

**Dr.Andy Galpin on Hypertrophy Extreme Responsibility and
the Myth of Perfect Knowledge**

PMR #132

June 30, 2016

Tony: Hey, Paleo Nation. I'm Tony Federico and you're listening to Paleo Magazine Radio, the official podcast of the original Paleo Lifestyle Publication.

This week, I had originally planned on featuring an interview with Jen Reissman of One Stop Paleo Shop. I recorded an interview a couple of days ago and I couldn't wait to share it with you. It's a conversation with Dr. Andy Galpin, a professor at the Center for Sport Performance at California State University and director of their Biochemistry and Molecular Exercise Physiology Laboratory.

Dr. Andy and I met at Paleo fx while I was moderating a panel called Swole by Science. He's one of the featured panelists and I was struck by his ability to take complex physiological processes like how muscle contractions occur, thanks to the millions of tiny protein filaments called actin and myosin and to break them down into an understandable and relatable form.

My plan going into this interview was to get Dr. Andy to reiterate the points he made during our panel discussion. What I didn't expect is that we would get into some seriously awesome side conversations about the nature of Academia by mediocre athletes make great researchers and what it's like to really train pro superstar athletes, what his father and grandfather taught him about extreme responsibility, had to cut through the smoke and mirrors of health marketing, the difference between knowledge and wisdom, how we went from being a Paleo fx skeptic to being a full-on fan, and of course how muscles work, what they're made of, and how you can make them bigger.

Before we get into Dr. Andy's interview, I want to take a quick moment to thank the sponsor of today's show, Ancient Nutrition, makers of Bone Broth Protein. When Jordan Rubin joined up with Dr. Josh Axe to create Ancient Nutrition's Bone Broth Protein, they had one goal in mind: to produce the world's first real bone broth protein powder that provided all the nutritional benefits of bone broth in a convenient and easy to use form. To put their product to the test, Jordan decided to challenge Dr. Axe to a cook-off.

Jordan: Hi. I'm here in the kitchen with Dr. Axe. Today we've been talking about the benefits of bone broth for your joints, your gut, your immune system, your metabolism, and of course your skin. We also know that making bone broth can be a little bit time consuming so I've decided to throw down a challenge to Dr. Axe to see if he can make one serving of bone broth protein faster than I can make good old-fashioned bone broth. Dr. Axe, are you ready for a challenge or are you [chicken 00:02:37]?

Dr. Axe: I'm ready, Jordan. Challenge ...

Jordan: Begin.

Tony: To find out who wins the bone broth protein challenge, go to AncientNutrition.com. While you're there, you can also find out more about Ancient Nutrition founders Dr. Josh Axe and Jordan Rubin. Check out the

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ingredients in their products and find stores in your area that sell Bone Broth Protein. All right, folks. It's time to bind actin to myosin, Paleo Magazine Radio starts now.

Dr. Andy Galpin, welcome to Paleo Magazine Radio.

Dr. Andy: Thanks, man. It's great to be here.

Tony: We had the opportunity to meet at Paleo fx this year. I was moderating a panel called Swole by Science and that was the title.

Dr. Andy: I didn't name that. I don't think you did either, right?

Tony: No.

Dr. Andy: You could blame Keith on that.

Tony: You're on the panel. I was just really impressed. I just felt like you had a great way of describing things and making what can be a little heady scientific concepts relatable. I just thought you did a really good job with that and had a good presence when it came to distilling the scientific information down into takeaways. Really that's the absolute perfect thing for podcast hosts is to find somebody who can do those things. I was like, "All right. We gotta get this guy on the show."

Dr. Andy: Awesome. I appreciate that. I made it one of my career goals. In fact, if you go back to my interview for my faculty job when I came to campus, I was interviewing and they ask you all these terrible questions about, "What do you see your career going," and all these things. Before I ever had a job, my first goal was always that it's critically important to me that I translate or transmit or transcribe scientific information into usable, tangible take-home, actionable things for individuals. To me, there's no point of doing science if you can't give someone something to do out of it. Certainly some mechanistic stuff has to be done that that's not usable and [use 00:05:12] animal models and subculture stuff but in my personal career, I try to do is I work as hard as I can.

I get looked down upon a lot by other researchers and I get criticized a lot because my goal, in fact, is actually in my official university contract is I want equal amount of what we call way or general population articles as I do peer reviewed scientific papers.

What we tried to do is is every time we finish a study, "Okay. Cool. This is published. It's been accepted. Okay. Now, how can we deliver this? Whose podcast can we go on and talk about it or how can we put this up on some page to focus and get this?" It's not to promote ourselves but it's to say, "Okay. Look. You're not reading my research papers, you know." Let's break that wall. Right? It's not happening. I barely read them. So can we put this on Instagram? Can we put this on Snapchat? I don't do Snapchat or anything

but where can we put these things so that people can't use it and can we distill that information out and say, "Okay. This is what we think is actionable." That's one thing I've worked really, really hard so I'm really happy to hear that you say that you thought it was successful.

Tony: I mean is immediately evident that that's something that you're doing well and obviously I didn't know all the work that went into it and all the current history behind that. I certainly remember when I was studying Exercise Science at the University of Florida and you'd have certain professors that could translate information and make it real or make it relatable. Then you had others that just really didn't seem too concerned in doing that. It didn't really inspire a love for the subject matter. If anything, it just led to frustration and sense of being overwhelmed and lost in this world that was very foreign and esoteric. The fact that you're doing that not just at Paleo fx when you're doing a panel but that you're doing that with your students, you're doing that with your research. I mean that's really applaudable and certainly hope that the critics don't shake you from your commitment to that path.

Dr. Andy: I'm far too arrogant for that.

Tony: Perfect. Awesome.

Dr. Andy: It's one thing actually. Sorry to jump there.

Tony: Go for it.

Dr. Andy: I want to make sure that I did mention this. This is actually one of the major reasons I said yes to come down to Paleo fx the first time 2 years ago. That's certainly not my normal place to go. In fact, [whenever like 00:07:43] you have to serve a report, your travels, your professional travels to the university for insurance purposes. When I set my stuff in there like, "You're going to a Paleo conference?"

