Speaker 1: Bulletproof Radio. A state of high performance.

Dave Asprey: Hey its Dave Asprey with Bulletproof radio. Every now and then I have just the perfect interview happen. When it happens, I can feel it when I'm doing the interview, and I want to share it with you. The odds are pretty high that you haven't heard this episode. I worked with the team here to remaster the interview, because it was one of the most popular, most impactful ones. I'm re-releasing it as a special edition for you. This has a separate benefit for you, because I'm using some of this time right now to finish the final edits on the brand new book about mitochondria. I'm about to tell you the name of it and where you can find information on it. This book is cool. Its got so many other things in it, I'm going to finish editing the chapters to meet my deadline and I'm offering to you right now one of the most impactful interviews I've ever done. I think you'll really enjoy this.

Today's cool fact of the day is that humans have evolved to have larger skulls and we'd like to think anyway, smarter brains. Its seems like a pretty good idea, except for the way your skull makes room for your larger brain is by using less bone here in your jaw. What that means is its harder for us to eat tough food, which is fine, because that's why we have rib-eye. On top of that our teeth have stayed the same size, even though our jaws are smaller, and that's one of the reasons that you can get impacted wisdom teeth, just because your brain's too big. You can also say its because your mom, or your grandmother, ate grains, which can also impaction of your teeth.

If you're a regular listener you've heard me share my list of top 10 bio hacks. Lets talk about number 9. Button hacks for the bullet proof mind. It may sound weird, but hanging upside down is a great way to hack your brain. Regularly inverting trains your brain capillaries, making them stronger and more capable to bring oxygen to you brain, its pretty straight forward. More oxygen in the brain means better performance.

I get my daily stretch and my dose of oxygen with my teeter inversion table, which is so essential for optimal focus, concentration, and mental energy. That full body stretch elongates the spine and takes the pressure off the discs so they can plump back up. Less pressure means less pain. If you have back pain, even if you've been luck enough to avoid it so far, you really want a teeter to invert everyday to keep your back and joints feeling great. For over 35 years teeter has set the standard for quality inversion equipment you can trust. My friends over at teeter have decided to show some love to Bulletproof listeners.

For a limited time you can get the teeter inversion table with the bonus accessories, and a free pair of gravity boots so you can invert at home or take the boots with you to the gym. To get this deal, which is a savings of over 138 bucks, go to getteeter.com/bulletproof, you'll also get free shipping, and a 60 day money back guarantee, and free returns. There's absolutely no risk for you to try it out. Remember you can only get the teeter with bonus accessories and a free pair of gravity boots by going to getteeter.com/bulletproof. G-E-T-T-E-E-T-E-R,

.com/bulletproof. Check it out.

Today's guest has been on the show quite a while a back, and its my great pleasure to introduce a guy who I really consider a groundbreaking exercise guy. This is Dr. Doug McGuff. He's an ER doctor, he's an exercise geek, and a weight lifter. He's one of those few ER doctors who happens to have his own gym, called Ultimate Exercise. He's one of the authors of Body by Science, along with John Little. Looking at what high intensity training does for you. I've used his techniques for a very long time to support my own lifestyle, which is minimal amounts of exercise for maximum gain. Doug does an amazing job of helping people understand what they're doing from an exercise perspective. Its been more than 100 episodes back when Doug was on. We've met in person a couple times, and Doug I'm just stoked to have you back on the show.

Dr. Doug McGuff: Awesome. I'm really glad to be here. Hey, my wisdom teeth, they came in no problem. I think my brain must be too small.

Dave Asprey: That's too funny. Don't have wisdom teeth problems? Its because you're dumb, that should be the headline.

Dr. Doug McGuff: [inaudible 00:04:18] has a study more than most people, but you know oh well.

Dave Asprey: You did something right because you've come up with some new stuff. The reason that I wanted to catch up with you, aside just to get an update because I know you're constantly researching this stuff, but you've been looking at myokines.

Dr. Doug McGuff: Yeah, its kind of my new obsession these days. I certainly didn't come up with it, I stumbled across some of the research about it. There were always these things that I just believed but could not prove. The myokines is starting to kind of fill in a little bit of that black box for me.

Dave Asprey: What the heck is a myokine? I'm sure everyone driving right now is wondering what is this?

Dr. Doug McGuff: Yeah. A myokine is basically just a chemical signaler. The more generalized term for that kind of molecule is called a cytokine. There are all kinds of cytokines that do chemical signaling, endocrine signaling from one organ to another, or paracrine signaling within a signal organ to direct the body as to what it should be doing at any given moment.

Well, they've recently discovered that skeletal muscle is not just this really great tissue that contracts, makes us strong, and able to move. Its actually one of our largest endocrine organs in our body and it signals to other tissues in our body in a very meaningful way. Art De Vany, a long time ago, made mention of this concept, that the tissues in your body don't necessarily all work together in this harmonious fashion necessarily. In a lot of ways body tissues compete with each other. A lot of this competition takes place through cytokines. Specifically, body fat and muscle

tissue have cytokines, these signaling hormones, that work in opposition and in competition with each other. How you eat and how you exercise can give the competitive advantage to one side or the other, such that reaching optimal health, optimal body composition, even optimal neurological functioning, can be augmented by tipping the balance in favor of one verses the other.

Dave Asprey: What are some of the most famous myokines? I know a lot of cytokines. I monitor inflammation in a lot of the bio hacks in the Bulletproof diet book are around, oh look you can lower this specific inflammatory thing with this nutritional intervention, or sleep, or stress. Myokines are a subcategory of cytokines, correct?

Dr. Doug McGuff: Correct. Most of the myokines that have been studied are actually cytokines that have an anti-inflammatory effect. Much of the myokines will have an anti-inflammatory effect that directly opposes the inflammatory effects of a lot of the inflammatory cytokines. Probably the longest known and most deeply understood myokine, is one called interleukin 6. That myokine is liberated from contracting skeletal muscle, particularly when its doing high intensity work, but pretty much in any sort of muscular activity it is released to some degree. It is actually, as the intensity of exercise rises, its released in an exponentially greater degree because it is done by an amplification cascade. Meaning that when its triggered, 2 molecules will trigger 4 molecules, and 4 molecules will trigger 8, and that just amplifies very quickly.

Dave Asprey: That's a beautiful bio hack because what you're saying then is by modifying the intensity of your exercise, you're basically exponentially increasing the amount of an anti-inflammatory substance in the body?

Dr. Doug McGuff: Correct.

Dave Asprey: Wow.

