BUILTLEAN

Afterburn Effect

Q&A With Dr. Christopher Scott, PHD

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Marc Perry, Creator BuiltLean **Dr . Christopher Scott, PHD**

***Marc Perry**:* Hello, everyone. This is **Marc Perry** from www.builtlean.com. I have a very special guest joining me today on the phone, **Dr. Christopher Scott**.

Just to give you a very short bio, which I'm sure is not going to do Dr. Scott justice, but **Dr. Christopher Scott** is an Associate Professor at the University of Southern Maine. Dr. Scott has been called a "pioneer" for his research focusing on the determination of energy expenditure for strength, speed, and power-related activities, both during and after exercise.

He has been a professor of exercise physiology for over nine years and is the sole author of the five-star ranked textbook A Primer for the Exercise and Nutrition Scientist: Thermodynamics, Bioenergenics, and Metabolism.

Dr. Scott, I want to thank you very much for your willingness to share your insights and your time today.

***Dr. Chris Scott**:* No problem, Marc. Call me Chris.

***Marc Perry**:* Thanks, Chris. I was hoping to go into four sections in this call. The first starting out with an energy expenditure primer, then

talking a little bit more in depth about this concept of the afterburn effect, which I know your research is really pivotal. The third is discussing the body composition implications of intense anaerobic exercise, and then finally tying it all together with practical applications.

I guess to get started – I know it's a pretty rudimentary question for someone who wrote an entire book on it – but what is energy expenditure?

***Dr. Chris Scott**:* Primarily what we're talking about is that in order to survive, we have to supply ourselves with energy. Muscles have to have the ability to perform work, and to do that requires energy; energy exchange from one form to another.

We eat food, and essentially that food – the energy within the chemical bonds of that food – is converted into a form that your cells can use to perform work, like muscle contraction. It is inefficient. If we weren't inefficient, we'd probably be more overweight than we are. But it costs, if you will, to convert energy from one form to another, and that essentially is energy expenditure.

***Marc Perry**:* Got it. Can you describe the difference between aerobic and anaerobic exercise?

***Dr. Chris Scott**:* Yep, we're talking about the energy expenditure behind these as well. There are two formats of energy exchange, if you will – or themes might even be a better word. The one that uses oxygen, this is called aerobic. It's traditional exercise. It's the way it's traditionally been studied by exercise physiologists, and it essentially boils down to long, slow distance, either running, or cycling or something along those lines. You're typically asked to get your heart rate up for a period of time, might be 30 minutes or so, three to five times per week. This is cardiovascular work or aerobic work.

When we start getting into activities that involve strength, speed, and power, this is very intense physical work. What that requires is energy exchange rapidly taking place in your muscle cells, and it really takes place so rapidly that oxygen uptake can't supply the energy demand.

So we have other avenues, another theme, if you will, and that's anaerobic energy expenditure. Essentially what happens is you're breaking down glucose molecules faster than you can use oxygen

for energy exchange. What's formed, as a byproduct of this, is lactic acid. This is what is referred to primarily as the main anaerobic energy pathway, if you will.

Then there's another format of anaerobic energy, which has a sort of strange twist to it in that you have stored – in every cell in your body, particularly your muscle cells, you have stored high-energy molecules, phosphocreatine and ATP. They're very minimal amounts, but they enable you to perform, for example, one repetition maximum, two repetition maximum, really hard, intense sprinting for 40 yards or so. A vertical jump is another good example that uses these high-energy phosphates. That's also referred to as the anaerobic energy system.

The twist on it is that these phosphates or molecules are actually resynthesized in the recovery from exercise, and the recovery from exercise is all aerobic. We say that having these phosphocreatine and ATP molecules is the anaerobic energy system, but interestingly enough, they're actually resynthesized aerobically.

Those are the two systems in anaerobic energy expenditure. Then what we started off with was the aerobic system that uses oxygen.

