Huffines Sports Medicine Podcast –

Dr. Karyn Esser – 9/19/14

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S1 00:11 Welcome to the Sports Medicine podcast brought to you by the Sydney and J.L. Huffines Institute for Sports Medicine and Human Performance in the department of Health and Kinesiology at Texas A&M University. At the Huffines Institute we're always working to facilitate, apply, and bring you the most up to date coverage of the wide world that is sports medicine and human performance. All in a language you can understand and share with your friends. And now here is our host. The Director of the Huffines Institute, Dr. Tim Lightfoot.

S2 00:40 Hello and welcome to the weekly edition of the Huffines Institute for Sports Medicine's podcast of the week. We are back from our summer vacation and we're so glad that you've all taken the time to download us and listen. Today, as we have every week since we initiated this podcast about three and a half years ago, we have a very interesting individual in the world of sports medicine and human performance, Dr. Karyn Esser, who is the director of the Center for Muscle Biology at University of Kentucky. Welcome to the podcast, Karyn.

S3 01:08 Well, thank you. It's great to be here.

S2 01:10 We're glad to have you. I'm going to tell the audience a little bit more about you, and then we'll just jump into the podcast. Dr. Esser has a PhD from the University of Michigan. As I noted, she is a professor at the University of Kentucky and a director of the Center for Muscle Biology. She has some really interesting things going on with a muscle growth project, the circadian rhythm project, and all those other things that we're going to get into. It sounds like it's going to be a fun conversation. Tell us a little bit. How did you get into and why are you interested in muscle biology?

S3 01:42 That's a good question. I was a field hockey player as an undergraduate at Wake Forest University, and was coming in one afternoon from practice, and ran into some people who were working in the Human Performance Lab, and struck up a conversation. At that time, many years ago, they had a cardiac rehab program. That really changed my professional career because I started - I was sophomore in college - and I started working in the cardiac rehab program. And at that time, I was involved in ECG preparation. So that got me thinking about just the adaptability of humans, exercise. I was an athlete, so that was very relatable. But the focus on muscle really came in my PhD work at Michigan. When I started my PhD there, I was working with Tim White's lab. And again, there's a lot about having that rich environment. So we had a number of people at Michigan, John Faulkner, Bruce Carlson, any number of people that were world experts in muscle, muscle regeneration. It just fascinated me how muscle could just adapt and adjust to both use and disuse.

S2 02:56 It is really cool to add tissue because it gets bigger, it gets better in so many ways. It's been interesting to watch the field of exercise physiology over the years, how there was so much focus on aerobic fitness and so forth. Now, it's really very specific, and there's a lot more people looking at muscle now than there has been in the past. Why do you think that is?

S3 03:18 I can remember having a conversation with actually the provost at the University of

Illinois, Chicago, about this - why were we studying hypertrophy and why weren't we doing more in terms endurance. I think the point that I made with her is that if my dad or my mother isn't strong enough to get out of the chair, if they don't have the strength, if they don't have the power to initiate the movement, then endurance is meaningless. I think as we've seen with the aging population, and me being part of the Baby Boom contingent here - loss of lean mass, loss of strength, changes in quality of life, increases in mortality falls, all those kinds of things - the issue of strength has come more center stage.

S2 04:06 When we talk about human performance, so many people think that we're just talking about athletes. But in reality we're not. We're talking about healthy living in general, especially for an older population.

S3 04:15 Absolutely. And one of the things we're doing at the University of Kentucky Center for Muscle Biology is actually looking at the role of muscle weakness and wasting in a variety of chronic diseases. Liver disease is another one where the progression is really not very pleasant. The physicians really have no good management plan until they can transplant somebody. Muscle is such a large compartment in the system, and the muscle gets weak and these patients just start spiraling. So we're looking at trying interventions, obviously not to fix the liver disease per se, but if we can improve the muscle strength and mobility, this will have an effect on the progression of the disease. If nothing, the quality of life, obviously.

S2 05:01 That provides a really good justification for certainly why you have the Center for Muscle Biology at the University of Kentucky. Tell us a little bit more about that. Tell us about the center and what you guys are doing.

S3 05:12 The center is great. It's been a lot of fun. Actually, it was started by someone, I think that has been here before, Dr. Michael Reid. He came in as the chair of physiology, I think in 2003, at the University of Kentucky. I was in the first cohort of new faculty recruits to the department. His vision was to create a strength in skeletal muscle-- or striated muscle.

S2 05:37 That's a nice pun by the way. The strength in skeletal muscle [laughter].