I'm like, "No, no, no." I think this is why I want to go but honestly didn't know what to expect. I guess what I'm saying is if you're listening and if you've never been and you're like maybe you don't jive totally with the "paleo diet" or something in that is like, "Ugh, I don't know." That's exactly how I was feeling. I'm like, "I'm not going to this thing. There's gonna be a bunch of charlatans and snake oil charmers here." They really hounded me to go so I was like, "Fine. I'll go," and I was really hesitant. I had no idea what to talk about the first year because I'm like I don't even know who I'm calibrating to.

Now after 2 years, I'm like, "This is one of my favorite things to do," and I want to come as many years as I can now because it's so interactive. I think that the audience is so appreciative. I just get a warm feeling of connection so I'm not sure in promoting your conference too much but I actually thought it was perfect. I found myself 12 years being like, "I wish more scientists would come to these things because this is exactly why we do the work we do."

Tony: That was awesome.

Dr. Andy: Seriously, you guys are putting this thing together for not what I thought it was going to be but I thoroughly enjoyed it.

Tony: That's great. It's certainly the goal. I think there's a lot of misconceptions about what paleo is [it was 00:09:08] certainly perpetuated by the media and they stick to these tropes of cavemen and raw meat and barechested high-intensity exercise or whatever sort of images the media likes to portray about paleo when it does talk about it at all. Not really the reality on the ground, the reality on the ground like you said.

There's a lot of people that are just really curious about health and wellness. Inquiring minds want to know what's the best way to go about doing this thing which is being healthy and happy and living a vibrant life. There's just a lot of concepts within the paleo umbrella that are really geared towards that and gear towards making people better. That's really what we're trying to figure out here. I'm glad that you felt so brought into the movement and welcome in the [inaudible 00:09:57] and you're certainly a valuable voice and that's something I witnessed first-hand.

Before we get into the subject matter for today's show and I really wanted to reiterate some of the things that we talked about in the panel Swole by Science, so that'll be the main thrust of this particular podcast episode. Before we get into that, I'd like to get to know you a little bit more. What brought you into the study of sport performance and exercise science and going down this particular path when there's a lot of different ways you can get involved in this subject matter. You can be an athlete, you can be a researcher, and you chose a blended approach.

Dr. Andy: I got in for the same reason. I think a lot of us sports scientists got into it and that's because we were mediocre athletes so if you really, really [crosstalk 00:10:51]

Tony: Just got right down to it, didn't you?

Dr. Andy: Yeah. That's reality. If I look up and down the hallway and my colleagues here, all of us were maybe played Division 1 sports but you're never going to play professionally. Maybe you played Division 2 or in my case, I played Division 3 football. I was talented enough and good enough to see, to receive enough positive feedback, to encourage me to want to try hard, to work hard because I was really lauded in high school and got a lot of awards and things like that.

I had a lot of success in college but it was still Division 3, so you're like, "Well, you can't get too arrogant. Like how arrogant can you possibly get a Division 3 school?" My point is the carrot was close enough. It wasn't so far away where I'm like, "I'm terrible," or, "I might have to work for years." I just

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barely [made JV 00:11:35] and get cut but it wasn't so close where everything was so easy.

For me, the difference between maybe making all conference or not really was optimizing my training. Everything had to be perfect because that really did make the difference. I was on that kind of good to train your ass of for a bunch years and you might get to good or pretty good or wherever that [stick 00:11:57] is for you. Honestly, that's where it was.

I grew up in the state of Washington about halfway between Seattle and Portland. I grew up with a very small high school. We had probably 80 people in my graduating class so pretty small and it was out in the country so we had no science at all. We had a Physical Science my sophomore year or something but there was no Chemistry, there was no Anatomy, there was no Physiology, no Advance AP courses, like none of this stuff. I was just super into training. I started lifting and training when I was probably 15 or 14 or something. I'm a pretty small guy so I have an older brother who is older and is still bigger natural frame. There's the story you heard a thousand times. But for me ...

Tony: Chasing after big brother?

Dr. Andy: Yeah, exactly. It wasn't like he beat me up all the time so I wanted [inaudible 00:12:58] which for the record he did. For me, it was more like I just remember being 12 or 13 years old and somebody is saying, "If you wanna get better at football, you need to train and do this stuff." I just thought, "Okay." Why would I question that? That sounded completely reasonable.

Tony: Just to kind of pause you there just because I want to paint the picture. I can think of my first efforts at working out. Being 12 years old, had a bench press in the garage, maybe went up to 100 pounds, and I would just do like one set of [this 00:13:31] many reps as I could. I'm like, "Yeah, that was a great workout," and then spend the next 30 minutes flexing. What did those first efforts, that weight training and working out, look like for you? Did you have any coaching? Did you have any direction or you're just swinging for the fences, do whatever you could?

Dr. Andy: I'm a little bit of both. I was swinging it for myself but what it was is my dad had, he got into [he wanted to 00:13:58] start to get into working out. He bought probably like an old Bowflex and one of these rowing machine kind of things but not like a rower like we think, like your legs and hips move at the same time, you go up and down, like [perfectly 00:14:12], it's really weird. I can't remember what it's called [and he thought 00:14:15] ...

Tony: It wasn't one of those Chuck Norris exercises?

Dr. Andy: No but it was like that.

Tony: Something along those lines?

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Dr. Andy: Yeah. It was basically honestly like what we would now do, we'd almost call like a hip extension, like a glute bridge machine that you just did over and over and over again. They had that. Then we had the standard \$100 bench press with the concrete-filled weights that you put on probably there. Then eventually, we graduated and got one of these multi-leg extension lat pulldown bench press row [a set 00:14:50] of multi-exercise machines.

I remember he just got a workout probably one that came with the machine or out of a magazine or something. It was like three sets of 10 of every exercise basically. We just [had us 00:15:04] kind of [painted 00:15:06] and we just wrote that on a piece of paper and taped it up against the wall. I just remember doing that. I remember never missing a workout and all of my friends would do it occasionally or we go to [the old 00:15:15] high school and we would try to lift there and they would do it occasionally. I just remember being so shocked that they missed.

I just remember thinking like, "Why the hell did you ever miss a workout?" You just literally missed a chance to get better. I just could not understand it. I was fortunate that way where it was in my mentality like they told me, "You should train 3 days a week, why would you ever not train 3 days a week?" I just could not grasp that idea.

