Huffines Institute of Sports Medicine Podcast With Dr. Mike Reid

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| S1 00:00 | Hi, this is Tim Lightfoot, the director of the Huffines Institute for Sports Medicine and Human Performance. We're really excited to tell you about the event coming up. We hope that you're close enough or you're near one of our satellite sites to see it, and that's the Huffines Discussion 2013. This is the one where we bring in guest speakers from all over the world, that are going to tell us their big ideas about the role and the future of Sports Medicine and Human Performance. Join us in November the 15th, 2013 from one to four PM here on site at Texas A and M at the Annenberg Presidential Conference Center. You can also go on our website at huffinesinstitute.org. Go over to the news, and pull down to where it says Huffines Discussion, and you can find a list of all our satellite sites around the country, that will be simulcasting the event at the same time. Join us on November 15th, 2013 for the extraordinary Huffine Discussion three [music]. |
| S1 01:25 | Hello and welcome to the weekly edition of the Huffines Institute for Sports Medicine and Human Performance podcast. We're so glad that you took the time to download us, and that you've taken the time to listen. I'm your host, Tim Lightfoot and again every week we bring you an interesting individual in the world of sports medicine, human performance, general health, and just sometimes good old physiology every once in a while. Today is no exception, we have a distinguished scholar with us in the Huffines Institute podcast studio, Doctor Michael Reid. Welcome Mike, to the podcast. |
| S2 01:56 | Thank you very much. It's great to be here. |
| S1 01:59 | It's really great to have you here. Let me tell the audience a little bit about you, and why we have you here, and then we will jump into the conversation. Dr. Reid is currently a professor of applied physiology and kinesiology, and he is the dean of the college of health and human performance at the University of Florida. He has a PhD in Physiology from the University of Texas at Southwestern Medical Center at Dallas. He has huge number of awards, both teaching and research-wise over his career. One of his faculty stops was at Harvard, it was in the Baylor College of Medicine, and he was most recently at the University of Kentucky before he went to the University of Florida. He has published over 130 scientific articles. He's got well over 200 presentations out there. He's maintained an unbroken record of federal external funding for over a quarter of century. His research team was the first to demonstrate the skeletal muscle produces reactive oxygen species, and the first to identify nitric oxide as an endogenous modulator of muscle contraction, which we are going to talk about a little bit. And on top of that he's a really nice guy, as well. Plus he drives race cars for fun as well, so he and I have that in common. Again, welcome to the podcast. We're so glad you're with us this week. |
| S2 03:12 | Tim, thanks. It's terrific to be here. |
| S1 03:13 | You're welcome. And I will say up front that Dr. Reid is visiting because he's speaking as one of the future speakers for the Texas American College of Sports Medicine. If you'll hit our departmental website, and actually put the links up on with this podcast, you can see his talk that he gave today, which was absolutely fabulous, which will actually augment some of the things that we talked about today. Mike, you do a whole lot of work with oxidative stress. That's a big phrase and people go, "Ah." They run away. So, what is oxidative stress, and why should we even care? |
| S2 03:45 | That's a great question. It's actually not a trivial question, because there are a fair number of scientists who differ over what that word means, so they use it |

differently. I think, by in large, when people use the word oxidative stress, what they mean is that there is a biological environment in which the oxidants - they exceed the normal amount or the normal ability of a cell to buffer oxidant activity, so that you develop an oxidizing environment which then modifies protein's DNA, even fats and carbohydrates in such a way that the cell is altered it's functional properties. Say in muscle for example, muscle contraction can be different, or gene expression can be different, or signaling pathways that regulate how a cell functions, or how it adapts can be modulated. And that perturbation is often associated with a stressful condition, say disease or damage or injury. So under those conditions, the fact that free radicals are elevated and bad things are happening at the biological level, folks would usually use the term oxidative stress there.

S1 04:48 That sounds scary [laughter].

