON: When you talked earlier about how maybe it's not so enjoyable for you to be able to give here something like general advice that we can give out to everyone, I am presuming that's based on you presumably think that there's probably more benefit to be gained if we can even more focus this on a specific well put together training program, the same way as we know for someone generally trying to get fitter or stronger, specific program that set up in a periodized fashion to help that person. Is it going to be better than some generic template, say presumably the same logic

applies here – where are we in terms of that with cancer survivors and patients in terms of going about setting up training programs that are going to be more likely to be efficacious to them than those kind of generic general recommendations?

CIARAN FAIRMAN: A long way away. So, you are right, the frustration is a go to different support groups or patient groups and in that group I have someone with lymphoma, who's going through a treatment, breast cancer survivor who's been five years post treatment, a prostate cancer patient who's been on ADT for two years. And I am just telling all three of them to do the same activity and that's not the case. But, where the specificity comes in is you've got people like myself, the field is exploding right now in terms of people coming out with this mentality and working one-on-one we can give those specific recommendations and you know yourself, those lower recommendations will never substitute hands on one-on-one work where I can get to know you, I can develop a program to you.

But to answer your question, in terms of actually establishing exercise as a standard of care, we are far away from that and it comes down to a lot of policy changes. But there are people with the expertise and knowledge available to where when you get diagnosed with cancer, you meet with your radiologist and your oncologist and your team and medicine doctors and all that, you should be meeting with physiologist and we should be having that meeting where, okay, what's your treatment, what time point are you at, what do you like to do, any injuries, any comorbidities. We can design a program that helps complement treatment and we should be a part of that standard of care.

And our frustration is physiologist comes in where nutrition is a standard of care, they have all of these in almost every cancer center that are willing to give out this sort of advice, and our perspective is that the field of nutrition and cancer care is so messy and you've got – you had Chad Mathews on the podcast a few weeks ago, you've got people within that field butting heads with each other about what's optimum as nutrition. What we know about exercise is so much more clear cut. There's no one debating if exercise can work and there's no one debating that during a specific cancer

you know for prostate resistance exercise is probably the way to go. So we have a lot more evidence and it's a lot more clear cut in terms of how exercise can help. We should be in that model.

DANNY LENNON: Yeah. And so in lieu of that time until we get to that point where it becomes a part of standard of care, there's obviously maybe a lot of personal trainers or physical therapists listening to this podcast now who undoubtedly at some point in their career, are probably going to work with someone who's had cancer or some cancer survivor at some point in a practical setting. So in such a case, is there anything that you can recommend or advise in terms of setting up that initial exercise program, is there kind of a few things to bear in mind that maybe useful in working with this type sub-population?

CIARAN FAIRMAN: Yeah, absolutely. I mean, for the most part your standard screening process applies. You go to their background and their activity history, their injury history, so on and so forth. But what's really important, particularly if it's an active patient, is one, getting some sort of communication with one of their physicians and communicating openly about what you are doing with them. And what I tend to do is look at okay, what's your cancer type, what sort of treatments you have, if they have surgery along cancer resection or along resections don't look different than a mastectomy versus a prostatectomy, they are going to have different issues in terms of range of motion, in terms of mobility, physical function in those localized regions.

So getting a complete overview of their treatment is really important in terms of what's their radiation schedule like, what's their chemo schedule like, how far they are from treatment if they are out from treatment, what their surgery look like. A lot of them maybe on hormonal therapy for several years, so understanding what they are – you know just like you were on any other sort of medication, getting an understanding of what their medication is and what the side effects are, and the more we've gotten into this field, you get really deep and specific. But once you understand all that, it allows you to step back and say for the most part, it's a similar process, but you

still need to understand the physiology of the disease and the pathophysiology of the treatments to be able to effectively design a program around it.

So in terms of what that looks like I think it needs to have the openness and the humility to be able to approach a professional, whether it's contacting a researcher who has experience in that area or again being open with the physician and saying, I don't have a lot of experience in X cancer but you are their oncologist, what they typically see in terms of side effects, anything I should be concerned about, and how can we work together. And that relationship can take a while to develop but once you establish that credibility, it's a really smooth process.