Tony: You cracked one of the "secrets" of success which is really consistency right out the gates which that's something that eludes people well into their adulthood. Is there any particular personality trait that you can attribute that to why you would be able to say, "Okay, they said 3 days a week and I'm gonna stick to it and I'm not missing a workout and, you know, this is my path?"

Dr. Andy: Yeah. That's interesting because I'm not, like I don't typically have that personality that would not be a normal thing for me to do. I generally question everything. I'm very skeptic. This is sounding funny for running a chemistry lab for a living. I'm generally not very detail-oriented.

Tony: That doesn't sound like what I would expect you to say.

Dr. Andy: That's why you hire people that have skill set outside of you. That's normally not in me but at the time I don't know. That was sort of like, "Well, this is what you do." I got lucky my grandfather and my father and actually turned out to be my head football coach we're very, very similar where they're, all three, a very no excuses, their extreme leadership is always your fault in terms of like this is on you. It's not because you're born too small. It's because you didn't train hard enough. They told you what to do, you didn't do it. That's your fault. There was no excuses.

I spent my summers working for my dad who worked for my grandpa. We built roads, road construction. This is a 2 to 3am wake up call to drive 2 hours to Seattle to put your shovel in the dirt or the gravel for 8 to 12 hours

minimum. My dad a 12 hour work day means your shovel goes into the ground at 6am and your shovel comes out of the ground at 6pm. Not like, "Well, my alarm clock went off 12 hours between when I got back home." I mean you're there working with your half an hour lunch break and then you're driving 2 hours home.

That was just normal to me. I didn't know and in fact even at that age it irritated me when people would make excuses and not do stuff. I'm like, "What?" I think a lot of, I just got lucky and the fact that's how my dad and my grandpa were. I would look back thinking if I was 15 years old and I said something about something was too hard, I would have been punished but the look on my grandfather's face would have been like, "Are you kidding me?"

Tony: It might have been worse than getting punished.

Dr. Andy: Exactly. The disappointment of like, I'm like I would have been embarrassed of the things he went through and all that. I probably have to thank the stars on that one. I just got lucky to be in that environment and to be around people that supported that kind of culture. We didn't have money. We were extremely poor and extremely broke for a long time but that was just I guess the one thing you could control since we couldn't control money. It was sort of like you control the alarm clock, you control the effort. There is nothing else. This is not negotiable.

Tony: That's awesome.

Dr. Andy: Fortunately that way.

Tony: You had this family culture that's kind of extreme responsibility I guess you could say. You're the master of your destiny and you got the weightlifting bug and that got started. How did that progress? Obviously, you played sports but when did that start to shift into, "Maybe this is something I wanna do after I graduate from school?"

Dr. Andy: What I would say is actually just found out maybe a week or two ago that I got early tenure in promotion.

Tony: Congratulations.

Dr. Andy: Thanks. I say that to say I'm not even sure I still know what I want to do, which is funny. When I grew up, the city I grew up and you played everything so you're more than a football player. If you were a sport person, you played everything. You played soccer. You played basketball. You played track and field. You wrestled. You did everything.

When I got to college, again, I was pretty good. I played a lot as a sophomore, started as a junior but I wasn't a freshman All-American. I played with some guys that went on to the NFL but that was no chance of

ever happening. My point was like even when I got to college. I was like, "Okay. I've got to figure this stuff out now." Now I have a bit of resources in terms of I've got time, I've got food here. I won't have to worry about these things anymore. I still had a job. I'm still majoring and so I just wanted to major in this topic so that I knew it as much as possible. I went down the, actually I had science road and realized that nothing I was getting in my classes was going to help me at all in training.

I got very fortunate as a freshman. I met, still a near and dear true friend of mine, Doug Larson from the Barbell Shrugged podcast and those guys. We lived together and he was in the same boat. He was a worse athlete than I was. Hopefully, he's not listening.

Tony: We'll send him the link when we [quote you 00:20:41].

Dr. Andy: He's the worst. I shouldn't say this. He's the worst football player [now 00:20:44] but much better at other things.

Tony: Like you said, a lack of talent in one area, you can super compensate in other areas.

Dr. Andy: Totally and so [crosstalk 00:20:54]

Tony: He's excellent at podcasting.

Dr. Andy: He and I just went off the deep end. We just started writing our own programs and getting into it. We're very, very fortunate. He had a mentor growing up named Mark Riehl who I just got to see yesterday, who was engineer at Hewlett-Packard, for whatever that's worth, but just loved strength and conditioning. Built his own gym, put himself through conferences, clinics, [real books 00:21:16] and so he helped us. Then he started taking us to NSCA Strength and Conditioning Conferences, the local things, and we just started getting our hands on everything we could do.

It was definitely a passion that we just, we were self-taught. We made every mistake you could possibly make and we wrote our own programs. We did them. He's very very much like I am in terms of there's just no excuses. It's always your fault. He's very detail-oriented. The details would be better for him and so we work very well together.

I think at that point, then I started being interested in muscle itself. Once I was given a little bit of taste of Muscle Physiology, I was like, "This stuff is really cool. I can see how it relates actually to training." We finished our undergraduate degrees. Doug went on to coach Colorado Rockies. I went to Arizona to start training professional athletes, realized I hated working with professional athletes.

Tony: What was the dream and what was the reality? Everyone wants to be trained professional athletes but most people don't actually have the opportunity to

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do it so they don't really know what the reality of that is.

Dr. Andy: Exactly right. The dream for me was everything. Let's be real here. The dream is that you want to be famous. That's the reality. It's [crosstalk 00:22:37]

Tony: I have a little trickle down celebrity.

Dr. Andy: You want to be famous and so you want to be around famous people. You want to be able to tell your friends, "Oh, I trained Berni Davis. I trained [Patrick Clemence 00:22:48]. What you're really looking at is you're trying to get famous off of their shine. That was not something I was totally aware of. Once I realized the reality of it was, they don't care about you. You're not important.

They're paying \$1,000 a week to train. You're dispensable. Everyone in America and the planet wants that job and they'll do it for free. They'll get up at 4am and they'll go to bed at midnight and they work Saturday night and they'll ditch their family because this guy wants to train right now instead of tomorrow when he's supposed to. You show up to the gym at 4am and then you realize he doesn't show up because he went to Vegas last night instead and didn't tell you. That was the reality of it and [crosstalk 00:23:32]

Tony: Not as glamorous as it seem to be.