***Marc Perry**:* Great. Very well said. How is the energy expenditure from aerobic exercise typically measured?

***Dr. Chris Scott**:* Typically it's measured with an oxygen uptake measurement. When I give talks, I typically start out every talk by really going back to the history, or reminding people that energy expenditure – the fact of the matter is we can't go into the cell – each and every working skeletal muscle cell during exercise – and determine how many of these high-energy phosphate molecules are actually being depleted. If we could, we would solve all our problems.

We don't measure energy expenditure. We estimate it, but we do estimate it with a measurement of oxygen consumption. Now, clearly, and this has been known for – in animals anyway for well over 200 years, and in humans for certainly 100 or so – and that is that the amount of heat that you give off, which is really a direct measure of energy expenditure, it is in relation to the amount of oxygen that you consume.

The problem is that it's really, really difficult to measure heat loss, especially in large creatures like ourselves. To house somebody in a container where you can measure their heat loss for an extended period of time, it's quite unreasonable.

But luckily heat loss is proportional to the amount of oxygen we consume, and it's really easy to measure oxygen uptake. If you were to step on a treadmill, or a cycle ergometer, or a rowing machine, or something along those lines, an elliptical trainer in a gym, and it asks you to place your weight into the computer, it'll give you an energy expenditure in calories. That is basically coming from a laboratory somewhere that measured somebody who was actually consuming oxygen while performing that activity.

That's very straightforward. You just measure their oxygen uptake. It's done with what's called a metabolic cart. If you are an exercise physiology lab, wherever in the world, I can tell you that's a staple piece of machinery in every exercise physiology lab. That's the metabolic cart to measure oxygen uptake.

***Marc Perry**:* This makes perfect sense. How is the energy expenditure for anaerobic exercise typically estimated or measured?

***Dr. Chris Scott**:* Well, this is the problem. There is no gold standard. Everyone recognizes that if you're going to measure or estimate aerobic energy expenditure, you're going to measure oxygen uptake. There's not a person I know who won't agree with that. Anaerobic metabolism, however, how do we measure that? There is no universally agreed on way to do that, and so anybody who dabbles in this, including myself, it's going to be controversial.

What I've tried to do is just really get to the basics of energy expenditure and then using the best tools that we have and realize that, hey, we're not measuring this directly. We're trying to come up with a reasonable estimate.

That's where I am really right now. My lab work is measuring strength, speed and power stuff, but I look at myself – I tell my wife that I'm in the marketing phase of my career where it's really just trying to sell my ideas more than coming up with new ways to do all this stuff.

Anaerobic energy expenditure is tough to measure. What I do is I measure blood lactic acid levels after very brief and intense activity, and that gives me a rough idea anyway of what the anaerobic contribution is.

The point I like to make with colleagues that disagree with that is if you don't include an anaerobic energy expenditure component,

then you're essentially saying the anaerobic energy component is zero, and that's where I have an issue with some of my colleagues, if you will.

***Marc Perry**:* Understood. Just to summarize, total energy expenditure for anaerobic exercise can kinda be broken into three components. One is the calories burned aerobically during exercise, right? That's Number 1.

***Dr. Chris Scott**:* That's correct.

***Marc Perry**:* Number 2 is calories burned after exercise, which is this EPOC concept, excess post exercise oxygen consumption, the "oxygen debt" it used to be called, right?

***Dr. Chris Scott**:* Right, that's correct.

***Marc Perry**:* Then third is this really novel way of looking at it, which is what you've contributed, and I've never heard before, I've never heard at any fitness conference ever, is this concept of lactic acid contribution of exercise.

***Dr. Chris Scott**:* Right.

***Marc Perry**:* So it's this third one that really seems to be different from what a lot of other people have done in the past.

***Dr. Chris Scott**:* Yeah. If you look at – I don't wanna speak for other people, but I try to grasp – I'm struggling with, wrestling with, why do people think the way they do, and that is that you can take an anaerobic activity such as weight lifting. There's nothing more mainstream than that. We know. You can open up any textbook on the subject, and you know that weightlifting is referred to as an anaerobic exercise, so how do we measure the energy expenditure of an activity that doesn't use oxygen? Why, we hook you up to a metabolic cart and measure your oxygen consumption.