DANNY LENNON: Yeah, awesome. I wanted to ask you about the paper that you published earlier this year, which you are the lead author on that I know Eric and Mike kind of contributed to as well, and within that it was really interesting reading of seeing really an insight as to the potential for where this can go, and I think some of the things that kind of stood out is taking some principles we now see emerging within good quality literature and applying that to this population. One that kind of just comes to mind is the potential for a role of auto-regulation in cancer survivors which is something that could be even potentially more important given some of the things you mentioned around their treatment schedule, how variable it's going to be on how they feel on a different day and how up and down that can go, and the value of a tool like this. Can you maybe just talk to people about some of the main takeaway points from that paper that you are trying to get across and some of the key things to take from them?

CIARAN FAIRMAN: Yeah, sure. And obviously, of course I have to give a huge amount of credit to Mike and Eric, saying they had a part in the paper, they've done a huge injustice. They were incredible throughout the whole process and obviously the two of them are just incredible scientists and practitioners and a lot of respect for how they help shape the manuscript and just really help bring our ideas. I went to them and said, auto-regulation would be a good idea and they said cool, let's get together and do it, and they just brought their

wealth of experience. So a huge thanks to them for getting involved in that.

But yeah, so essentially, I mean, auto-regulation is by nature modifying the stimulus based on how you are feeling and your readiness to train let's say. And having come from that performance background and being an athlete myself, I saw the utility, I mean, anyone that needs some sort of auto-regulation, if a cancer patient who's going through dramatic fluctuations day to day in energy and fatigue and nausea, all of which is going to affect their readiness to train. And my perspective was that no matter what cancer center you are in, no matter what research study you are in, as soon as they walk in the door, the first thing we say to them is how do you feel. And they say, good, bad, however. And we say, okay, maybe you should take it easy today or you are having a good day, let's see what you can do.

So the paper was trying to find a way to somewhat standardize that process and again, as we said, bringing a lot of scientific principles in from the strength and conditioning world and apply it to this clinical world. So again, the premise is just that we have these dramatic fluctuations in both physiological and psychological symptoms, all of which affect day to day ability to train. So how come we find a way to modify this stimulus and give it an appropriate stimulus that's going to set you up for not just optimizing adaptation but optimizing recovery. If we have for example a high volume day set for a Wednesday and you do your chemo infusion on a Monday, you might feel good on that Tuesday again because we talked about some of the steroid infusions, but on Wednesday you could feel absolutely wrecked. So, why are we giving you a high volume session of 12 reps and just kind of really important and not made to lay your rest and recovery which again the importance comes in and rest and recovery just doesn't need performance, it means your response to treatment as well. So it's really important that we provide an appropriate stimulus for the safety of the patient too.

So, again, the idea was to provide different scales or energy ratings to kind of say not just how you feel, let's see if we can put a number on that, let's see if we

can get a little bit more accurate in terms of how you are feeling. So, for example, a recovery scale of 1 to 10, if you are feeling really not recovered on 1 or 2, we are going to expect a much lower response in terms of your training. So maybe we drop the intensity a little bit, do a lighter session and work with resistance training, we will go down to allow a percentage of 1 repetition max, or it's aerobic training, well maybe just go for a walk instead of what maybe we had planned a run or a high intensity session. So again, it just points back to auto-regulation can be done in so many different ways, it's not a new concept, it's just trying to bring in different scales that will help us use that as a tool.

DANNY LENNON: Yeah, one of the big things that struck me from the paper is it obviously outlined so many different ways in which we could, I suppose, for lack of a better term, optimize a training program for a given individual. And obviously that's tying in things like having a proper periodized program, having the right quality exercise selection, tailoring volume to the individual, auto-regulation, all these types of things. And the thing that stood out to me is like there's so much more that could be done, but when you look at simply what just generic just be more active advice has done so far, it's been nothing short of remarkable that alone. So imagine, how much more there could be if we like cross the t's and dot the i's on all the stuff, in that just the most basic general stuff has had this profound effects or it jumped out on me.

CIARAN FAIRMAN: Yeah, it's huge and that's what I am a huge advocate of. If we can see – and kind of I had a presentation at ACS this year where we looked at – there was a year-long study in breast cancer survivors looking at how resistance exercise can affect lymphedema is a huge concern. And we can talk about that later maybe but 12 months in, and I don't want to miss quote myself, there was a 40-pound increase in lower body strength with resistance training in breast cancer patients, again with that kind of fairly generic prescription. And the problem with these long term studies is that they progressed these patients for about three or six months and then they put them into a maintenance phase, where you are diluting a lot of potential effects, if you keep that across that 12 months.