Dr. Andy: No. I don't know what the term is. I guess I will say that I am too alpha for that, which is arrogant enough to say. I just like controlling my own life and I could not handle being at the whim of someone else. Not everyone experiences like that and not all athletes are like that's what it was for me. More importantly, it wasn't enough of a challenge for me, not to say it's not hard because it's tremendously hard but just like my learning was over, my learning of Physiology was done. I wanted to know no more about the intricacy of the muscles and I realized that wasn't my scratch, thinking not to say it's easy because it's super difficult.

I realized this isn't for me. I like to educate. I like to teach and these people don't really care about learning. For the most part, professional athletes [through there which 00:24:24] just not break them especially the ones I had. I had 15, 18 people that went in the first shot in the NFL draft. You're just babysitting at that point for the most part.

I decided to leave actually and go back and get my master's. I went to Memphis, Tennessee. Doug actually went along. We went up there together because there was a guy out there Andy Fry who now is running the program at Kansas. He was doing biopsies of weightlifters. He had just done, finished, Chris Moore had just finished there and they were doing biopsies, things that [came 00:25:01] ...

Tony: Just to pause you there, can we do a little side bar and just give someone a Dr-Andy-Galpin-on-Hypertrophy-Extreme-Responsibility-and-the-Myth-of-P...

quick idea of what a biopsy is if they haven't encountered that procedure in their life?

Dr. Andy: Yeah. He just came to my lab about 20 minutes ago [inaudible 00:25:13] because [they nine 00:25:14], just [add 00:25:14] nine of them actually. We just started our epigenetics study where we do a biopsy of their quad. You take a sample about the size of the end of your pinky. You take a muscle tissue sample, I go into your quad about [inaudible 00:25:30] so your outside quad muscle and I go [end up 00:25:34] a needle and extract some tissue and that's your donation to science.

We did that and went did basically a leg press and leg extension till they die and we do another biopsy, wait 4 hours, and do a third one. We just started out this morning. This guy was in Memphis and he was doing that. He was doing studies like, "Hey, let's do squats with chains and bands and let's do 10 sets of 1 [at your wonder 00:25:58] at max and let's do it everyday for 3 weeks and let's take biopsies halfway through and at the end. I was like, "What?" He's going to the junior Olympic trial.

Tony: Mindblowing.

Dr. Andy: He's going to American Open and taking biopsies of the weightlifters. I'm like, "This is what I wanna do."

Tony: That's getting rid of all the speculation. I mean, so much in strength and conditioning and a lot of fields to be fair. It is a little smoke and mirrors sometimes. Who's the best marketer not necessarily who's got the best methods.

Dr. Andy: Exactly.

Tony: If you're doing a biopsy and you're pulling out a piece of tissue from a person that did the thing, you really can't [juice 00:26:40] that too much. It's either working or it's not.

Dr. Andy: Exactly. I was interested and particularly if you look at the exercise science and exercise physiology world, about 90% of it is study state endurance training which is cool. I can [truly 00:26:55] appreciate that but I was like, "Man, where are the muscle studies on anaerobic athletes? Where are the muscle studies on strength athletes?" We don't even know something like fiber type yet of powerlifters. I don't know of a weightlifter. I don't know. You would think we know these things but no one's actually studied the muscle of well-trained anaerobic athletes and it still hasn't been done. I was like, "What the hell? This is what I'm interested in. How was no one actually ever studied this muscle? But we have 350 papers published on the muscle of a marathon runner."

Tony: When you say anaerobic, you mean people that are doing things like CrossFit or mixed martial arts or weight lifting [crosstalk 00:27:32]

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Dr. Andy: Sure. Even if they're doing whatever type of P90X, I don't care. It's only about running 60 minutes three times a week at the same pace. That's like that's all we had.

Tony: That's exercise. When they say, "We're studying exercise," that's what they're generally studying?

Dr. Andy: Almost always, yeah, or is a very classic, "Okay. Let's go to the gym and we'll do some resistance exercise but we'll do leg extensions, we'll do three sets of 10 at 70% of your max and then that's it."

Tony: That was the program you're doing when you're 12 and you're on your Bowflex.

Dr. Andy: Exactly. I'm like, "Come on. They're so much more." The analogy I always give is this: "Okay. If I take a strength coach or a CrossFit coach, anyone in that space. And I say, 'Is there a difference between three sets of 10, five sets of six, or 10 sets of three?' All of them are gonna say, 'Absolutely, yes' and they could tell me in detail about the different adaptations you'll get from all three," but from a muscle perspective, we have never studied that, I mean, for the most part, like almost nothing. I'm like, "How was it that every personal trainer in the planet can tell me the difference but not a single science scientist has ever actually studied that?"

Tony: We all know when I say no in quotes that lower reps, that four to six range, that's your strength training range and then you have your hypertrophy range of eight to 12 reps and then your endurance range of 20 plus, 15, 20 plus or something like that. What you're saying is that's just hypothesis or just something that's been repeated a lot of times and we just took it to be true?

Dr. Andy: Pretty much. We have some new stuff coming out now and a friend of mine has done a lot of research in this area that exposed a lot of these things but we haven't even really started with the intracellular stuff. When I say it hasn't been started, what I mean is we don't have an extended field of information.

Tony: You got this, you had this realization that we just don't know what's going on underneath the skin literally and in the muscles. You started working on doing some of the stuff, doing the biopsies. How did you land where you're currently are?

Dr. Andy: When I finished at the University of Memphis, I went on to get my PhD in an area called Human Bioenergetics, which is Muscle Physiology for better [inaudible 00:29:55] [when 00:29:56] I went to a lab of that was specialized in muscle [now 00:29:59], they were doing the same basic exercise stuff as I just complained about. They were very good at the biopsy technique and in the muscle analysis. I want to learn the analysis there.

When I graduated and I went in at the job market, I had a real niche for

myself and the fact that I had this pretty extensive strength and conditioning background but I could also match it with the sophisticated biochemistry and molecular physiology stuff that I was doing. I came out and started looking at jobs and a guy by the name of Lee Brown who just won the NSCA's Lifetime Achievement Award last year, he runs the strength and conditioning program and there's very few of these in the country and he said, "You know, you put in a job posting that looks like, 'Hey, we need someone that can do strength and conditioning but we wanna start adding some molecular stuff in too.'" I was like, "My God, you just wrote a job description for my skill set."