S2 04:52 Yeah, it does sound scary. I think all too often, one of the conversations that we had earlier today centered around the issue of free radicals as bad guys or good guys. I think free radicals are usually assumed to be bad guys, but they may get a bad rep sometimes. They are normal part of the cellular environment, or normal part of the milieu in which our cells function, and they're necessary for normal cell function, so they've got a good cop, bad cop role, I think.

S1 05:20 Yeah. A few weeks ago, we had John Lawler talked about reactive oxygen species and free radicals. And it's interesting, the image people have a free radical surrounding around the system [laughter]. But I like your phrase, they may get a bad rep sometimes.

S2 05:36 I gave a seminar yesterday at a different university, and one of the questions back was, why do you want to free the radicals? It took us a long time to put them off [laughter].

S1 05:45 To put them off for a while like that, actually. That's good. So, are there any benefits to this kind of oxidative stress in the body?

S2 05:51 Sure. Absolutely.

S1 05:51 Considering again, it sounds scary. But it's like--

S2 05:55 So there are transient events in our normal functions. We're muscle guys, and so we think about exercise, for example. During exercise, you get a big increase in free radical production and you get transiently for a short period of time. You get a biochemical picture which suggests that t's oxidative stress. What it is, is it's a pulse, or a transient increase in oxidant production, which then functions as a signal for the cell. So the cell says, having to deal with more free radicals once in awhile, so maybe I should adapt for that, so in the same way that the muscle will adapt to running and get better at running, or a muscle will adapt to weight lifting and get stronger. A muscle will adapt to oxidative stress so that it's better buffered, it's better able to deal with the stress. A lot of times, it actually can be a good signal. It can help a muscle, or help the brain, or help the immune system adapt in such a way that it will function better under stressful conditions.

S1 06:55 There's so many supplements we hear about today that talk about antioxidant properties, so I guess some of these companies are focusing on maybe or perhaps the bad side of oxidant stress. That has opened up a whole can of worms, yes, but what's your impression with all of that?

S2 07:15 I think any oxidant can often be extremely good for a company's bottom line, and in that regard--

S1 07:21 For a company's bottom line.

S2 07:21 A company's bottom line. So, you've got to agree for the good side on that. Whether or not excessive supplementation is good for your body, is a different

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| | question altogether. I don't think there's much evidence that taking very high levels of antioxidants do anything beneficial for a normal healthy body. I think if you are deficient in vitamins, then that can make you sick and you can fix it by taking vitamin supplements. But if you are well nourished already, if you're taking in normal fruits and vegetables and your antioxidant nutrients, you're getting them in adequate doses, then taking more than that isn't going to make it better. |
| S1 08:00 | Otherwise, you're just flushing that stuff down the toilet? |
| S2 08:03 | Yes, absolutely. How many extra nuts and bolts will make your car go faster? Once you've got enough, you've got enough. |
| S1 08:11 | If they're missing, you want to replace them. |
| S2 08:13 | Otherwise, you're fine. |
| S1 08:16 | What is this role of this thing called nitric oxide in fatigue and pain and weakness? |
| S2 08:22 | That's a terrific question, and it's complicated. I can tell you a little bit about what I know, with the understanding that there's a much larger literature out there. |
| S1 08:30 | They can watch your talk. If you're listening and you want to know more about this, watch the video. |
| S2 08:36 | That's right, and there'll be a question later. You may be able to win a t-shirt. |
| S1 08:39 | Thank you. |
| S2 08:40 | Thank you. I'm here to help [laughter]. So, nitric oxide exists in biological systems, and the major sources from enzymes that make nitric oxide. |
| S1 08:57 | This is not laughing gas that you get in the dentist office? |
| S2 08:59 | No, it's not nitrous oxide. |
| S1 09:01 | Good point. |
| S2 09:01 | A lot of people get that wrong. |
| S1 09:03 | Nor is it the stuff that goes in bottles in the back of racecar. |
| S2 09:07 | Nitrous oxide. |
| S1 09:08 | That actually would have some kind of nice symmetry if that was the case. |
| S2 09:12 | It's Nitric Oxide. NO is the chemical depiction of it. Nitric oxide is made by enzymes, and it's used by cells to signal to one another, and to regulate their own function. So, I think the most famous role for nitric oxide in biological systems is vasodilation and regulation of vascular resistance in the periphery. Endothelial cells that line the inside of small blood vessels make nitric oxide, they have the enzyme, they make nitric oxide. And that's part of the way that your body regulate your blood pressure. It's part of the way your body regulates where blood goes within tissues. It place a really essential role there. Nitric oxide plays an important role in your immune system. The white cells that kill bugs, that goblet critters and kill them in part do that by making lots and lots of nitric oxide that killed the bug. Nitric oxide plays an important role in your brain and then synaptic transmission, and how your brain function. So it's really multi-purpose, very interesting molecule for which the Nobel Prize was awarded, and that sort of an illustration of how important the discovery of nitric oxide was. |
| S1 10:26 | And this is relatively young story. |