S3 05:40 Yes, exactly. We were a strong muscle not a weak muscle. It was really an exciting opportunity to have really well-established, outstanding research scientists as colleagues, but in a way that was complimentary. So having people that study stem cells or satellites cells versus, in Mike's regard, reactive oxygen and wasting. And we have some biophysicists. Actually, the members of the center cross eight different colleges on campus. Some muscle is part of meat. So we have people from agriculture come over, and they care about it. Maybe not exactly like we do, but they do care.

S3 06:26 I think as the director - I took over director in 2010 - I think the main role that I have is actually working with the membership to try to help coalesce resources as I can from College of Madison, and identify ways to help some of the basic science and some of the people doing more applied work work together, set up research teams in areas. Maybe that will be stroke rehabilitation, so we have some people working with stroke patients. We have others, like you said, with the liver disease contingent. Aging is an area that we have some strengths. Really trying to help people achieve their research goals, but also growing the impact of the center, and that includes both funding, as well as outreach. We work with YMCAs, and helping them with some of their programs.

S3 07:27 In particular, I'm working with a colleague in kinesiology. We're going down to work

with kids down in Clay County Kentucky, which is a very rural and very impoverished county. If anybody had read, there was an article in the New York Times about ten of the worst counties in the United States, in terms of socioeconomic, health status, education. And Clay was in the bottom five. So this is a really tough county, but working with these kids we see an opportunity to, hopeful, to improve things like their activity levels and getting them engaged in math, science, health related things. The centers activities really range from things in the hospital to community outreach, and everything in between.

S2 08:14 So you really described your role as administrator very well.

S3 08:19 That's sad.

S2 08:23 It's necessary, as we know, as you and I both know in this business. Tell us what gives you up in the morning as far as your science goes. What are you really passionate about? We've got a couple of areas on my cheatsheet here, but--

S3 08:33 No. It's circadian stuff. Absolutely.

S2 08:35 Tell us about what circadian is. Are those the things in trees that make noise? Are those circadians?

S3 08:38 No. Yes [laughter]. Exactly. No, circadian rhythms. I say to many people, it was an accidental scientific change of directions. As you referred to, my lab has historically had been studying how skeletonal muscle, senses, mechanical tension, how it takes that mechanical information and converts it into a anabolic or a growth response. Basically, why does weightlifting work and give you bigger muscles? In the process, we were doing one of the first generation unbiased gene array profiling experiments in the early 2000s, and looking for genes and muscle that were changing when we did high force contractions. Fortunately in those days, we weren't looking at tens of thousands of genes. We were only looking at 8000, so it was a lot easier to manually look through the list.

S2 09:39 Nowadays, you get a read back of 8000, you go, "I've got nowhere to start."

S3 09:43 Where do I start? Yeah. I can even remember where I was sitting in my office. I looked at this one gene - the name of the gene was BMAL, B-M-A-L 1 - and I'm just, "I don't know what this is." Thankfully we had PubMed, so you went in and did PubMed. In the old days I would have had to walk to the library. The more I looked into this, the more fascinating it got. This was a gene that was involved in what is called the molecular clock. So a time-keeping mechanism in cells. That historically had been believed to be only in the brain. But here it was, changing in our muscle. Fortunately for our design, our control was actually from the contralateral non-stimulated limb, so we actually had control for time in there, which was an accident [chuckles], a fortuitous one.

S2 10:33 Science works like that though, doesn't it?

S3 10:34 It does, absolutely. There are a number of things that just got me very passionate about this. One was the fact that circadian rhythms are ubiquitous on the planet earth - they're in bacteria, they're in plants, they're in insects, and they're in humans. As someone that had training in biology and a physiologist, it's like, "Well, why would they still be in muscle if it didn't matter?" But the other fortuitous and lucky part of this was, I sent off an-- so I was reading a review, fascinated. One of the authors of the review was a guy by the name of Joe Takahashi. I just didn't know who he was, dropped him an email, and just said, "Look, we're seeing this gene change and skeletal

muscle after contractions. You're a clock person. What do you think?" He responded within half an hour. I often wonder, if he never responded, I just would have walked away. He was enthusiastic because that was the time they were realizing that cells outside the brain had clocks. So the field has been very-- at least from the mammalian science, it's very neuroscience oriented. So I ended up doing a sabbatical, which I recommend to any academic person. Just take a break from what you're doing, go up an immerse yourself in something that you just get really excited about.

S2 11:55 To do something different [?].