Tony: Awesome.

Dr. Andy: I applied for that and it was just a no-brainer. I didn't want to live in LA I would have done anything in the world and to not live in LA. I knew it immediately. I'm like, "This is exactly what I want to do. I can do real application. I don't have a tremendous amount of grant pressure so I don't have to go searching after diabetes or obesity or things which are important but they're just not my interest." I was able to do the stuff I want and so I came out here and eventually convinced [those yag who's 00:31:19] at the Barbell Shrugged guys to come out and join me and it's been rock and roll ever since.

Tony: For someone who's not living in that world, can you explain what you mean by grant pressure?

Dr. Andy: It's really tough at the university level. We'll back all the way up. What's happening now is that anyone who understands higher education it's getting more expensive. There's all problem there but what's actually happening is is not really getting more expensive. They're just shifting the burden from the state to you. The state is giving, essentially subsidizing less and less and less percentage of your tuition and making you pay more. What they're basically saying is: "University, you just start funding yourselves."

The universities come and say, "Okay. That means we're gonna charge students more in tuition. And faculty, you need to start actually bringing in money to the university." You need to either get a grant or get a company, a supplement company in our case or equipment company, and they need to pay you to do work because you basically need to start paying your own salary or more. This has been the case for a long time and it's just getting worse and worse. Combine that with the fact that the national government is also reducing funding for science dramatically.

When I was a student, 20% of all national grants got funded and now something like 3 to 6%, which basically means the only people getting funded are the people who are already funded. It's the classic good old boys club. It's like, "Well, if I'm gonna give it someone a million dollars, I'm gonna give it to someone who's performed before." This new person wants to start this new lab so it's impossible to get money. What we're left with is this pressure.

You have to go after topics if you think about it this way. If I go to the government, the National Institute of Health and I say, "Hey, I wanna do this study on professional MMA fighters and I wanna take biopsies and look to see why they're so powerful." Then you show up. Tony shows up and says, "I wanna have a grant. I wanna look at children with obesity issues." Who's the government giving that money [to 00:33:19].

Tony: That's a no-brainer.

Dr. Andy: I'm not even saying I blame them. I'm not even saying I disagree with them but there's just no way that funding is coming to me. Either you have to change what you're doing, you have to study ketosis or obesity or you have to study something fundable like that, children, or you have to say, "You know what? I'm goinna make funds otherwise or I might have to worry about funding. I'm just going to do the research I wanted to," which generally means you're paid, your salary is a lot lower but you end up doing something you feel is more important. That's what I mean, this is where I came to do the research. I want to do what I think is important that I think people care about but it's going to come in a pretty big grant funding hit for me [crosstalk 00:34:02]

Tony: The price of freedom or a degree of freedom, that maybe would've been available otherwise.

Dr. Andy: Exactly. I mean it is the price of freedom too. I don't have to do certain things that I don't want to do and study anything I want to study.

Tony: Awesome. Let's get into. We started talking a bit about muscles and one of the things that we did during the panel discussion that we had at Paleo fx is you gave us a nice little overview of the structure of a muscle fiber. Maybe you could do a repeat of that performance and give us a bit of a breakdown of what a muscle actually looks like or how it functions to the best of our knowledge at this time.

Dr. Andy: Awesome. I think the best way to think about it is our lab generally has an approach that says, "We want to go a whole body [to gene 00:34:52]." Here's what that means.

Tony: It's like one of those episodes of the Simpsons or whatever where you're looking at Homer's eye and then it scales back to the universe.

Dr. Andy: Yeah, right. Exactly but we kind of go there anyway. What we say is this: "Okay. If I just take, we'll stick with your quadricep. So by definition your quadricep is four. Okay? There's four muscles that make up your quadricep and so we'll just stick with one of them. It doesn't matter which one but we've got one muscle. Well, inside your muscle, it's actually composed of millions of individual muscle fibers. All right."

Now, you can think of this as a bunch of analogies. I'd like to use analogy of cable wire, so imagine looking outside and seeing your power lines. All you see is one power line. That would be your muscle. Inside that power line, it's a whole bunch of other individual wires and around each individual wire has it's own insulation and probably inside that is a bunch of more of those things. We're looking and you're seeing one muscle or one power line but you don't see is thousands of individual, probably microlines inside of that power line.

My friend, my other friend likes to use a ponytail analogy. If you think of your muscle as a ponytail, and all of your muscle fibers, all of your individual hair follicles, hair fibers. That's where it's like. You've got your entire muscle and wrapped around your entire muscle is that fascia. This is why [we're phone rolling 00:36:20] the myofascial release, all this stuff. It's a connective tissue.

Now surrounding that, you have a bunch of bundles and that has a connective tissue and then you have a bunch of those that are surrounded until you get all the way down and this is a couple of layers deep into the individual muscle fiber, which has its own connective tissue around it. Once you get inside that individual muscle fiber, you got a lot of things going on but that's where going to hold your things like your mitochondria. Mitochondria are the things that give you oxidative stress are the things that you use oxidative metabolism to you, so the only way you burn fat and the way that you burn, you finished bringing carbohydrates to this mitochondria. That's where you hold your nucleus. The nucleus is the control center for the muscle. That's what holds your DNA and it tells your muscle to grow, shrink, die, repair, et cetera.

Then you also have your contractile proteins, so these are myosin and actin. In other words, these are the things that make your muscles contract. We have the the small one which is actin and you've got myosin. The big myosin reaches up, grabs actin, holds two actin fiber molecules together, and shortens the distance between them. In fact, it starts almost like stacking them on top of each other. That's why when you flex your bicep, your bicep gets thicker. It looks like it gets thicker anyways because you're starting to stack these myosin and actin on top of each other, for the most part. That's essentially a 2-minute tutorial of the microanatomy of the muscle [inaudible 00:37:46].

Tony: Sure, and the mitochondria that are in there, in the mix, on that cellular level, they're powering that ratcheting of the myosin and actin.

Dr. Andy: They can. They would be powering it if the myosin, if you're using aerobic metabolism. If you're using anaerobic, then it'd be coming from either muscle glycogen which is, glycogen and sugar. When you store it in the muscle, we call it glycogen. It could be coming from phosphocreatine or it could be coming from lactator or ketones or any of your [physical 00:38:20] sources.