So we compare that to – Amanda Haishan did a phenomenal job in a 16-week program where again, the first eight weeks were kind of those generic exercise protocols, and a lot of them tend to be machine based exercises. Again, kind of coming from the concern of safety and just kind of let them easy into it. But Amanda did a phenomenal job of transitioning them after eight weeks to a free weight session where they are doing bunch, they are doing squat, they are doing deadlifts, really good compounding that can stimulate a lot of muscle tissue, and they saw an 80-pound increase in 16 weeks. So you look at 80 pounds in 16 weeks compared to 40 pounds in a year. That in itself highlights the power of appropriately manipulating these variables, and that's where we are kind of coming at and saying, if you can have these improvements, we can, in terms of optimizing what we do, there's a need to modify these variables, and look at how we monitor and prescribe and progress resistance exercise accordingly.

But I will also hold my hands up and say, there's people that have valid points coming back at me for example from a behavioral perspective and saying sure, you might say that doing an undulating program or a high intensity program is optimal in terms of gaining the muscle strength. But is that optimal in terms of exercise adherence? Is that optimal in terms of just adoption of activity? And you kind of say, maybe when we think of optimal, there's different ways of saying what's optimal. And you kind of come back to say, well, if the participants in action study gained 80 pounds, well, then they said, that was way too much and they stop exercising. A year later, maybe they are not, you know, they don't have the 40-pound increase. So it's important to have that in mind as well when you are looking at it.

DANNY LENNON: Yeah, for sure. When it comes to kind of the frontline implementation of this and like we mentioned earlier, some people are probably in a position right now where they can start making use of this, do you find not only the, maybe safety concerns that some survivors have, but also a bit more wariness of actually fitness professionals or strength coaches within the field have or a bit more apprehension about

implementing some of this with people or are there kind of typical concerns that come up with this from any direction and what are – you are probably responses to most of those that you see with implementing this stuff?

CIARAN FAIRMAN: Yeah, so, I mean, the concerns differ among, as you said, the kind of different angles that are coming up – first of all, physicians and oncologists quite frankly aren't trained the way we are and they don't have the time to dig into literature to see how much has been done. So, researches in academics tend to have a little bit more creditability coming to them and saying here's what the science is, but for example, breast cancer is the easiest one to give an example. People still come to me five, six years after treatment and say, my doctor told me never to lift a gallon of milk over my head because how I had maybe a port infused or a port inserted for chemo infusion or I had a mastectomy so it's the range of motion issues, and that tiny passing comment can have dramatic long term implications in terms of never lift a gallon of milk over your head.

These people don't walk out for five, six years, and when in fact it should just be, let's work through a rehab program, let's work on range of motion in the upper body, but you can still do a lot with your lower body. And then because of that patients and survivors, patients in particular aren't necessarily told about the benefits of exercise. Sure, they get handed a pamphlet for the most part, but a lot of them did – there's no one with the expertise or the time to sit down with them and squash a lot of those fears. Again, in terms of, am I going to make the cancer worse, they get a lot of advice to be concerned about pain in terms of how to treat it. So a lot of them are concerned about DOMS and how we need to explain to them that DOMS is okay, the severe acute pain maybe is not understanding that, educating them on again you are not going to make your symptoms of nausea worse, you are not going to make your fatigue worse, this is actually going to help you. So understanding that is, and educating the patients is a huge part.

And then professionals is interesting – I mean, physical therapists obviously have a lot better

understanding in terms of the range of motion issues. They tend to be a little bit more conservative and they will only, as their profession dictates. But if you come in for a range of motion issue in your shoulder from breast cancer, they are really only going to fix the shoulder, but they are not going to look at it globally. I haven't had too much experience with personal trainers in terms of their fears, a lot of people who come to me are just excited about the field and want to learn about again these modifications. I haven't had too many professionals come to me and say I am worried about working with them, it's more just saying I don't know enough about it.

DANNY LENNON: Right, perfect. To try and start wrapping some of this stuff up, kind of what I alluded to previously, in terms of where we go from here, you obviously said before this becomes a kind of standard of care, we've got quite a way to go. So in terms of where the field goes from here, there's probably on two counts, number one, practically getting this into use more often with more patients and survivors and then two, more so probably in your side, on the research should where do you think the next few realms of research has to go within the next couple of years that will help us answer some of these questions better, what are the big questions that we can really get some good answers to over the next few years do you think through research?