I went all the way – eventually getting my Ph.D – through school, but I can remember professor after professor, asking 'em that question. It was, "Keep reading, Scott. Keep reading." It's, like, "Wait a minute. This doesn't make sense."

If I'm going back to why do people think the way they are, I think that the way scientists have started the origins of exercise physiology are pretty much all aerobic exercise. That's what it is. Now many people are applying aerobic exercise concepts like

long-distance running and cycling, and they're using what they found there and applying it to resistance training and weight lifting. That's where I pretty much have drawn the line. I'm not going to do that.

We need to do something just a little bit better than that. We need to at least get a reasonable number on this anaerobic component. That's what I've attempted to do.

***Marc Perry**:* Great. This is really phenomenal. Just so we're clear, let's, I guess, start talking a little bit about what the effects can actually be from aerobic exercise energy expenditure versus anaerobic exercise energy expenditure.

From what I've read, basically aerobic, you're burning a lot of calories during the workout, and then it's minimal after the workout. Conversely, with anaerobic activity, you're not necessarily burning that many calories during the anaerobic exercise, but after can actually be way more significant, especially when you take into account this lactic acid contribution of exercise.

***Dr. Chris Scott**:* That's correct. What we're finding – what I decided to do is – most research that looks at weightlifting, they'll take – they might take pre exercise measurements, and then they'll wait till all these sets and reps and everything else is done. They'll do a complete workout, 45 minutes, maybe an hour or more of weight lifting, and then they'll take their measurements again.

What I decided is, wait, we need to go back to the beginning. Maybe I'm just being a little too crazy here, but I'm, like, "You know what? Let's just take this one set at a time instead of going through umpteen numbers of sets with different reps, different rest periods. There are so many variables here to deal with. Let's just keep it simple."

I just started doing single sets of bench-press exercise, and I did two sets with another study. Then I did three sets, which I'm actually working on this summer, writing up the paper.

What we're finding is that after every single set, the largest contribution to energy expenditure is clearly coming from the recovery component. If it's a single set with muscular endurance-type work, the largest component is actually the anaerobic energy component followed by this excess post oxygen component. The

lowest denominator, if you will, of energy expenditure is exercise oxygen uptake, which for aerobic activity is the largest component.

What I'm trying to get people to realize is when we look at things one set at a time, there really is quite a difference between how aerobic energy expenditure and anaerobic energy expenditure are compared.

***Marc Perry**:* Great. In the article – so I'm going to post this interview on an article. In the article, I'm going to include the results from your misconceptions about aerobic-anaerobic exercise expenditure. I think it's pretty shocking, the intermittent sprints versus a steady rate walk. I think it's really impressive. I think it will kind of surprise people in terms of how many calories are actually being burned total from anaerobic exercise and especially after the exercise. I think it's great.

***Dr. Chris Scott**:* That particular study – I did that study, Marc, a long time ago when I was just trying to actually get the methods for this new one. I wasn't actually collecting blood lactate back then. I was using another method, assuming what anaerobic energy expenditure was by how much oxygen was not consumed.

I wouldn't so much agree with the numbers on that, but what it did do was paint a picture that we are possibly way off in terms of looking at the total energy expenditure of a weightlifting activity or a sprinting activity.

Don't get too hung up on the numbers on that particular study, but it clearly shows that if you're going to be doing really intense work, you're probably burning a lot more calories, if you will, than what we originally proposed.

***Marc Perry**:* That sounds perfect. I want just to go a little bit further along. How long can metabolism be elevated after an intense bout of exercise, anaerobic exercise?

***Dr. Chris Scott**:* What we do just to keep our model reasonable, we actually follow oxygen consumption after exercise until it falls below what a standing-resting oxygen uptake is. We're finding that after a single set, depending on who the person is, recovery can last anywhere from, I don't know, 4, 5 to 15 minutes or so.

Going into other people's research, however, when you start doing complete workouts, workouts that last 45 minutes to over an hour or so, they're starting to see – or I'm starting to see from reading

other people's stuff – that weight lifting or resistance training might actually result in a longer recovery than aerobic energy expenditure.