Tony: That's the actual, muscle action is that. It's the summation of all these

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thousands or millions of little protein filaments, ratcheting along each other and, like you said, stacking up to create what we see as a contraction which is actually all of these little fibers contracting.

Dr. Andy: It's exactly right. You've got all of these things going and then when you send a signal from your central nervous system which is your brain and brain stem and spinal cord, and it goes out to your quad muscle and it says, "Okay, go ahead and contract," it opens the flood gates literally. Opens up, sodium comes rushing in, you have this potassium, sort of interaction. Calcium gets released from this little organelle called the sarcoplasmic reticulum. It binds, it moves things over, and it binds together.

It's literally like a pistol. If you imagine, this myosin and actin complex is like a cocked pistol. As soon as you get the calcium influx, it pulls the trigger and it just fires. To put this another way, most people have heard of things like fast-twitch and slow-twitch muscle fibers. Right?

Tony: Right.

Dr. Andy: Cool. If you think about this way, what that actually means is some of you are shooting .38 Specials and some of you are shooting .44 Magnums.

Tony: They're all pretty fast though.

Dr. Andy: Exactly, right? They're not going to do a lot of damage but what that actually means is the faster you can redo that process, the faster your contraction happens. If I can get this calcium signal to pull the trigger really quickly and then I can pull that trigger again and again, so I guess my analogy is better like shooting a single shot revolver versus fire a 30-round clip into a pistol. If I can keep firing, that's going to produce a lot higher velocity contraction and a lot more force in that contraction.

Then once I have all these fibers contracting, since we remember that they are actually surrounded by connective tissue, what actually happens is I pulled that fiber but the fiber doesn't really do anything. The fiber just pulls on the connective tissue. If we go back to our power line analogy, if [you just pulled 00:40:36] one of the fibers from inside that power line, it's going to pull the whole power line because it's going to pull on the insulation, which is going to pull on the other insulation, which pulls on the other insulation. Before you know it, the entire thing is moving.

Tony: You got that scaffolding in there.

Dr. Andy: [inaudible 00:40:51] so that's exactly what's happening is all of your connective tissue from your one muscle all comes together and it fuses into one connective tissue and that connective tissue turns into, and this is what we call tendons. Tendons are just simply this connective tissue that's fused together and then the tendon inserts onto a bone. All of that calcium stuff I was mentioning, all of that does is force you to pull on your connective tissue

which actually then pulls on the bone.

If we look at muscle contraction, it's really a function of three things. It's some sort of neurological activation, so I get to send this signal and then the muscle itself has to contract. Then that actually has to pull on the connective tissue which pulls on the bone. I can have improvements in performance or I can even explain differences in performance. This is why, Tony, you squat three times as much as I do or whatever it is. Maybe that's because you're stronger or what's that mean? That could mean one of three things or a combination. Maybe neurologically you're more efficient. Maybe you're more [efficient 00:41:58], not any more efficient.

Maybe I'm more efficient than you but you still squat more for me because your individual fibers contract with more force. Maybe we're the same or maybe I'm better at those first two but you're actually better. Your connective tissue is more efficient in the way that it is structured so [it upholds 00:42:12] on the bone at the better angle and I get a better mechanical advantage and so my actual force production of my moving body part is better.

Tony: Automatically, anyone listening to this is realizing that doing something like a bicep curl or jumping up onto a box or anything like that, it's a lot more nuance and a lot more complicated than that, than we originally thought.

Dr. Andy: Yeah. That is fair to say. I think you would say that this analogy is, you're probably at the point in your life too. This is true for you. We're both kind of young guys but old enough. When I was an undergrad and I went to my two or three or four muscle physiology classes and even as a master's student I was like, "Yeah. Okay. I got this thing figured out." Then, as a doctor student, I was like, "Oh, shit. I don't know anything."

Tony: Just keep going deeper and deeper?

Dr. Andy: Yeah and so it's totally true. It's like if you think you know this stuff or if you're a trainer, if you're a coach or the person you listen to on a podcast tells you like, "I think, I don't know, figure out about muscle," they're probably very young or have a master's degree or lower. Anyone with a PhD or higher is going to be like, "Well, I may know a few things but, man, I don't know shit because I got experts at every level here. I mean, I don't know anything about connective tissue. I don't know anything about nerve relative." I know more than probably most of the listeners but if you brought a nerve person out here or a connective tissue person out here, I don't know anything. [I don't know 00:43:37].

Tony: [They 00:43:37] may be able to go down the rabbit hole in each of their respective domains.

Dr. Andy: I'd be taking notes just like you are. I wouldn't know and in fact [like 00:43:44] even worse if you brought in some muscle people. I would be like, "I don't know what that is." We get so nuance in about what aspect of human

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skeletal muscle do you know well. Someone could come in and talk about a certain area and they study one particular protein and they [even study 00:44:00] one protein in that whole thing and I'm like, "I've never even heard of that protein," and you've got 20 papers on that protein. I don't know anything.

Tony: When you flip to the back of your Men's Health or whatever magazine, you're looking at and they say, "You know, they've got a program that's guaranteed to pack on 10 pounds of muscle." When you see those things, what do you think?

Dr. Andy: I don't care honestly. I generally laughed because I'm not one of those people who get offended. I actually try to never, the world is not better with people complaining about other people's work. It doesn't help anything. I try not to do that because what's going to happen is if you just shut up and you don't make any mention of it, if that program is not effective, it will go away.

Tony: There you go.

Dr. Andy: If you just don't give attention to those things and so what I think is better is I will, instead of seeing those things and being mad and then posting on Twitter like, "Look at this jackass. He did this thing," and being so mad, again, really all that is is an ego play. It's me trying to say, "I know more than this person. Everyone look at me like how smart I am."

What I tend to do is start to say, "You know what? I'm just gonna give credence or promote things that I find that I do like. Hey, this guy is smarter than me. He did better than me. This program is better than what I have going. I really encourage you to go see this dude's podcast or listen to this podcast or go to this person's blog. This guy has really got it figured out," or, "This girl is really smart about this program." That's what I actually helps. You present people with solutions, that helps as opposed to complaining. That helps nothing.