S3 11:57 What's been really fun about this is that fact that part of circadian behavior is physical activity. So this is also bringing me full cycle. I started it as a-- I had a masters degree in Exercise Physiology, my PhD is in Kines. I've been a muscle Scientist or Biologist or Physiologist for many years. But now by moving in to circadian rhythms, I'm actually able to logically bring the whole training together - and it's fun. The idea that activity is all a part of something that's naturally timed and programmed in us. And conversely, what time we're active actually feeds back information to the clock systems in our body.

S2 12:44 Really?

S3 12:45 Yeah. I'll be presenting some today at the seminar. But it's gotten me thinking about my own-- most of us don't think about what time we do things as actually mattering. Whether we do it at 8:00 in the morning or 8:00 at night, as long as you get it done. But there is a growing body of literature that says, "No, there is a difference." I think the fact that exercise actually feeds into the timing and the synchronization between organ systems within the body, provides an interesting, but very hypothetical model, where one of the roles of physical activity could be to help support systems talk - systems interactions, systems synchronization.

S2 13:37 Do you think it would also help training responses?

S3 13:40 Yes.

S2 13:42 On a personal level, I know if I run early in the morning, it's terrible usually. I do not like running early in the morning. But if you get me afternoon, I'm good - I feel good about running, I usually perform better, et cetera, et cetera. So does the difference in the time of day not only support different systems, but maybe it changes the training responses?

S3 14:01 Absolutely. Absolutely. There are some groups in Europe - and I apologize, because I don't remember their names right now - but they've actually done some really nice studies with humans, and showing that you are stronger in the afternoon than you are at the morning. They've coupled that with looking at-- because I thought, "Well, you're just sleepy. Your brain's not working." But based on the data with EMGs, it would argue, "No. It's not EMGs. It's actually potentially coming from the muscle itself." So there's that. If I talk to most people that I know that do weightlifting, almost all of them, unless they have to work out in the morning, they all go in the afternoon.

S3 14:40 The other thing though, too, that you raised-- because I'm a morning runner. I'm reverse of you, so if you try to make me run at 3:00 in the afternoon, I can do it, but it feels horrible. This is the mess that is humanity. We have different-- what are referred to as chronotypes. Generalizable there's the lark and the owls. They're those people that are early morning larks, and there are those people that are owls. There obviously a lot of overlap between that. But I can even look in my lab. I know those

that, as hard as they try, getting into the lab at 10 in the morning is probably the best they can do. But they're gonna also stay until later at night. Whereas I like getting going at 6:00 in the morning. But once you get me past 7:00 or 8:00 at night, then don't ask me to think too hard - unless there's a grant due the next day.

S2 15:37 We all make exceptions for grants, right?

S3 15:38 Yes.

S2 15:39 So does the physical performance, is that correlated with cognitive performance as well? I do better cognitively in the morning.

S3 15:46 Right.

S2 15:46 Whereas I do physically better in the afternoon.

S3 15:48 I don't know. That's a great question, and I am not aware of anybody that's actually tried to look at both of those in the same population. So I don't know the answer to that. I think it depends.

S2 15:58 On the individual [chuckles].

S3 15:59 Yeah. There's actually some big movements going on right now, because one of the other ways that one can look at this is if you look at maturation. So during adolescence there is a huge shift in the timing of the clock - from elementary school years to high-school years. If you look around now, high-schools are starting to start later. What they found is young people in that age bracket, it's more natural for them to go to bed later, to wake up later. If they actually get school to start later they're seeing changes in ACT scores, SAT scores, that kind of thing, saying, "Look. They're not being lazy. This is their biology that's driving their sleep patterns."

S2 16:43 So how does a master clock regulator in a muscle regulate performance or the strength? Is it through a neural system?

S3 16:53 What we know at this point is that every single cell in your body has its own clock. So if you think of it, each cell has its own watch. That watch is going to work on an approximately 24-hour cycle. What we have learned is that what that clock is doing in terms of this timekeeping, is it is targeting arguably 10 to 20% of the genes in that one cell. You'll see very dramatic changes in a cohort of genes from day to night. You can see four to five-fold differences in, let's say, a troponin - a part of the muscle thin filament system. One of the troponins is under circadian control, so it's going to be higher during the dark phase and lower during the light phase. I can't say I can sit here and molecularly explain how the clock is affecting strength yet.

S3 17:50 But we can come up with some hypotheses that there is also a tight link between that clock and metabolism. What we know going from, in terms of humans, going from day to night, we shift our a preferred substrate. Some of that is behaviorally, but some of it's the clock. It just says, "Okay. We're now going into the night. We're now going to start switching over into more fat, less carbohydrate as a fuel." So I think when you time some of these metabolic changes with athletic performance. If you're going for power and fast, and your body's saying, "No, I'm just going to hang out over here in fat metabolism," it's not that you can't do the performance, but it's probably not going to feel as peak. You're not going to peak on that.