Dr. Doug McGuff: It has this anti-inflammatory effect, but it also has neat biochemical effects. It very aggressively up-regulates the uptake of glucose into the muscle cell, and glucose utilization, and glycogen mobilization. It also ramps up glycolysis, so mobilization of fatty acid from stored body fat. Its ramping through the cell, thorough the mitochondria to do beta oxidation of fatty acids. All of that is augmented and ramped up by interleukin 6. Other things that it does, it stimulates the release of nitric oxide, which causes vasodilatation, increase blood flow into the skeletal muscle, but has a more long term effect of modulating blood pressure towards more optimal levels. It actually acts as a leptin surrogate to increase insulin sensitivity. Just this 1 myokine has so many beneficial effects that we're looking for. That's the thing that I always intrinsically felt about high intensity strength training, is that it was so much greater than the sum of its parts. There seem to be something more going on in terms of body composition then could be accounted for simply by the energy that it used.

Dave Asprey: You mean exercise isn't just to burn calories?

Dr. Doug McGuff: Yeah, no.

Dave Asprey: This is fascinating because nitric oxide has been, really identified as a signaling molecule in the body that we didn't know that much about even, would you say 5 years ago? As a major signaler? It just sort of popped up.

Dr. Doug McGuff: Yeah. Lets see, interleukin 6, its probably been known about and some research done on it for the past 10 years.

Dave Asprey: Yeah.

Dr. Doug McGuff: The interest in it has gone up exponentially. The neat thing for me, as an exercise geek is, you know I started doing this stuff back in the '70s, so I've always been an exercise geek over the long span of time. What I've noticed is that all the major advancements in exercise physiology don't come out of exercise physiology, they come you of cell biology, and biochemistry.

Dave Asprey: Amen. Yes.

Dr. Doug McGuff: Freaking geeks that have never exercised in their whole life. When they find something that's relevant to exercise, then you really got something. There's very little that comes out of exercise physiology literature that really has an effect or changes anything at all. When it comes from some biochem geek, man you're on to something big.

Dave Asprey: Everything that you just said, probably, in my experience I'm not certain that it applies to muscles, although I think its pretty darn likely in my experience, but you focused on that more. All of the brain training and cognitive stuff that I've worked on, the same exact statement about when you change something at the cellular level, everything above it, including the way you think, and your ability to pay attention, all of that changes. I'm going to send you, I think its September 10th I'll have my early things, a new mitochondrial thing, we're calling the whole body nootropic, called unfair advantage.

Its the single most exciting new supplement I've done, as important to my own performance now as Bulletproof coffee, that up-regulates your mitochondria. Basically you can feel it within 5 minutes of taking it in a big way. I'm predicting there'll be new world records set from people using this stuff, because just like you said. What happens when you fix something at the cell level, it goes throughout the body, I've honestly never been more excited. I'll send you a box of this stuff, its not even available for pre-order yet, when it comes out, everyone's going to talk about it.

Dr. Doug McGuff: That's cool. Here's another thing about this interleukin 6, it is an anti-inflammatory molecule, but its not just the effect of the molecule, its the effect of its receptors. Its not only anti-inflammatory, its pro-inflammatory in terms of its receptors. If

you're generating lots of interleukin 6, then you up-regulate interleukin 6 receptor sensitivity. When that happens, it has that pro-inflammatory effect of, actually I'm saying it backwards. More interleukin 6, you down regulate the receptors. The fewer receptors you have, the less inflammation you generate.

Dave Asprey: Oh wow.

Dr. Doug McGuff: Not only is the molecule anti-inflammatory, the down regulation of its receptors is anti-inflammatory. Its kind of a double-whammy with the production of these cytokines.

Dave Asprey: I'm inherently a lazy guy, I call it strategic laziness. Where I'm not lazy because I don't want to do the work, I just want to do the work faster so I can do something else that's more important. Couldn't I just get an IL-6 nasal spray, or inject the stuff, down regulate my receptors and just not even pick up something heavy?

Dr. Doug McGuff: You know, I'm betting that there are pharmaceutical companies working on that right now. Now there are genetic manipulations that can be done to increase or decrease your production. A lot of the research that's been done on how interleukin 6 is based on taking it away from experimental animals. The way they do that is by genetic manipulation that produces an interleukin 6 knock out gene.

Dave Asprey: Wow.

Dr. Doug McGuff: The DNA is just a big series of bases, cytosine, adenine, guanine, and its this little code, and if you frame shift the code a little bit, whatever transcribes that particular gene will now become gargled nonsense. Then the animal doesn't have interleukin 6 anymore, and then in an animal devoid or severely hampered in the production of that hormone, you can figure out exactly what its doing.

Dave Asprey: Wow. What about gut bacteria? Do they make IL-6? Is there a gutbiome component to this whole thing?

Dr. Doug McGuff: That I don't know. That's my other big fascination that I'm way behind the curve on, is the whole intestinal microbiome. I'm certain that is has some sort of interaction, but I've not really tweazed that out of anything that I've read so far. Like I said, I've just kind of scratching the surface of this stuff, but its pretty cool stuff.

Dave Asprey: Its remarkable how many of the different cytokines are some way manufactured by the gut bacteria to the point that in the research that I've been working on, on the Bulletproof diet book, these little bastards, some of them are good for you but a lot of them are there, they're hacking your system. Your body has its own regulatory system for inflammation, and then these little things sit in there and say, oh we wanted you to be more inflamed or less inflamed for our own nefarious uses, which is mostly keeping their life support system alive. In intrigued to see what happens when we look at both high intensity exercise plus gutbiome. Is there some group of people who work out really hard but have a bad gutbiome, and either it doesn't

work because ... that was my experience, an hour and a half a day of heavy lifting for half of it and heavy cardio for the other half. I couldn't lose weight, granted I was over training like crazy, but I weighed 300 pounds and I was desperate. I'm certain, in retrospect, that my gutbiome was a part of the whole equation.

Dr. Doug McGuff: Yeah and I think that's probably going to turn out to be true. It'll probably be true in a feed forward kind of way. In the sense that, if you're doing proper training and its high intensity, and its brief enough, and you should be able to recover from it. If you're one of these people who has trouble with recovery or you're just totally hammered for 2 days after a workout, I'm highly suspicious that the answer might be that some how your gutbiome is disrupted. In the feed forward mechanism, I think the delivery of an appropriate exercise stimulus may release those myokines in such a way that drives behavior towards reestablishing a better gut flora. I think that both can benefit the other, and both can harm the other, depending on what you're doing. I think if you're someone who's going to chronically over-train, that clearly gut inflammation from ischemia, related to over training marathon runners, can really disrupt your gut biome, and in that process turn you into someone that's just a poor excersier and poor recoverer.