The problem is it's really hard to compare the two. I've seen studies, for example, that followed a weightlifting routine where sets and reps were at 70 percent of a one-repetition maximum. Then they looked at aerobic exercise that was 70 percent of maximal oxygen consumption.

As an exercise physiologist, I can imagine, well, okay, the numbers 70 match, but can you really compare in terms of intensity the maximal amount of strength output versus 70 percent of oxygen uptake? I don't think that's a legitimate comparison.

It's hard to look at the two, but even so, there seems to be something to resistance training that is not there with typical cardiovascular or aerobic work.

***Marc Perry**:* Understood. Some studies have shown your metabolism can be elevated by as much as 20 percent for up to 48 hours. Does that number sound reasonable? I've even seen up to 72 hours. Do those numbers seem reasonable?

***Dr. Chris Scott**:* Yeah, that's quite high, actually. You're starting to get 20 percent of resting metabolism? That's a lot.

My guess is, and this is where I'm a little confused – I can't answer the question. You look at each individual exercise component – or excuse me, recovery component – after each set. Now, is that traditional recovery, or is that part of – or should we keep it part of the exercise oxygen uptake, which most people do? Should I wait until everything is complete until I have exercise finished, absolutely done with, before I start measuring my recovery component?

Then you start getting into protein synthesis and all this other stuff that might take place. Some people they're interested in muscular hypertrophy. You start laying down protein, this takes energy. It takes energy to build proteins, and that might be the difference between aerobic exercise and anaerobic exercise in terms of this relatively large recovery component.

***Marc Perry**:* Right, and I was actually just about to get to that in a second. That sounds great. A couple of things that I think are interesting when people think about energy expenditure. The first thing that comes

to mind is your heart rate. If you have an elevated heart rate, then you're burning excess calories, and that's really what it's all about. Can you elaborate a little bit more on kind of the heart rate; how it may or may not help predict energy expenditure?

***Dr. Chris Scott**:* Yeah. Again, it goes back to this we don't measure energy expenditure. We estimate it. Now how do you estimate it? Different people do different things.

The best way – most people would tell you – again, for aerobic exercise – and that's where everybody starts – is oxygen uptake. Well, the fact of the matter is most people don't have access to a metabolic cart, so they can't do that.

Well, what's the next best way? Well, the next best way, again, for aerobic activity is heart rate. Then you can go down to a rating of perceived exertion. That can measure oxygen uptake. I work with people that use pedometers to try to measure what's so-called – or estimate what energy expenditure is. You can use physical activity questionnaires to measure this, if you will.

This gets tricky because you could be, for example, doing hand-grip exercise, which is not using a large muscle mass at all, but it'll get your heart rate going sky high if it's done right. I'm under the impression that it can help with an energy expenditure estimate, but it also can be misleading. You have to be careful.

To get my students laughing, or I hope to get 'em laughing, I'll imagine I have a plate full of methamphetamines or something like that, and "Here, try these. What's it going to do to your heart rate?" "It's going to elevate it." "Okay, does that represent what your energy expenditure is right now?" The answer is, "Well, probably not."

I could scare you and elevate your heart rate. You could be in the sun overheating, and your heart rate's going to go high. Is it really increasing your energy expenditure? Probably not that much, but it helps. It certainly helps.

***Marc Perry**:* Great. I guess another kinda component is some people are, like, "Oh, you know what? As long as I sweat a lot, I'm burning a lot of calories." Can you maybe talk a little bit about how that may or may not be helpful in terms of estimating total energy expenditure?

***Dr. Chris Scott**:* Energy expenditure is heat loss, if you go back to the fundamentals. If you're sweating, you're dissipating heat, and there's probably something to that.

You've given me an idea, although I probably won't pursue it because it's difficult to determine how much water is evaporating off a person, but you could probably use that as an estimate of energy expenditure. There probably wouldn't be a – it's not going to be perfect, but anything that helps, I'm for it. You know what I mean?

***Marc Perry**:* Absolutely. I just remember one of my friends is like, "You know what? I really don't like exercising. Why don't I just go in a sauna and sweat and try to burn extra calories that way?"