I still don't know what to do, so I don't care. [I never resign 00:45:33] don't necessarily care when I see those things is, I try to teach my students is and I make a point, I embarrass them the first week of class. One of the worst things you can ever do as a strength and conditioning coach or as a professional in this field at all is to criticize someone's program whether that be their nutrition program, their meditation program their lifestyle program, whatever it is, by simply looking at it on a piece of paper.

Like, "Oh my God! How arrogant and stupid are you to think you know exactly what that programming is because you saw it at the back of a magazine, you know, [one day 00:46:08] clip." You have no idea why they wrote the program. You don't know who it's for. You don't know how they're going to implement it. That would literally be like me judging you by the picture I'm looking at on your Skype profile.

Tony: Hopefully, it's a pretty good picture.

Dr. Andy: It's fantastic.

Tony: Thanks.

Dr. Andy: You're amazing. Your hair is tremendous.

Tony: Appreciate it.

Dr. Andy: That's how silly it is. [crosstalk 00:46:30]

Tony: Right. Exactly.

Dr. Andy: I'll put it this way. I have a challenge that I make my students do. I guarantee you right now, if you could show me the worst program you've ever seen in your life and I could come up with a scenario, I guarantee you, within less than a minute, I could come up with a scenario in which that program would be very effective.

Tony: I think that that's the thing. You could just about come up with anything and you apply it to enough people, somebody's going to get a positive response.

Dr. Andy: Absolutely. What you don't know is like, "Well, I wrote it for this person with this situation," and then you're like, "Oh, oh, man. I shouldn't criticize that maybe." It's one thing that I try to work [a decent world 00:47:14]. I'm not perfect at it. It's what some people phrase being a learner versus a knower.

A knower looks at that program and knows why it's wrong and knows how to fix it. A learner looks at that program and goes, "Hmm, that's not how I would've wrote it. Let me email that person cuz I'm wondering, 'I wanna learn from you. Why did you write it this way? What were you thinking here? What was your philosophy?'" I'm telling you, almost always, you get an answer back that you're like, "Omigosh! I hadn't even thought about that yet."

I learned something here as opposed to you being so smart that you know, which in my field that sounds like the opposite. I'm supposed to be the all ever knowing. As your professor, a PhD in Muscle Physiology, I'm supposed to know these things but there's almost nothing I would consider to be know without getting too philosophical [when you hear 00:48:06]. I'm always just trying to, "What can I learn about it? Why did you do that? What is your situation? What were you thinking?" This is a much better approach.

Tony: I definitely noticed there's a trend in scientists, any scientist that I've talked to for the most part, who's engaged in the study of something and looking at it deeply. They tend to hedge a lot. They tend to speak in, "Well, in this case, but maybe not." I think that that's the effect of like what you're saying before, the more you know, the more you realize you don't know it all. I guess when somebody's coming to you and I think, as for me, myself personally, I still

train clients and you have a customer, they want the answer. When you're doing a podcast or when you're writing a blog post, a lot of times people are coming because they want answers

Dr. Andy: You have a very valid point. Actually that was really nice. Awesome job, dude. You can't do that. You can't do that vague approach when you have a client because here's a different scenario. Now you know this scenario, now you know exactly and so the way I would answer is: "Okay."

I still work with athletes right now. I got a girl heading to Rio who's reigning world champion. She's [all odds 00:49:26] on favored to win the gold. I never gave her vague answers. She always has very clear instructions of exactly what to do and not to do for me. That's because I've got six or seven months of blood work on her. I've been working with her for a long time now. I know exactly what her training is, everything. I see her multiple times a week. I check in with her multiple times a week, almost daily. I can say, "Here is exactly what I want you to do. Don't do this, don't do this."

Whereas if someone came up to me and said, "Well, here's a good example." If someone came up and saw the nutrition program or the wake up program I have her on, I just look at the program and deleted her name and information from it and just posted that thing online, I guarantee you people [would shred 00:50:07] that program. They'd be like, "What is he doing? He's such an idiot. Why is he doing this? Why is he giving her vitamin C," which is a good example like vitamin C, I generally don't recommend prophylactically but she's on vitamin C. That's because she has a very specific reason.

Had they given me that one program 10 years ago, I would've looked at it and be like, "This guy's an asshole. He doesn't know what he's doing. He's giving athletes vitamin C. How stupid is he?"

It's a situation where you made a good point of when you have that information, you're going to be a terrible trainer or a terrible coach or a terrible consultant if you don't give them actual answers because they need that. They're paying you for answers. They're not paying you for your philosophy. You got to give them answers but you have to know as much information. I guess the middle ground to that is what happened to an athlete or client that comes to you and they want an answer but you don't necessarily have that much background information.

Tony: Exactly, like when you're speaking to a podcast audience, for example. We have no idea who's listening to this.

Dr. Andy: Here's what I would say is if we were doing like and open Q and A and you had a bunch of questions from the audience or something, I would say, "Well, here's where I would start. This what I think is likely to happen." Your [inaudible 00:51:17] was saying like, "I don't know cuz I don't know your thing but I've been around enough and in my experience to people and the little bit

of scenario that I think you're in, this tends to work best."

That requires you to break down your ego wall and saying like, "I don't know the answer. This might not work. And if you wanna leave me and pay somebody else, I understand because I'm not gonna lie to you and tell you I guarantee this works 100%. I'm gonna tell you like I really, really, really think this is gonna work. I've done this a lot for many, many years and it's very likely to work but we're going to have to see."

Tony: Let's give that a shot. Let's just say we're speaking to a group of people and someone says ...

Dr. Andy: You're putting me on the spot [inaudible 00:51:57]

Tony: I put you on the spot. How do I get, Andy, Dr. Galpin, how do I get huge? How do I get big? You don't know anything about me.

Dr. Andy: Anabolic steroids. There's a lot of them.

Tony: Drop the mic.

Dr. Andy: Put it this way. It's really not that complicated, the old adage it's got the no-pain-no-gain sort of thing. That's another example of, "Okay. That's completely wrong but it's also completely right." Anyway, without knowing anything about the person, what do you need? You need to do two things. You need to train and you need to eat. I know [Doc Pars 00:52:40] is going to say, "Well, you got to sleep too and recover." I know but training-wise, you got to eat. What that means? You have to have a calorie surplus. You have to have extra calories. That has to come from having more fat. You have to have more protein probably and you have to have more carbohydrate probably so you need to eat more. The better quality food, probably the better results you're going to get. Training-wise, it needs to hurt a little bit. It doesn't need to [crosstalk 00:53:08]

Tony: Get around that.