Dave Asprey: Yeah. My little memory trickle bookmark was accurate, I just pulled it up. There's a study from actually 10 years ago, where they were looking at the effect of MCTs, the stuff in brain octane and the MCT, that when you combine that with a bacterial toxin, in other words you have bad bacteria in the gut, that only in that case in rats that MCT changes the secretion of interleukin 6. The primary myokine that we're talking about. There's an interesting thing from what you eat based on the toxins made by what's growing in your gut, changes your inflammatory profile, basically how you respond to it. Its so complex, and its so amazing, that what you're talking about, which is we'll just down regulate your receptors by lifting heavy things sometimes. It seems like an elegant way to get around a lot of this complexity. Even if you have a problem with your gut bacteria, you're still getting less of this problem.

Dr. Doug McGuff: Yeah the more I read on this, that's the cool thing about all this complexity. All that complexity and all these feedback loops seem to benefit us by making what we have to do very simple. All that complexity and all that adaptability means that we just have to have a few gross heuristics to operate within, in order to optimize everything. All the complexity of that will take care of it for us.

Dave Asprey: Doug that's one of the things I really like about your perspective. You dig in way more than most people would because you're an exercise geek, and because you have a little bit of training that went into your medical degree. You have this way of thinking, and this body of knowledge. You've gone in at that level on exercise which lets you make those basic heuristics. One of the questions I'm sure people have got to be asking themselves, you've talked about the benefits of lifting heavy things to up regulate the production of IL-6 and down regulate the number of receptors you have so you'll have less inflammation, but how often do you have to do it?

Dr. Doug McGuff: Well that kind of depends upon the individual and the recovery status at any point in time. If someone is interested in optimizing their results, you really don't have to do it that often. Over time I've really, I really like working out, and I will do it as much as I can get away with, even though I'm a huge advocate of appropriate recovery and doing very brief workouts infrequently. To answer your question, I think it is always, in exercise, a great idea to strive for a minimal effective dose, because exercise is pro-inflammatory. Okay, if you're a person that is not living life right, not eating right, burning at both ends of the candle all the time, you have to understand that the exercise you're doing, at least in the acute phase, is adding an acute inflammatory event onto a chronic inflammatory state.

When you're making this transition from, lets say you're finally going to say, look I'm going to take care of myself, I'm going to live life right. Its most important for that person to do exercise in a way that invokes a pro-inflammatory state, but does it in a way that allows you to make that transition without chronically heaping more and more stress and inflammation onto a chronically stressed and inflamed body. Minimal effective dose is a great way to do that. As a 52 year-old guy, who has no major injuries from training over the longer term, its also important because really what you start to find out is that you experiment with all these different ways of training is that all the extra crap that I did through the years didn't make a difference. Actually the best results came when I truncated and minimized my training and really paid attention to recovery and diet. Things on the recovery side of the equation.

Dave Asprey: Yeah.

Dr. Doug McGuff: I mean you can get the hammer and pound the shit out of the nail, but if you really tune the recovery side of the equation, you don't have to hammer, and hammer, and hammer. The training becomes a nail gun, not a hammer.

Dave Asprey: What a beautiful analogy. I wish someone had told me that when I was 20 at the gym, 6,7, days a week. It was exactly what you were describing. I didn't understand you should recover like a demon, not exercise like a demon.

Dr. Doug McGuff: You know and I don't know if a younger guy will every listen to that. So much of having to be tough in your youth, just has to do with the fact that you're just fucking stupid.

Dave Asprey: Yeah.

Dr. Doug McGuff: And you just need to be tough because you're stupid, until you get to have accumulated enough lumps to actually become smart.

Dave Asprey: You know I've got a 5 year-old boy, and 7 year-old girl, and I got to say maybe the fact that he's a boy, but I'll tell him its going to hurt if you do that. Then he looks at you and does it anyway, like well its a learning experience. We've got iodine for that or whatever it is. Its funny because it continues and we know the prefrontal

cortex really finishes, kind of solidifies around 24, somewhere between 23 and 24. During that time, there's a whole set of these behaviors that are subconscious that come out.

I beat the crap out of my body, I have a screw in my knee and 3 knee surgeries before I was old enough to have my prefrontal cortex all the way in. Because I wouldn't listen to my body, also I was doing things that were supposed to be good for me that just simply weren't. That's one of my motivations for what I do now, why don't we just do what works because I was strategically lazy when I was under 23. If I don't have to do it, I don't want to do it. I thought I had to do things that were actually bad for me. That's kind of an obnoxious thing.

You're saying though that you like to exercise? You work out as much as you can get away with. I get clients like that, when I do coaching. With the Bulletproof diet book coming out, its getting harder and harder to do one-on-one coaching, but I still make some time for this. There are often times, like type A career CEOs, celebrity types, they're working really, really hard. Not enough sleep, frequent travel, they also want to Iron Man athletes. They want to do some seriously intense stuff, and then you look at their blood panels and they're clearly, CRPs high, they're HRV, heart rate variability, is all not right. Classical over training. Then you tell them, you need to back off a bit, and then they sort of look at you like they're going to cry, I need my exercise it makes me feel good. There's some opioid addiction there, but there's a comfortable line between having to beat yourself up every single day, where do you draw that line? For people who want to exercise more a the minimum effective dose? How do you know if its too much?

Dr. Doug McGuff: Well, the way I tell people to assess it in themselves is, if something comes up in your day to day life, on a day where you're scheduled to work out, and if something interferes with that and you have to cancel it and move it to another day, if it freaks you out, or if it pisses you off, or if it ruins your day and you're in a foul mood the rest of the day, or you can't stop thinking about it, you're doing too much. That is the weird thing about the over training syndrome is it is a form of OCD. Its like telling someone with OCD, stop flicking the light switch man its not good for you. Well yeah, but if they don't they're going to feel enormous angst over it. That angst is the signal that you're there.

This is why I like your concept of strategic laziness, because that's what we evolved out of. We want the most results for the least effort, because in the evolutionary environment from which our bodies evolved out of, that was an absolute necessity because there was really severe scarcity. Now in the age of, the modern age where capitalism has provided [inaudible 00:26:11] abundance, we got a mismatch of that. I find that amongst hard driving executive types that you service, is this whole Johnny Quest mentality. That I'm going to work 16 hours a day, I'm going to travel all over the world, and I'm going to run marathons, do ultra endurance events, and climb mountains, and you know all this Johnny Quest crap.

In the end, what you end up figuring out is in order to be super human, you have to

realize that you're only human. When you have accounted for that, and followed the biological imperative to cover and take care of yourself with the appropriate nutrition, and the correctly modulated exercise, its then and only then that you really do feel super human. I think that's a big, big key in all of this. Its a hard thing to get these hard driving individuals to understand.