***Dr. Chris Scott**:* Yeah, I don't follow that reasoning at all. *[Laughter]*

***Marc Perry**:* Of course, and so I think there might be this misperception that just 'cause you sweat, it means you're burning a lot of calories, whereas, I think the type of activity that we're discussing, the aerobic versus anaerobic, just 'cause you're sweating a lot doesn't necessarily mean you're going to burn the maximum amount of calories.

***Dr. Chris Scott**:* Yeah, if you're sweating because of activity, that's what I'm thinking. It might be some sort of an estimate of how much energy you are expending. But like you say, if you're sitting in a sauna doing nothing, and you're sweating, I'm not buying that argument that sweating is related to energy expenditure.

***Marc Perry**:* Got it. All right, so you talked about this briefly, and so the concept of muscle soreness, and micro tears, and how strength training intensely with heavier weights can create this kind of effect that throws your body out of homeostasis and requires this kind of extra recovery component.

That's personally what I've found. Since I've been working out all my life is there's something going on after a very intense workout. My muscles are really sore. It might help me burn more calories after the workout. Could you talk a little bit more about that kinda component?

***Dr. Chris Scott**:* You're getting outside of my range of interest, if you will, in terms of my research, but clearly, if you're working muscle to the point where you're causing damage at the microscopic level, then you're certainly going to result – it's going to take energy to repair that.

That's what I was getting to earlier. If you're really working hard and laying down – breaking proteins and laying down new proteins, that is most certainly going to be raising your energy expenditure.

There's obviously a – I like to show things when I give talks. You look at the energy components of living, if you will, daily life during the day, resting, increased energy component after eating, increased energy component for exercise and recovery.

There's also medical issues, if you will, that increase energy expenditure, and the largest one is burns. If you're a burn victim, you can literally double your resting metabolic rate with severe burns. The reason why is you look at your skin, which is mostly protein, you're laying down new protein. Your nutritional demands are literally off the chart.

Get back into working skeletal muscle. If you've damaged protein, and you have to lay down new protein, you're most certainly going to be increasing energy expenditure.

Now, whether you need to work out to the point where you're actually damaging muscle, I guess that's another issue.

***Marc Perry**:* Okay, great. By the way, how are we on time? Are you okay?

***Dr. Chris Scott**:* Yeah, I'm fine.

***Marc Perry**:* Great, so in terms of body composition, so we've kinda talked about energy expenditure and kinda this afterburn effect. In terms of body composition, does high-intensity anaerobic exercise burn more fat than traditional cardio for a given period? Is that an accurate – that's a question for you.

***Dr. Chris Scott**:* Here's my answer: yes. This is where I think certainly within my lifetime, we've had to change the way we think about things. I'll give you another example before we get back on this. We used to think that in order to be healthy, you had to be fit. Now we realize that you don't necessarily have to be fit, but you have to be physically active in order to get health benefits.

A similar thinking was that if you wanted to burn fat, you would have to do long, slow, distance activity because that's going to burn the most fat. We're starting to realize now that in fact it's the other way around that during really brief, intense intermittent bouts

of strength, speed and power-related stuff, I'm under the impression you can burn even more fat.

The reason why is that when you start – there was a study I saw years ago, and I still quote it, and they were doing these six-second bursts of all-out cycling. It was 10, 15 sets of this, and they found this unheard of amount of free fatty acids that were broken down from fat stores within the muscle. It begs the question why, during an anaerobic activity that clearly utilizes glucose as a fuel, why is so much fat being broken down?

The answer appears to be, well, the exercise component is six seconds long, and that's using glucose, but however long the recovery component is, that's when you're burning fat. If you add all these intermittent periods together, you're probably – the rationale that I use to determine energy expenditure, I literally assume that during the recovery from strength, speed and power-related stuff, you're primarily burning lactate and fatty acids, and that's where the body composition stuff comes in.

If you wanna lose weight, lose body fat, get ripped, I'm under that impression that intermittent bursts of high-intensity activity followed by rest periods, that's the way to do it.

People like you, the anecdotal stuff where you're actually out there working with people, the trainers that I know, they're the ones who tell me that if you want somebody to lose body fat, that's the way to do it.