Dr. Andy: No. If the training is so easy that you don't cause any metabolic stress, if there's no mechanical stress, if you don't get the least kind of a little bit tired and sore, it's not enough for you to convince your body to actually go through the resource training of building new muscle. It's not going to commit to that step. On the flip side, if you don't want to train so damn hard, you just completely wreck your body.

There's no relationship between the level of sore you get and the amount of hypertrophy you get. If you give yourself so sore that the next day, here's a good example. This happened to Doug, a friend of mine, when we were, I think we were in college. We did 20 rep squats and the idea was to do it like 80% of your 100 max. It's terrible. He got through it which is great and it was something like 2 days later this is a 210 pound college football player. He's

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literally crying in the car because his legs were so sore he can't get out of his car and he's in tears.

I'm like, "That was stupid. We didn't even nearly that close to sore. That did not help the situation at all. It was weeks before he could squat again and he was 20. Imagine if you did that when you didn't have all those hormones circulating that allows you to recover so [crosstalk 00:54:28]

Tony: He might have [rhabdo'd 00:54:28] himself.

Dr. Andy: Sure, [out 00:54:31] for months. To wrap up your answer long-winded but it's like, "Well, you need to train. You need to train pretty frequently, probably two to three times a week for the most part. You need to do as much as ever you can for as many reps that you can that are of excellent technique with excellent positions and you need to get pretty tired but not mega, mega, mega, ultra tired but pretty damn tired." You do that. If you have a calorie surplus, you're probably going to get there if you're patient enough. It doesn't matter if you're doing 12 reps or 18 reps or 20 reps or nine reps or six. If you're doing three sets or five, if you're doing a machine or whatever, that stuff, it does matter but at this level of answer, it really doesn't matter that much. It will all work.

Tony: Eat more, get a little sore, do that consistently a couple of times a week. Chances are pretty good, you're going to make some gains.

Dr. Andy: Exactly and you don't want that, even if your program isn't perfect, you'll learn. You'll figure out like hey this is too much for me or this movement hurts my back or this always makes my neck or whatever. You gain so you'll be able to tweak and add more or hey this is not quite enough. I can actually do, I can train four days a week and I'll recover really well. You'll be able to adjust from there. What it really comes down to, they're just personalization anyways. Even if I knew the tremendous amount, if I had your blood work done, if I had to use your entire genome sequenced, I still have to guess through program anyways.

We always say this. I got a bunch of athletes. Most of the athletes I work with now I've had for at least a couple of years but whenever I start a new athlete, I'm like. "Look. I don't know what your training [calves 00:56:17] are gonna look like until we've been training together for a year maybe." Then I can start to figure out, "Okay. Here's how you respond." Even if I have all that information, I still start with the big ass guess and I have to adjust from there. This is what the entire field of [epigenetics 00:56:32] is finally getting us to a new [nutrigenomics 00:56:34] like it's getting us that same point of knowing all of your stuff. It's a starting point but we're just guessing.

Tony: You know what? I'm going to have to say that this is the end of our conversation today but in many ways I feel like this is also just the starting point and certainly I think that we're going to have you back on the show because we could just keep going on and on and still have more information

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and insights to uncover. This has been really a pleasure for me.

Dr. Andy: [Awesome 00:57:06]

Tony: Just to have an opportunity to talk to you again and to get a little bit of deeper understanding of what I know and what I don't know and now the scientific process can be applied practically for people trying to make some gains or to improve their speed or whatever other endeavor they might be undertaking. Thanks a lot for coming on the show. It's been a real pleasure.

Dr. Andy: Awesome. It's a real pleasure like I said beginning. I really love the audience so much so I'm happy to come back. We could actually get in a lot more actual detail about some things next time to get some folks more take-home messages. I look forward the crowd. Like I said, I love it. Your listeners are I'm sure reflective of the people that attended the conference. It's great. I got a couple things that if [any of you 00:57:54] stuff folks like to, I try to put as much stuff up from our lab on our Twitter and our Instagram. That is @DrAndyGalpin, so D-r, Andy, y, Galpin. I'm sure you can throw stuff up there.

Tony: That's how I got a hold of you actually.

Dr. Andy: I'm super responsive. I'm really good about that stuff. I tried to take the time if you have a question. I think I have like a 99% return rate as long as they're fairly reasonable because it gets fair, like I don't mind that stuff. Then I've got that website coming too.

Tony: Sweet.

Dr. Andy: I'm trying to do actually is put every single lecture I ever give to all of my university classes all online for free. That's coming. That's on my website and developing .com. I've got a bunch of stuff out there posted now but it's all coming. It's in 5 minutes sections so you can do like if you want a five-minute lost answer your question those are up. If you want a more in-depth answers some of those are an hour long or more. But that's all up and the idea is to give all this information always free as I possibly can and to tell some fun stories.

Tony: Awesome.

Dr. Andy: That's out there.

Tony: You're doing a great job. I appreciate the work that you're doing and look forward to checking out some of those resources myself.

Dr. Andy: Awesome. It's been fun Tony. I look forward to seeing you again.

Tony: That was Dr. Andy Galpin, professor at the Center for Sport Performance at California State University Fullerton and director of the Biochemistry and

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Molecular Exercise Physiology Laboratory. You can connect with Dr. Andy on Twitter and Instagram @DrAndyGalpin. On next week's Paleo Magazine Radio episode, we'll pick back up with our interview of Jen Reissman, founder of the One Stop Paleo Shop. Until then you can check out our full Archive of Paleo Magazine Radio episodes on Paleomagonline.com. Thanks again you are show sponsor, ancient nutrition foods and their bone broth protein powder, one of my favorite things to do is to make bone broth protein with grass-fed whey, organic hemp protein and powdered greens for supercharged post-workout recovery Shake. I threw a mine in a Shaker jar and mix it with water when I need it so I can't say that it tastes great but it doesn't taste that bad and it's a quick way to ensure that my muscles are giving getting the essential nutrients they need to get Swole. Paleo Magazine Radio is brought to you by the Paleo Media Group. Our show music features the song Light It Up by Morgan Heritage and Jo Mersa Marley.

Paleo Magazine Radio is produced by me. On behalf of everyone at Paleo Magazine, thank you for listening.