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| S2 10:28 | It is. |
| S1 10:29 | It's only been around 30 years. Not been around, but I mean the discovery and the elucidation of what it does is relatively recent. |
| S2 10:36 | Yeah. I think the Nobel Prize was in the mid-90s. I don't remember when it was exactly. But I was part of that field, or just got into the field prior to the award of the Nobel Prize, and it was just so exciting to be part of the field at that time, and that here, the rapid progress has been made. The discoveries had been made on most - on a weekly basis. And to watch the competition among the big laboratories trying to figure out what this molecule did, in the end, a lot of the important fundamental work that nitric oxide is responsible for was identified, but we continue to identify new roles for nitric oxide. Because it has become more recognized, better known, oxidative stress has become the target for commercial exploitation. I was talking with my mom the other day who had gotten an ad in the mail, and then the ad it explained to her that as you age, you lose nitric oxide synthase and its really important to take supplements, and they were trying to sell her supplements, so that her body-- |
| S1 11:37 | That's interesting. |
| S2 11:38 | Could still make nitric oxide. |
| S1 11:41 | And there's no validity to that. |
| S2 11:42 | Not that I know of. No, I think what the pill was selling probably wouldn't have done much. |
| S1 11:49 | So there's your first tip, for the podcast audience [laughter]. If someone tries to sell you nitric oxide synthase tablets-- |
| S2 11:56 | Maybe not. |
| S1 11:57 | Maybe not. Go along with all your protein powder supplementation to build muscle. You'll just wind up putting it down the toilet. Just send the money to us, right [laughter]? |
| S2 12:07 | That's Right. |
| S1 12:09 | So, the nitric oxide is - and you've shown quite well that there's some dysfunction that happens with some disease situations. It causes problems with the nitric oxide systems, so it prevents regular muscle contraction. Tell me what kind of chronic diseases you're talking about? |
| S2 12:24 | Sure. So, we're very interested in the weakness that develops from diseases which are not primary muscle diseases, but are very well-known. For example, folks with cancer who were getting chemotherapy, folks with chronic heart failure or congestive heart failure, chronic renal disease, emphysema, other type of chronic obstructive pulmonary disease, aging could even be considered, sort of been in this category. In all these roles, rheumatoid arthritis is another one, we talked about actually this morning isn't it? These are conditions where you have low level of chronic systemic inflammation. So the body is fighting a disease process or a damage or an injury, that requires continual ongoing generation of inflammatory mediators, activation of the immune cells, and that process, wherever that battle is being fought, whether it's your heart or your kidneys, or your lungs, or your joints, there is spill over from that battle, collateral damage if you will. So you get signals in your blood, that get carried out to the rest of your body, that relate from this inflammatory process, in a very specific place. And so cells that aren't necessarily diseased or injured, healthy cells, would be subjected to these immune signals, and that can alter the way your healthy cells function. We think about that in the context of muscle. Muscle is sort of an innocent bystander during chronic inflammation, but it's |