***Marc Perry**:* Great. I think that was extremely well said. I have here in my notes to talk about the fat burning zone, but I feel like you kind of debunked it already, but I was hoping you could kinda talk about this concept of the fat burning zone and how it might be somewhat misleading for consumers.

***Dr. Chris Scott**:* There's some truth to it. Don't get me wrong. The problem is that in order to get what's also known as the crossover, whenever you start exercising – there's my New England coming out – whenever you start exercising, you're predominately burning carbohydrates. If it's a low-intensity activity, at some point you're going to cross over to less carbohydrates and more fat, and that, from what I've seen, occurs maybe 20, 30 minutes into a long, slow, distance type of a workout.

Now, in order to do that, you have to be at moderate to low intensity. Yeah, you're burning calories, but you're not burning, I

don't think, to the extent where if you were really intense brief bouts of work output, I think that's what really drives the total energy expenditure up.

If you really add all the components together of exercise and recovery, what we're finding is that the recovery energy expenditure clearly outweighs everything else in terms of caloric cost. So if you're predominately burning fat during that time period, that might be the better one for body composition.

Let's put it this way. You don't have to run for an hour or so, half an hour to an hour, before you start utilizing more fat, if you will. Here, you can do it within minutes, seconds maybe. Who knows?

***Marc Perry**:* This is really powerful stuff. I think many of these major organizations out there, these health organizations, are kinda promoting this slow cardio concept, whereas, Americans are obviously time-strapped. They don't have enough time, and I feel like promoting this type of research can be helpful. You know what? You don't need to spend that much time. Even ten minutes would be very helpful.

***Dr. Chris Scott**:* What you say is true. Again, I try to search for why is that, and I think the answer really is that – I'll be 50 years old in November, so I started this a long time ago. I looked back at in the '70s in high school, and then early '80s in college, and I was always taught about aerobic activity.

Now, nothing in the textbooks considered weightlifting or anything like that. Now, we're realizing that it's different, but who are the professors that are teaching today's youth? It's the exercise physiologists that were taught all about aerobic activity.

As an example, I just went to a conference at the American College of Sports Medicine, and there was a guy at a school in Wisconsin. He called me about my research techniques. He wanted to apply it to kettlebell training. What's the – man makers, or something like that? That's what he was doing, kettlebell swings or something.

We had a nice conversation, and I'm all happy, like, "Oh, yeah, good, I got another guy who's going to use my techniques." Then when he shows up at the conference, he really ditched everything and did it all traditional.

I didn't get a chance to talk to him, but a buddy of mine did. He was saying that he was kinda disappointed. Maybe he should've listened to me. It's funny. The chair of this guy's department, who he works with, is a long-distance runner or used to be.

***Marc Perry**:* Of course.

***Dr. Chris Scott**:* He told that guy, "No, that's not the way to do it." I just got a good laugh out of that because it sorta just goes along with my thinking here where you have essentially exercise physiologists that are a big family unit of distance runners and distance cyclists, and they're applying what they learned to weightlifting today. What we're finding out now, obviously enough, is different, I think.

***Marc Perry**:* Wow, I think that's a really interesting kind of anecdote. It sounds plausible to me, especially given that I've been to all these conferences, and I've seen it happen.

I would hope to talk a little bit more about the practical applications, and you started to kinda touch upon it in that last answer. Does intense strength training create a greater afterburn effect than this intense anaerobic cardio exercise like sprinting, or is it kinda comparable do you think?

***Dr. Chris Scott**:* Yeah, I can't answer that now 'cause we just don't know. But my guess would be that, yeah, it would be comparable, that if you want – let's put it this way. If you want body composition changes with exercise, the first thing I would think of is some type of intermittent interval training, something along those lines, weight lifting, something along a – but it would be muscular endurance. I wouldn't use power lifting, for example, to create body composition changes.

Than another thing I always tell people – I'm not a nutritionist, obviously, but I know a little bit about it – if you really were to come to me and wanted to lose weight, and we made a list of ten things, one through seven of 'em would be dietary, watching what you eat. Then eight, nine and ten would be exercise.