Dave Asprey: Its really something I didn't understand, but resilience is itself a practice. No one's like, good job Dave, you were really resilient, its like you were strong, and you didn't give up. Bottom line is, giving up is one thing, deciding that you've had enough and that you need to recover now, so that you can get up again the next day and do it over, is just a different skill. Its not one that we praise, its not one that we train, and its not one really that you're likely to know about, unless you've hit the wall really, really, hard a few times.

Dr. Doug McGuff: Yeah. I just was watching a Vimeo clip, and the interesting thing is ... you talk about a navy seal, or special forces type people, those people are put under huge amount of stress. Both as a weeding out process, but also as stress inoculation to make them.

Dave Asprey: Yes.

Dr. Doug McGuff: What they found is in all of their stress inoculation training, the one thing that decreased the wash out rate at BUD/S from 38 down to 23% was one simple thing. That was to teach combat breathing, which is a meditative form of breathing, where when you're freaking out and you need to slow your heart rate down. Because once your heart rate goes above about 145, motor control and decision making capacity goes to crap. What they did was, they taught these guys how to meditate, and how to breathe. 4 seconds in, hold 4 seconds, 4 seconds out.

Dave Asprey: The box breathe.

Dr. Doug McGuff: Yes. The box breathe training, and learning how to mediate, that alone proved more valuable, in terms of stress inoculation, and making it through the BUD/S course than all the other more traditional stress inoculation techniques that they had done. Stress inoculation is a good thing, and its good to challenge ourselves and do big things, but again that whole realizing you're only human to become super human is important. There are elements of self-care that make you able to handle those stress-able moments. As an emergency physician, I've had a 25 career in this including residency, so 22 naught, but a long career in emergency medicine. As going from a new ER doc to an old ER doc, one thing I've really come to realize is that the answer to dealing with this uncontrolled pace, overwhelming pace, and sick people and dying people, is not to get yourself all amped up on Red Bulls and all hyped up and crazy. You've got to have an ability to calm yourself, to be the eye of the storm in order to function truly well.

Now you can kind of get yourself through it when you're not as good as you should be, by drinking Red Bulls and going ape crazy, but the better way is to have that

kind of calm.

Dave Asprey: Its funny you mention the medical side of things. I've learned those meditative breathing techniques and all the 40 years of zen neuro feedback and all that sort of stuff. I've learned to calm myself even at in an ER, which use to be always terrifying. I made a commitment training my kids the same way. Both my kids play the HeartMath game, the inner balance sensor, they clip the little thing on.

Just last night, Anna, who's 7, was running and she tripped on a stair and landed, skinned all 4 joints you can skin at 1 time. Screamed, and you know it was a disaster. She sat up and literally did 4 full slow in, slow out breaths, stopped crying, picked herself and decided that she wanted to go into the forest before we cleaned up her wounds. I was just flabbergasted to see this. Just teaching those basic skills. What would happen in the ER if everyone who came in, with whatever kind of critical injury they have, knew how to breathe like that? Do you think more people would survive? I don't want to put you on the spot, I know you have licensing issues or whatever.

Dr. Doug McGuff: Well yeah, no, you're talking about surviving. I kind of suspect that it might be, because one thing that we found is that in critical care patients, someone that is a bad multi-trauma, or someone with bad sepsis that you have to put on the ventilator, that if you don't provide appropriate pain control and analgesics, that their mortality is actually significantly higher. If you have a big dumping of catecholamines during an acute injury or illness, your survival is actually worse. We try to manage that pharmacologically, and through medical intervention, but now that you ask the question, someone that was able to access their own physiology, like in my opinion every human being should be taught to do.

Dave Asprey: Yes.

Dr. Doug McGuff: If they were able to do that, I think it could make a real difference.

Dave Asprey: Probably not in some cases.

Dr. Doug McGuff: People that are under acute stress. Their ability to manage their own physiology can save their life in a critical situation, but certainly I think it can also diminish the likelihood of developing PTSD during a stressful event, or something. Because all of these ... you know this big dump of catecholamines, and inflammatory cytokines, I think has a long term effect for setting the stage for those sort of bad things, so yeah. I've not thought this out ahead of time before you asked me, but when you asked me that I think yeah.

Dave Asprey: You know what you're doing, because according to my friends over at the HeartMath Institute, I'm an advisor for HeartMath and just a friend and supporter of their kind of technology, they've looked at that. People who are trained in heart rate variability before they go into combat are less likely to get PTSD, because they can get out of fight or flight. Its funny that you predicted that based on your

knowledge from ER, in fact that's startling that you did.

Dr. Doug McGuff: Funny that you asked me that, because now when I think back about it ... right now I work, the past 20 years I've worked in a high volume, high acuity community emergency department. When I was in residency and we rotated amongst different big hospitals, at the children's hospital they had a specialist called a Child Life Specialist. Per my recollection, when the children were in painful or stressful situations, they would come in and they would actually talk them through breathing exercises and things for self calming, and it really did make a significant difference. I think we do this for kids, why don't we do this for everyone, and for adults? That's probably something that could be applied in the emergency medicine setting that would be beneficial for a lot of people. I tell you, I got the sense that on any given shift on any given day, 40% of what I see is driven largely by anxiety states.

Dave Asprey: No here's an odd question, and then we'll go back to some of the other exercise related stuff, could you set a ventilator to do box breathing?

Dr. Doug McGuff: Yeah, you can.

Dave Asprey: Does it calm people down?

Dr. Doug McGuff: You know, I don't know.

Dave Asprey: I'm so intrigued.

Dr. Doug McGuff: You can set a ventilator, mostly what we manipulate ventilator settings for is to do 3 things. One is to control the level of carbon dioxide that's circulating in the blood by how well you're blowing off carbon dioxide, to what extent. The other is to effect oxygenation of the blood, and third is to provide pressure support for when the lung is ill, when its got fluid that's causing the alveoli to collapse and things of that nature. Mostly the ventilator is tweaked to optimize acid/base balance in the blood, and to optimize cardiac output. To answer your question, some critical care specialist that's very adept at manipulating- you could.

Dave Asprey: Wow, I'm so intrigued.

Dr. Doug McGuff: What we're finding with ventilator settings is, I mean 10 years ago we would run much higher tidal volumes and respiratory rates than we do nowadays. Now the tidal volume is gone down significantly and the level of oxygenation, and respiratory rates have been modulated some what. I guess in some sort of sense that would be the ventilator version of that kind of approach.

Dave Asprey: Lets take that back to exercise. Given that you know so much about blood gas mixes, more than anyone with a degree in exercise physiology is likely to, have you applied that to exercising in oxygen tents, high altitude velocity training, lifting heavy things without any air, stuff like that?