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| | exposed to all these pro-inflammatory cytokines that the muscle cells respond to. They respond in part by making more free radicals. That can lead to the muscle cells becoming smaller, and perhaps more importantly the muscle cells don't work as effectively. So, when you try to contract your muscles you don't generate as much force and therefore, you become weaker. You're more likely to become fatigued. And these are side effects of disease, of chronic inflammatory disease, which patients often complain about more than they complain about the disease itself. The fact that they're just so exhausted all the time. |
| S1 14:37 | Yeah. The things that you're talking about is not a result of-- for example with the rheumatoid arthritis, it's not a result of them not moving because it hurts, there are real biological pathways that are being inhibited to prevent the muscle from being as strong as it can normally be? |
| S2 14:55 | Yeah. Exactly. Certainly pain and physical inactivity, if you don't use your muscles, they will become they will become weaker, and they will become smaller. That probably plays a role in disease,but there's this other more insidious process going on that is probably the dominant cause of weakness, and it's beyond what folks do or don't do for themselves. It's pretty hard to ask a really sick person to exercise a lot. |
| S1 15:21 | Right. |
| S2 15:23 | So they're subject to this inflammatory stimulus and they don't have the opportunity to exercise and make it better, and one thing leads to another. |
| S1 15:30 | What can they do? What kind of treatments are being developed to actually interfere with this process? |
| S2 15:35 | That's a great question. Up to this point, we have not had many drugs on the market that are designed to protect or preserve skeletal muscle function, but that is changing. The pharmaceutical industry is aggressively pursuing a variety of strategies that could enhance muscle function. They could make muscle resistant to inflammation and inflammatory stimuli. So those types of drugs might act on the cell itself, to alter the way the muscle cell works, say release more calcium, give a bigger signal, allow the cell to contract more forcefully for example. Or it could work outside the muscle cell to protect it from the inflammatory signals that are causing it to get weak. I think that - well now, we don't have much to offer in the clinical setting. I think in the coming, the next three to five years, we'll see several new products that are pretty exciting, that have real potential. |
| S1 16:32 | The muscle wasting and weakness is a huge problem. Some of the disease stage, I think with cancer and some things that go along with that. |
| S2 16:43 | There's standard drugs that certainly will make muscles bigger. Anabolic steroids will make muscles bigger, the weightlifters have shown us that. Growth hormone, insulin-like growth factor one, IGF1, these are hormone-type molecules that will make muscle bigger. But they also have serious side effects. And their side effects that most physicians don't want to impose on their patients. And the side effects can be worst than the lost of muscles mass itself. So to get beyond those crude tools, they should develop more refined approaches, it's going to be great. It's going to be terrific. |
| S1 17:16 | Let's change gear for a second. One of the things that we tried to, is we try to help people understand how you've gotten to where you are, because that pathway is - actually for me is very fascinating in the scientific world. Because we've all gone through quite a bit and from the introduction people heard that you've had quite a few great experiences. So what's one piece of advice you'd give to students that are striving to have success in academic research, or in the |

academic world?

S2 17:46 So if I'm limited to one piece of advice--

S1 17:50 You know what? We will just take the limits off [laughter]. Unlimited.