CIARAN FAIRMAN: Probably the biggest thing in actually getting this established is ultimately going to be cost-effectiveness work. There's a couple of companies here in the states that can pay for certain parts of cancer rehab, but at the end of the day, policymakers are not yet willing to give you X amount of money to go to an exercise program. A lot of that stems from we don't have billable codes, you are going for an ACL injury, they know what to code for each of them for range of motion or for whatever it is. We don't have those codes set up in cancer rehab. But we also don't have enough evidence to say this is what a year of cancer rehab will cost and this is how it's going to affect quality of life down the line, which – that's the redline for a lot of these institutions.

The other side of that is that – I mean, we work with a prostate cancer doc here at Ohio State, and he makes the comparison in these insurance companies that we underpay 300 grand for around the chemo that may or may not extend someone's life a few months. But they won't put that same 300 grand into developing a facility that will help hundreds of patients and staff them for a couple of years. So that's our frustration, I think that's one of the biggest areas that we need to really push forward. When you talk about narrowing that gap between where we are at and when it actually becomes a standard of care, the cost of net effect in that.

One of the more really exciting things is the tumor might go environment and the biology of exercise. We talk about globally, you can see improvements in strength and physical function and quality of life. Now, we are starting to look at mechanistically what's going on and why is that occurring, how like Lee Jones how can exercise affect tumor vasculature. Rob Newton is leading a worldwide trial in 10 different countries and almost 1000 prostate cancer patients, again looking at how resistance exercise can affect tumor biology against markers of progression, against disease free survival. So those things where you are really getting deep down authority into the mechanisms, I think that will again give us so much more, I don't want to say creditability, but just give so much more support to what we are doing in terms of this. It's not a correlation, this is cause and effect.

DANNY LENNON: Awesome, yeah, it's going to be really fascinating to see how this develops and as more and more stuff comes out, and this hopefully becomes more and more mainstream and standard of care, it's going to be fascinating to see that research emerge for sure. Just before we get to the final question, CIARAN where can people find more about some of this work online and if your published articles, if you are on social media, any of that type of thing, where are places they should visit online?

CIARAN FAIRMAN: Yeah, so I am most active on Twitter @CiaranFairman. That's where you will see almost all of my exercise oncology work and just ramblings and thoughts. I also have my own company where I work

with professionals and patient survivors called REACH Beyond Cancer, go to reachbeyondcancer.com. And I have a podcast dedicated to this whole field called the REACH podcast. So if you Google REACH and cancer podcast, it should pop up, it's on iTunes and Twitter, and again, I have these episodes dedicated to diving into the specifics, so that's a fairly new one and I am getting a lot of good feedback about that. But other than that I am on Instagram, but you just see pictures of me in various cities. It's not [crosstalk 00:54:40].

DANNY LENNON: Awesome. And for everyone listening, I will link up to all of that stuff in the show notes. So please do go and check out and I am sure if you found today's conversation interesting, you will get a ton more value from the work everyone is putting out there with this podcast and any of the other stuff that he just mentioned. So with that Ciaran, we come to the final question we always end the show on and of course it's going to be do with any topic even outside of today's theme, and that's if you could advise people to do one thing each day that would have some positive impact on any area of their life, what would that one thing be?

CIARAN FAIRMAN: Reflect. We talked about my journey. I went from a big city in Dublin relatively to a very small rural town in Kentucky and being in a completely different environment around a completely different culture and mindset. It caused me to be a lot more introspective into who I was, how I carried myself, what I wanted to be and being looked from your family and friends at such a young age, again it caused me to be who do I want to be. And that has carried me throughout my graduate education and I've really enjoyed having that mindfulness and reflection almost daily in terms of what are the decisions I am making, I give myself personal accountability on how can I use that as a tool to continue improvement on progressing in both my professional and personal life.

DANNY LENNON: Brilliant. Great piece of advice and I think an excellent way to round out the episode and I want to say thank you so much for taking the time out to do this today and for the great information you've given, but also for the great work you continue to do, it's a fascinating

area and I've really enjoyed reading some of the work that you've put out as well as the other research in the field. So thanks so much for your time man, it's been great.

CIARAN FAIRMAN: Absolute, pleasure, thanks for having me.

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