Dr. Doug McGuff: No, not really. The thing with breathing and exercise is the same thing that we were talking about earlier with the complexity of myokines and gut bacteria and how all the stuff beats back is that if you're doing really hard work, the best ventilatory mechanism that you can use is the one that you don't think about. Because it auto-regulates very well. When you're doing hard, high intensity exercise, you start to generate a lactic acid, the production of lactic acid. The automatic response is that pH is received by the chemo-receptors in your carotid arteries and around your brain stem, automatically regulates your respiratory volume and rate to blow off carbon dioxide, to affect carboxylic acid in your blood stream, to normalize the pH relative to the lactic acid doses. That kind of auto-regulates. Go ahead, it looks like you're going to ask something.

Dave Asprey: There's a whole school of training, mostly for endurance guys, around live high train low, or vice versa, depending on stuff. I've been for the past almost month or so getting my blood oxygen levels, very short, intermittent phases down into the high 70s for up to 6 minutes at a time. I'm in the middle of basically trying to raise my EPO levels naturally as an anti-aging technique. I've noticed huge differences in how I feel after just a few days of that. Its shown to improve athletic performance. Its fascinating to look at high intensity exposures to really heavy exercise, which you just figured out with some of the latest research we're doing, what its doing to myokines and the number of myokines you have. It appears you can do the same thing with cold, cold thermogenesis, the same thing with blood gas levels. There's all sorts of ways to reach in to the body and give it a strong signal to make it change, even though that's a signal that might never have really occurred for most people in a normal way of living. I'm intrigued that we're going to find a lot more in there.

Dr. Doug McGuff: Yeah, oxygen is a whole different ball of wax then carbon dioxide monitoring for the body. How oxygen is moved around the body is through hemoglobin, which is a really cool molecule, its a tetramer. It has 4 binding sites per oxygen. It changes its chemical shape as it binds oxygen. If you have a tetramer with 4 binding sites, and you bind 1 oxygen, the remaining 3 binding sites attract oxygen more aggressively. Then you bind the second one, the third one, and the fourth one now bind more aggressively. When they're all 4 bound, hemoglobin holds on to oxygen very aggressively.

A lot of people think of optimizing their oxygenation means having better oxygen binding, and that's not the case. What you need is oxygen delivery. The hemoglobin molecule has to be able to let go of oxygen at the tissue level. At sea level, when you chronically have good high levels of oxygen, you're always binding oxygen aggressively, and its hard for the oxygen to let go at the tissue level. Things that can augment letting go of oxygen at the tissue level acutely are lactic acidosis then signals that there's tissue hypoxia. That changes again the shape of the hemoglobin molecule so it lets go of oxygen more readily. On a chronic basis, when you train at altitude, or you do what you're doing, you're actually up regulating a molecule called 2,3-diphospoglycerte. That is a molecule that changes the shape of

hemoglobin over the longer time span, so it binds oxygen less aggressively.

Dave Asprey: Really?

Dr. Doug McGuff: That means you're able to let go of oxygen more easily at the tissue level. What you'll find is if you train at altitude, you return to a more normal sea level, what you'll find is that your oxygen saturation rather than always being 99 or 100%, you'll be at 95%. Someone that's trained in a hypoxic environment produces more 2,3-diphospoglycerte, and they therefore bind the oxygen to the hemoglobin molecule a little bit less aggressively and are therefore more able to let go of oxygen at the tissue level, and pass oxygen from hemoglobin to myoglobin in the muscle where it can be utilized.

Dave Asprey: You're increasing the bioavailability of oxygen to your muscles?

Dr. Doug McGuff: Correct. By actually holding on to it less stingily to it.

Dave Asprey: Doug I'm so glad I asked you that, because no ones ever explained that to me. I don't even know that molecule, now I have to go look it up.

Dr. Doug McGuff: The cool thing is, if, can you see me on the screen?

Dave Asprey: Yeah. Although people who're in their cars won't, but a lot of people on YouTube watch.

Dr. Doug McGuff: Well I'll try to describe it verbally. The oxygen binding curve for hemoglobin is sigmoidal. It starts off very flat, and then as oxygen level rises in your blood stream, when the partial pressure of oxygen is about 20, your oxygen saturation is going to be 50-60%. As the partial pressure of oxygen rises to 30, 40, and 50 you get on the steep part of the curve that goes up. Once you get a partial pressure of oxygen about 70 or 80, your hemoglobin molecule will be about 95% saturated. Then you can drive oxygen up to partial pressure of 200 and you're not going to get, you're still going to bottom out at 99-100%. The shoulder where you go from really tightly bound oxygen and fully saturated hemoglobin is at about 95%. Someone that's trained in a hypoxic environment will sit right at that shoulder.

Dave Asprey: Oh.

Dr. Doug McGuff: So that they can drop off on the steep part of the dissociation curve really quickly. That person lets go of oxygen more aggressively at the tissue level. A lot of people when they do this and they put the pulse oximeter on and they're like damn, I'm only at 95% on room air, this isn't working. What that really means is that it is working, you should be running around 95-96%, not 100%. They think, I'm getting worse, when they're actually getting better because you're binding oxygen less aggressively, you can deliver it to tissue more easily.

Dave Asprey: Serendipity is awesome, because I put on my pulse oxygen monitor and it was just

at 96 and I was like, God damn, literally it happened to me like 30 seconds ago. I was like yeah, I've been monitoring my blood oxygen, I wrote about what happens to it when I fly, I've been playing with this for years. I guess all this stuff I'm doing, first time I saw it 96 during the day, here it is you predicted that.

Dr. Doug McGuff: That more is better, but when it comes to hemoglobin binding you want to bind the oxygen less aggressively. Most people that are well conditioned will float around 95-96%, because they let go of it easier.

Dave Asprey: Oh that's beautiful. All right. Lets get back into exercise. CrossFit and functional movement. What's your take on- clearly the intensity's there and it seems like minimum effective dose isn't going to give you the benefits of proper form that you would get from a functional movement training, what's your take on that for a Body by Science perspective?

Dr. Doug McGuff: I don't ever want to be a guy that comes across as a hater. In that context, I go to the CrossFit website everyday and I look at it. I like their sense of life.

Dave Asprey: Amen. Yeah.

Dr. Doug McGuff: I think there is enormous value in doing hard things. I think that's cool stuff, okay. The whole functional movement craze is a little off putting to me, because I think its over played. The human body, if its appropriately strengthening and conditioning, its functional and can get into most positions pretty well. I don't think you have to construct a major training component dedicated exclusively to that for that to be in place.