S2 18:40 That [outsight?], I would think, have some interesting applications about performance in general when you talk about individual in competition, or teams in competitions? What do you do if you're a coach and you're here in this podcast going, "Oh my gosh.

That's another factor I hadn't even thought of that we've got to control for?"

S3 18:55 Someone in the circadian field took major league baseball, and looked back over the years at the data on records from teams travelling from west to east. What we know from the circadian field is, it is harder to do what we call a phase advance, so that would mean taking someone from California and dropping them off in Boston. The adjustment that way is more difficult than if I go from Boston to California. What he did was, he looked at those teams that were going from west to east, and then had to play that night or the next day. The win/loss records were just-- it was fun study. It was not scientifically controlled, but it clearly suggested that performance was impaired in that first game after that travel. I actually know some colleagues in the horse industry, being in Kentucky and thoroughbred land. They pay a lot of attention to make sure that the animals get to the track at least a few days before performance. When you look at what countries do before the Olympics, adjusting to food, adjusting-- part of that is adjusting circadian; some of it is sort of more cultural. But getting into a regular sleep-wake pattern, getting into a regular eating pattern, all of that helps support keeping your circadian system synchronized.

S2 20:26 Fascinating stuff. One of the fun things about you and I at our phases in our careers, we can move back and see all the things that are different now than when we went to school. So when we talk about muscle biology, what's a big one that really sticks out you? Obviously the circadian rhythm stuff that is really changing a lot. But what is the biggest fundamental change you've seen in the understanding of muscle biology?

S3 20:49 I would say, I think the whole concept that muscle, like other tissues is an endocrine organ, so it's secreting. I think we are just at the tip of the iceberg on that one. When muscle contribues 40% to your body mass, then one muscle by itself may not be much, but when you combine all that, it actually can have a very profound effect on the system. Like I said, we're starting to see some of that. I think that's just going to continue to grow. So muscle doing things beyond just generating force.

S2 21:24 You know you just blew up the heads of several biology teachers that listen to this, right?

S3 21:29 I know. Yeah [chuckles].

S2 21:32 That's okay though. That's the fun stuff, right?

S3 21:34 I'm obviously very biased both by my role as a scientist and living in muscle, but also as a director of the center. One of our goals is to get people-- and when I say people, people in the health care industry, because most clinicians or anybody in healthcare, apart from physical therapists, don't get background in muscle. You get cardiovascular, you get neuroscience, but muscle's just not-- you don't get exercise. Maybe you get a little of nutrition. One of the things I always say is that I think we are starting to come into the time that muscle will have a place in health care. Especially when we think of chronic diseases and aging, and all these things, I think this is going to become important. I don't know, it's funny you say that because I can remember a cell biology teacher in my graduate program in Michigan. When we got to the muscle section he just said, "We know everything there is to know about muscle. There's actin, there's myosin. Let's go on." There's still a lot to learn from a performance perspective, but also from a healthcare perspective.

S2 22:44 All you have to do is look through the literature, when you're talking about sarcopenia and muscle wasting. The emphasis on that, and how that's becoming's--

S3 22:50 Cancer cachexia.

S2 22:51 Yeah, such a prominent role. Karyn, it's been great to have you here today. Thank you so much for being with us.

S3 22:55 Thank you. It's been a lot of fun.

S2 22:57 What we do with our guests is we give them an opportunity to give us a take-home message. The one thing that you want the audience to remember after they've listen to this broadcast.

S3 23:04 One thing is a hard one for me. But okay, if there's one thing you are to take home from this podcast, time of day matters. Sleep matters, time of day matters to your health.

S2 23:17 Excellent. Good take-home massage. Thank you again for being with us.

S3 23:20 Thank you.

S2 23:22 Thanks for being here at A&M too. It's great to have you.

S3 23:22 Yeah, it's fun.

S2 23:24 I want to thank all of you that have been listening for taking the time to download us. If you're a regular listener to the podcast, you know this is the time when we turn the podcast over - somewhat dangerously, at times - to our producers and they give us the podcast take-home question of the week.

S4 23:39 What travel adjustment is harder on sports teams? West to East or East to West?

S2 23:44 I thank Galen for that question. Again, the first person to e-mail us the correct answer at HuffinesPodcast@hlkn.tamu.edu will win one of our nifty podcast t-shirts. We actually have the new editions in, so send those e-mails quickly. Again, thank you all for taking the time to download and listen to us. And we hope that you join us next week when we have another interesting person in the world of sports medicine and human performance with us. Until then, we hope you stay active and healthy.

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