S2 17:54 That's scary. Let me just start with one. I think the one thing - this comes from a several conversations over the last week that have been really fun. When push comes to shove, it's not the brightest person who makes the best contribution in science. It's not the person with the best education necessarily. It's not the person who has the best tools or techniques necessarily. And it's not necessarily the person who gets the grip the first time and I submit. I think it's the person with the most persistence. And it's hard to know where that persistence comes from. I think it varies among individuals, but folks who just won't quit, who refuse to give up, who are insistent on pushing their line of research ahead, and are insistent on finding answers, and finding way to keep themselves funded, and finding ways to stay at the table and keep it going, those are the folks in the long run survive and make it through to a full career. I think if you're easily discouraged, or if you need things laid out in neat little patterns, and you expect things to always go your way, do not get into research. It's a much more messy world than that. It's a really entrepreneurial world. I suspect that being a basic scientist in an academic environment at least, is a lot like being a small business person. You've got to overcome the financial problems, you've got to deal with personnel issues, and you've got to somehow develop - I hate to say a product, but you've got to develop scientific research, and facts and data and a story that people want to hear. And so, that takes time and it takes time to mature, and you have to learn how to talk about it and present it. You have to learn what's important. Often times what you think is important about your research is wrong [laughter].

S1 19:35 That's right.

S2 19:35 The important stuff is the stuff you didn't really appreciate, but it comes out anyway. I think persistence is a big part of it. You have to have a love for it. A fire in your belly.

S1 19:44 A friend of mine once said, 'If you want a funding agency to give you a million dollars, you've got to prove to them why you're worth a million dollars.'

S2 19:49 Exactly.

S1 19:51 If you think it that way, that's kind of--

S2 19:53 Imposing.

S1 19:54 Yeah. It's hard for people to answer with a straight face, isn't it? As you've come through the ranks, did you think back about your career? Was there a decision point, where you said this clicks, I'm going to be a scientist, or I'm going to go back and sell hardware? Not that you ever did.

S2 20:12 No, that was not a trivial question. Going into doctoral program, I wasn't sure where I was going with my career. And I think for me, the switch flipped during my postdoctoral experience in Boston. I was at the Harvard School of Public Health, I was working in a small close-knit group of scientist in the respiratory biology program. My mentor at the time, Jerry Mead was a fabulous scientist and a wonderful role model. He recruited to that group - there was a floor full of people, all of them were smarter than me, and I spent time there learning how these folks thought, and seeing what was fun about science, and understanding what it was about. Ultimately, I found a line of research that was really mine, it wasn't theirs. It complimented what they were doing. It was a useful contribution to the team, but this was my question. And suddenly, I was staying up nights wondering what the answer was, and I couldn't wait to get back to the

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| | lab to analyze the data, and I really wanted to come in on the weekends and work more. And when you see that in yourself, you realize that this now has become your issue. It's not something someone is asking you to do, it's not something you're supposed to do, but you want to do it because you have a passion for it. And I'm confident that's when the passion first arose, was in that environment. |
| S1 21:33 | That's really cool. So, look for what turns you on and go forth. |
| S2 21:36 | Seriously. |
| S1 21:39 | It's been great having you here today. |
| S2 21:40 | Thank you very much. |
| S1 21:40 | Thanks for taking the time to do that - this conversation. At the end of every podcast, we let our guest give us one take-home message for the audience. If there was one thing that you want the people listening to remember about this podcast, other than the fact that we want you all to watch the video [laughter], what would the take-home message be? |
| S2 22:01 | Let's see. For today, how about caveat emptor? All those products that are available on the market, pay attention before you spend your money. Think about it hard. |
| S1 22:13 | Research is not as far long as people think it is. |
| S2 22:15 | No. That is so true. |
| S1 22:18 | Well again, thank you for being with us. And thank all of you that are listening for taking the time to download and listen with us. As regular listeners know, the podcasts is at this point, that we have a podcast question of the week. And with the podcast question, we have Kelly. |
| S3 22:35 | What is one role, the molecule nitric oxide has in the body? |
| S1 22:40 | Good question. Be the first one to send us that answer to that question, and you'll win one of those nifty podcast t-shirts that we've referenced several times already in this broadcast, and get them quick. They are flying out here, aren't they? Again, thank you so much for being here this week with us and listen. We hope that you join us next week for another interesting person in the world of Sports Medicine and Human Performance. And until then we hope you stay active and healthy [music]. |