Now my beef with CrossFit, from the Body by Science perspective, is 2 things. One is that for most circumstances and most people you have crossed the threshold way beyond minimal effective dose. If you follow the WODs and you do what's going to be going on at most boxes, you're going to be well beyond minimal effective dose. What that does for CrossFit from a marketing stand point is it creates the fitness version of SEAL BUD/S training. You kind of get rid of all the people that are not intrinsically tough enough to handle it, or don't have that genetically gifted recovery capability to begin with. You kind of weed out the weak, and you're left with the strong. Its a great marketing strategy for getting people that respond well to exercise. Its certainly greatly over steps the minimal effective dose concept, which I'm a big fan of.

The second thing is, I think they need to re-think a lot of the different WODs that are named after women. I don't even know what they are. I think it could be a real problem when you take a highly complex skilled movement pattern and mix it with exhaustion. Motor skills, like we said before, motor control degrades when heart rate elevates above a certain point. Complex motor skills degrade with exhaustion. When you're going to put a 500 or 2,000 meter row and a 100 burpees before you do some complex Olympic lift, I think that's a prescription to mess yourself up in a big way.

Dave Asprey: You're worried about the injury side of it?

Dr. Doug McGuff: Yeah. Body by Science, super slow, a lot of the high intensity world, we are way, way on the other spectrum of safety. We invoke so much safety that our margin of safety is almost ridiculous. I mean Ultimate Exercise has been open since 1997, we do 120 work outs a week, we've never had an injury in the facility.

Dave Asprey: Where is your facility? Plug it for a minute.

Dr. Doug McGuff: We're in Seneca, South Carolina. Which is right next to Clemson University, if anyone's familiar. We have this huge margin of safety. I'm not saying that everything they do is unsafe, but I think there are certain combinations where you're begging for it. I mean if you're really doing something that's highly exhaustive, its stacking a lot of fatigue and a lot of lactic acidosis, and then you're going to do a complex motor movement in a state of exhaustion. That's when you're going to drop the bar on your neck, or on your back, you're going to lose control of it going over head, and tear your rotator cuff, or get a slap injury. I think some of that probably needs to be rethought. People that are doing it well are probably arranging things in a way where that doesn't happen.

Dave Asprey: The composition of the WOD really matters for CrossFit, I hear you there.

Dr. Doug McGuff: That's their product, and that's their business, I'll let them handle it. I've got my product and my business.

Dave Asprey: Neither of us is dumping.

Dr. Doug McGuff: I love anyone that values doing hard things, I think its cool.

Dave Asprey: Yeah I even have Kelly Starrett coming to the Bulletproof conference to speak, he's doing some of both. I'm a supporter of it, but man if you're going to train that hard you better recover just as hard. A lot of the techniques that I've worked on are good for recovering, resilience, whatever kind of your stress is. If you're working out 6 days a week, your physical stress is pretty high, so lets hope your emotional and job stress aren't so bad.

Dr. Doug McGuff: The way they market themselves with all the military devotion and all the workouts named after dead soldiers, the whole Johnny Quest special forces things really appeals to the type A executives, that you've spoken about earlier. That can really throw gasoline on the fire of the OCD, over accomplishment, leading to over training problem that we talked about earlier.

Dave Asprey: Its something that I think is here to stay, its super high intensity and it feels good in the community, there's a lot of good stuff going. I hear what you're saying there, the concern about injuries, because me I'm actually grateful that I walk relatively normally. After my third knee surgery at 23 where they put a screw in my knee,

they sort of said well, be grateful you're walking. For me to have gone from constant knee pain in both knees to being able to track to the Himalayas for months, even though my knees hurt some of the time to be honest. It doesn't matter, I could do it, and it was within my capability and I didn't have an unstable knee or anything, so wow.

Dr. Doug McGuff: That's a cool point that I've noticed over the years, both in the emergency department seeing patients and in the training facilities, I see a lot of people with bummed up joints, bad knees, osteoarthritis. The people that are doing high intensity muscular work can have a knee, that by radiographic criteria is horrendous osteoarthritis, but they're asymptomatic. They don't have pain.

Dave Asprey: Wow.

Dr. Doug McGuff: Where as someone that is not doing exercise that challenges muscle in a meaningful way, those people have osteoarthritis with inflammatory changes and significant pain that limits their activities in daily life. I think it has a lot to do with this myokine stuff we've been talking about. One of them, interleukin 15, has a big systemic anti-inflammatory effect mainly by the fact that it antagonizes truncal body fat, which is the major distributor of all these inflammatory cytokines. It also has a direct anti-inflammatory effect as it circulates through the body. That's one of those things that I observe but could not explain, that I think myokines might explain. It might explain why you got this knee that's full of hardware, but it doesn't really bother you that much. When if you look at it on X-ray, anyone in their right mind would go, oh shit.

Dave Asprey: That may be the case. I did not know you were supposed to be able to walk without pain until some time in my mid 20s, like wow I actually did that. I played soccer for 13 years, it hurts to run, it hurts to move, that's just the condition of life. Granted I had extreme inflammation because I was exposed to some biotoxins and what not. I ate like crap because we didn't know any better, so mistakes were made. Still, looking at all this IL-6, IL-15, IL-8, all the different interleukins and all the myokines, its been revolutionary for me and you've studied them much more so than I have. I've looked at which supplements and in some cases which forms of things like growth and regenesis are going to down regulate inflammation, because I'm aging as a war against inflammation, so how do we win? Are you going to come out with a book on these? It seems like its about time.

Dr. Doug McGuff: Oh, man. That would be cool to do. The next go around, I'd like to do another exercise book that incorporates all of this sort of stuff again. Yeah, I probably will have to do that. Its not definitely in the plans right now, because there's so much other crap going on right now. Especially as my understanding of it delved deeper. The cool thing about it, its kind of the cool stuff about what you do, is that all of this complexity and all this stuff that you can really geek out on, the neat message behind it all is that if you just follow some simple heuristics and just do this, then all of that takes care of itself. That complexity is there to make it simple for us.

Dave Asprey: Its funny, I did not know half the reasons Bulletproof coffee worked. I experimented with this idea of putting butter in, has to be better than the other crap that's in cappuccino. I felt really good, I just noticed it in Tibet. As I wrote the Bulletproof diet book, I kept coming across research like, oh my God, someone actually did this study? They found the same results I noticed in myself, but I didn't know there was any thing science behind that. I was able to geek out and find reasons I was getting effects that should not have happened according to my expectations, but did.

Dr. Doug McGuff: Yeah, and that's the thing over the years experimenting in the gym and communicating with other people that are experimenting. I started to see the pattern. Everyone thinks science precedes invention and innovation, but it doesn't. Invention and innovation precedes science. Then we give science something to fill, all this science that's coming out on high intensity exercise was preceded by 20 years but guys like Arthur Jones and Ellington Darden and people that were looking at the high intensity exercise. The intrinsic intuitive, man this is really good stuff, that preceded any scientific investigation into why it worked. What I'm really starting to understand is that there's something that precedes innovation, its called tinkering and farting around. You know this farting around and tinkering with shit leads to innovation. Then once the innovation expresses itself, then society's like, hey what are these guys doing over here lets study it. That's the way it goes. Science never precedes innovation, that I have ever seen.

Dave Asprey: You look at observation, little bit of hypothesizing, experimenting, and then you really come in with the hardcore stuff. I just funded some research looking at inflammation. I paid for the IRB approval for a study. Its funny. Its an observation that I've made that, I'd say thousands of other people have reported to me, but no ones ever studied it in a systematic way. Either the inflammation numbers are going to go up or go down, according to a set of practices and that sort of thing. There's no real economic incentive for much of this high intensity, who's going to benefit from doing the study on high intensity exercise? Some new gym or something maybe? Its not like its a big pharmaceutical company. I'm looking forward to more quantified stuff happening.

Dr. Doug McGuff: I have this book that's called Body by Science, and I have been dogged by people for a lack of scientific rigor in some of the stuff I discuss on the internet, on my blog, and in videos, and with you. You've gotten a lot of crap, because guys like us what we're doing, I mean we throw dog shit into the screen door and see what lands on the other side.

Dave Asprey: Yeah.

Dr. Doug McGuff: When some stuff lands on the other side, then oh the serious scientists come pick that stuff up and run with it, its like, oh. That willingness to say, this works for reasons I don't understand and I'm going to keep doing it, even thought I can't prove it, is enormously beneficial. Sometimes the proving part of it doesn't happen for 20 years, so you don't have time to wait around.

Dave Asprey: Yeah aging doesn't wait. I'm not planning on dying because I was waiting for a double blind study that said dying was bad for me.

Dr. Doug McGuff: I'm 52, tomorrow I go to take my board, every 10 years you've got to re-certify for your board certification emergency medicine, tomorrow I go take my second 10 year certification. Which means the last time I took it I was 42 and I literally feel like it was 2 weeks ago that I drove down to the testing center and did it.

Dave Asprey: Wow.

Dr. Doug McGuff: The thing is, in our day to day lives, the days are long, but the years are short. We don't have time to mess around with this stuff, I believe that you've just got to get on with it, and do things.

Dave Asprey: Its totally true. I got to say, if you're watching and you're looking on Skype, you don't look any older than I am, and I'm 41, you're doing something right. I look odd today, if anyone's noticed me sitting with my eyes closed, 1 of my eyes is fully dilated because I had an eye exam right before this. I've been kind of squinting and looking funny the whole time.

Dr. Doug McGuff: Well you look like Satan.

Dave Asprey: Now lets see I've got 2 more questions for you. 1 of them is, have you looked at inflammation or muscles and whole body vibration at all? It seems like there's another whole set of hacked warm up stuff going on there, and full disclosure I have the whole Bulletproof vibe its a very small part of what I do.

Dr. Doug McGuff: No, and this is the second time someone's really pinged me with that. I had an interview with Joseph Mercola a while back and he pinged me about it. It triggered me just enough to kind of hit PubMed and see, oh is there any literature out here about that at all? There seemed to be a mother-load of it, but I've not delved into it yet.

Dave Asprey: You want me to send you 1 for 3 months to play with? I'd be happy to.

Dr. Doug McGuff: Sure, yeah.

Dave Asprey: All right, its yours. The Bulletproof vibe is awesome. I stand on it, probably between this and my next interview, I'll go stand on it for 2 minutes just to get the lymphatic system going, circulation and all.

Dr. Doug McGuff: Yeah. To answer your question in any real sense and to be able to comment intelligently on it, no.

Dave Asprey: Okay, cool.

Dr. Doug McGuff: It did pique my curiosity enough to go lets look see what the literature is like. There's a lot.

Dave Asprey: Yeah.

Dr. Doug McGuff: Its got to be read.

Dave Asprey: It goes back to that whole strategic laziness, minimum effective dose. I'm a big believer in movement and one of the things that I love about your book, Body by Science, is that its like look, taking the stairs is movement. Its not exercise, so you're not getting a hormonal response. Sometimes I don't have time to go for a walk, but I still want my body to get the movement that happens, if I can accelerate that into a smaller period of time, its maybe inferior but its better than nothing. I tend to look at it like that.

Dr. Doug McGuff: You know, its not exercise but I think that kind of stuff is important. One thing I'm also becoming a big believer in, the myokines kind of feed into that, is the concept of signaling. I've always found that when I spend a lot of time walking, long distances, an hour, 2, walks. Going on walks with the wife, I'm always leaning. I don't think its because of any exercise effect or calorie burning effect, but I think it sends a biological signal that says, look if you're going to be moving around that much, the diminishing marginal utility of carrying stored energy on your body is too high. Its cost is too high. Sure you've got 2 weeks of stored energy, but the cost of carrying around all that crap is too much if you're going to be moving around that much. The biological signal adjusts behavior in a way that allows you to be leaner. Its not that you're burning calories, or 10,000 steps a day burns a certain number of calories, that's crap.

Dave Asprey: Its laughable.

Dr. Doug McGuff: I do think it sends a biological signal that says, the marginal utility of having stored body fat is now diminished.

Dave Asprey: I think we would both agree that there's got to be something going on there. Same thing, it doesn't make any sense because you burn 3 potato chip's worth on your long walk if you're really looking at calorie burn. Yeah, you feel better and I always assumed it was something to with the muscle's effect on lymph. You increase lymph flow, maybe you have more ability to burn fat. There's clearly some little mechanism that we probably-

Dr. Doug McGuff: Yeah I think that there's just so much going on inside that black box that you know we've just got to be happy with what comes out the other side.

Dave Asprey: The other question I really wanted to ask you is something I think that would benefit readers, Bulletproof exec is relatively complex, there's a bunch of come here, start here kind of stuff. Really, there are people who really get into the weeds and there's a lot of weeds there that you can get into if you really want to go and

do something. When I go to Bodybyscience.net, you've got a lot of complexity on there too. I want to know how are you dealing with that, and where should new people want to go and check out your website? Where should they go to start looking at your recommendations? Honestly you've got tons of stuff on research, I find it a useful resource.

Dr. Doug McGuff: Yeah, I mean that's a great place for, its more of a gathering community for geeks like me that want to come there and geek out. I actually have a website that I run most of my consultancy through that has a direct link to a YouTube channel that's got some good videos, and lectures, and things of that nature. That's just Dr. McGuff, D-R-M-C-G-U-F-F .com, so DrMcGuff.com, if you go there you can see all the stuff on consultancy. There's links on learn and watch and stuff like that. Where you can go and pick up some of the lectures that I've given that've been recorded, that really kind of parses down into the essentials. It can even be much simpler than that. You have a great visual analog thing for diet that I think is a great heuristic to operate by.

Dave Asprey: Thank you.

Dr. Doug McGuff: My heuristic for diet is this, and for exercise is, do something really hard every once in a while and remain active otherwise.

Dave Asprey: Hold on that's too hard, let me write that down.

Dr. Doug McGuff: Do some really hard stuff every once in a while, and remain active. Diet is this, if you draw a straight line between the sun and your body, then that's a good diet. Your diet can be you getting directly in the sun, and converting vitamin D3 and probably a lot of other hormonally active substances we don't even know about that come from direct sunlight. Or the sunlight acts on phytoplankton, the sunlight acts on plants that go through photosynthesis, you can eat those like Terry Walls activates.

Dave Asprey: Yup, which is a good friend of mine.

Dr. Doug McGuff: There are animals that eat those plants and you can eat those animals. You can move up the food chain. That food chain is a chain that connects between you and the sun in a straight line. When you deviate off that straight line, through processing, that's where you get into trouble. A diet that stays on that straight line tends to be a single ingredient diet. You don't pick up a box and its got 40 ingredients that you can't pronounce, you pick up a, what am I going to eat, I'm going to eat an egg. What's in egg? Egg. What's in apple? Apple. What's in broccoli? Broccoli.

Dave Asprey: Yeah.

Dr. Doug McGuff: Single ingredient diets, straight line between you and the sun, and that works out. The heuristic, that little analog thing, good, better, best, for each of the different

macronutrients and stuff, that's a great gross heuristic. I think those are the things, those gross heuristics, that simply everything so that you can do it without having to devote so much mental energy to it, you can go on and do the more important things in life. I think that's really key.

Dave Asprey: I think we have a similar way of thinking, because I think you really welled it down in your book, same thing when I read that, I'm like I don't need to know all the details here, I'm more about feeling really, really good, having a ton of energy, having my brain work all the time, and looking reasonably good. I'm married, I have kids, I don't have to have a chiseled Hollywood 6% body fat, in fact I would probably die sooner if I did, like most people who look that way. The whole point there is like the goals aren't really different, but when it comes to exercise, I know you've gone 2 levels deeper than I have. I look at yours, here's the 5 things that you do, and do them about this often with about this little intensity, about there. You're not too perfectionist about it, love it, that's perfect.

Dr. Doug McGuff: Yeah. There's a letter of the law and I love digging into that. The purpose of letter of the law is so that you can operate with the spirit of the law. If you do that, you're 95% of the way there, the rest is just icing, and if you just want to geek out its there for you.

Dave Asprey: Its time to test your memory, because a 100 and so episodes ago, I asked you think question. I want to ask it to you again is the final question in the interview. What are your top 3 recommendations for people who want to perform better at life? If you want to kick more ass, do these 3 things, doesn't have to be anything to do with exercise, whatever else. You've learned a lot, you have an interesting career, the 3 things that everyone should know? We're going to test and see if this matches what you did before. Not really, there's no test. There's no test.

Dr. Doug McGuff: It won't match, because I've seen your other interviews and I saw the question and I thought what do I want to say this time? Its probably going to be different than what I said before.

Dave Asprey: That's actually good. Yeah, share your knowledge.

Dr. Doug McGuff: Its not going to relate just directly to exercise or physical aspects, but life in general.

Dave Asprey: Yes.

Dr. Doug McGuff: Because I'm studying for my emergency medicine boards, third time around, this time the renewal every 10 years, it gets me thinking about things in a more global sense. In the global sense, my 3 things for kicking ass in life are, number 1, just show up. Just show up, that's 90% of it, whatever it is just do it, just show up and be there and you're on your way. The number 2 thing is imagine. Actually if there's something you want to do, some way you want to be, being able to imagine it in your mind sets the stage for it to happen. You give your brain in your mind a target

to focus on, and that starts with imagination. Then once you've done that, the other thing is rehearsal. Just rehearse it in your mind, over and over and over again. There's certain big things that you have to have worked out in your mind ahead of time, so you know what you're course of action is going to be. Because when the shit hits the fan, and you're freaking out, you've got to be able to go there.

When I go to work, in the ER, everyday when I'm driving into work, I rehearse 3 things in my head. 1 is to do a thoracotomy, which is where someones been shot in the chest, they arrive in full arrest, you've got to open up their chest, open up the sac around the heart, evacuate the clot, save someone's life that's been shot or stabbed. The other is the procedure of cricothyrotomy, which is getting into the windpipe for someone who has had massive facial, or is having an allergic reaction there tongues so swollen that you can't get a tube into their windpipe by the usual route. You have to do it surgically. The third is a postmortem cesarean section. A pregnant woman that's beyond 20-24 weeks gestation that's had a cardiac arrest. Within 5 minutes of cardiac arrest, the only way you're going to save the mother and the baby is to cut and get the baby out.

The thing about emergency medicine, and the thing about so many things in life, is the greater your need to act quickly and decisively, the greater your tendency to hesitate. The only way to overcome that is rehearsal. Think about the big important issues in your life and how you're going to behave when those things happen, and rehearse them. Rehearse them everyday, so when it does happen, you'll know what to do. When you're on the 114th floor of the World Trade Center and the instructions are, well they told us just to stay put until they give us instructions, if you've thought it out ahead of time you'll be the guy that says, screw that, I'm going down the stairs.

When someone holds you at gunpoint in the parking lot of the shopping center and says get in the car, you'll the guy that says I'm not getting in the car. You can shoot me right here in the parking lot in front of all the cameras. There's all sorts of things, you've got pick what they are. Whatever these big issues in your life that you foresee coming some time in the future, think about what you're going to do and rehearse it. Those are my 3 secrets to kick ass.

Dave Asprey: Well those are definitely more impactful than the last ones, because I'm not sure I remember them without going back to look at the show, but I think I'll remember these Doug.

Dr. Doug McGuff: [inaudible 01:12:25] Rabidly scrambling here on my computer, trying to find the old episode.

Dave Asprey: I would have been sad if you said the same ones because people can always listen to the first interview. By the way, you should if you enjoyed this one, the first interview was good. We talked a lot more in that one about the basics of exercise and all. Doug its always a pleasure to have you on the show, would you toss out DrMcGuff.com and Bodybyscience.net, any other URLs besides those that people

should go to?

Dr. Doug McGuff: I think that will get you to everything that is sort of a portal to what I do. That's Dr. McGuff, D-R McGuff .com, and Bodybyscience.net you can find me from there.

Dave Asprey: Wonderful. Have an awesome afternoon and thanks again for being on Bulletproof radio.