***Marc Perry**:* Absolutely. I couldn't agree more. It's certainly what I found myself and with all of my training clients. Do you have an opinion on full body workouts versus body parts in terms of creating this afterburn effect?

***Dr. Chris Scott**:* I don't know. We're just so rudimentary with all this. I also tell people I'm not a trainer. You're the trainer. You know what I mean? I use exercise as a tool to study physiology, or as a model to study physiology, so I don't train people. But there are certainly concepts involved with – I know recovery is very important, for example. If you're doing whole body stuff, I'm not so sure you should be doing it every day, but you can mix and match muscle groups and do it all week long.

***Marc Perry**:* Of course. That makes perfect sense.

***Dr. Chris Scott**:* As you know probably, Marc, there's – people respond differently. I think that's where the better personal trainers are, where they really make independent programs for each – that are tailor made, if you will, for each and every person. That's where the expertise from the trainer comes in.

***Marc Perry**:* That's personally what we do with my training and nutrition practice. Some people respond really well to full body workouts. Some people get absolutely nauseous, and it doesn't work.

***Dr. Chris Scott**:* There are ways, if you will, to trick. You get somewhere in there who you want 'em to do high intensity stuff, but obviously, you have to be very careful with them. There are ways that you can get around that. You could do really brief stuff, two or three seconds long, and then have 'em do a long recovery.

Again, I teach my classes if you're going to go out there and train, it's the creativity part that's really going to separate you out from other people in your profession.

Safety obviously comes in there as well, but you have to be creative. You guys are artists in a sense, you know.

***Marc Perry**:* You hit upon something, I think, as a core component to all of this. There are all these programs out there that are super intense and extreme like P90X and Insanity, and it's six to seven times a week. It's absolutely crazy.

The reality is most people, number one, either can't do that, or they probably shouldn't do it 'cause if you haven't worked out in six months, how can you apply your research, which is saying, "Okay, do this really high-intensity exercise"? How do you do that?

For me, what I've done is started out with this kinda progression, where we don't even do any very high-intensity stuff for probably

the first month, maybe three weeks in or a month. So I'm kinda curious how you see your research benefiting the general population of people who might not be in good shape?

***Dr. Chris Scott**:* I think your approach obviously is to get them into shape before they really start working out. That's the approach to do it. I also think that depending on what a person's needs are, that's what's going to have application for what I do.

Again, if you want body composition changes, and you want an exercise program designed for that, I'm more convinced than ever it should be strength, speed, power-related stuff that uses large muscle groups. That's going to burn the most calories.

What we're finding here – we built this little device in our – we had the engineering department build a little device in our lab, and so we're actually able to measure work output. What we're finding is that the bottom level – and this is common sense – you don't even need science to show that this is accurate – the more work you do, the greater your energy expenditure is.

What we found is the most work that can be done is the least amount of weight for the most repetitions, muscular endurance stuff. You use large muscle groups like your legs, let's say sprinting, you're doing 40 yards sprints or something, that's as much energy expenditure as you're going to get, for sure. It will most definitely, over time, result in body composition changes.

***Marc Perry**:* Great. Well, listen, I guess I have one more question, which is: anything else you would like to add that we didn't cover that you think is important?

***Dr. Chris Scott**:* No, other than the fact that we have a long way to go before we understand this, and that there are times when it's almost – for me, from a scientific standpoint – it's almost overwhelming because we're finding out that isotonic contractions are different than isometric, that are different from isokinetic. Then you add different one repetition maximums or ten repetition maximum, how much exercise time's involved, number of reps, the number of sets, the number of rest periods in between sets.

All these can be manipulated to the point where it's not cohesive right now. You know what I mean? It doesn't make sense. Sometimes I look at everything that I've done so far, and like, man, can I make sense of all this? You know what I mean? That's why I wanted to start from the very beginning.

We have a long way to go, there's no doubt about it, before we find the perfect exercise program, if you will. The truth of the matter is there's probably not one perfect program. There's probably dozens of perfect programs. Again, it all goes down to the independence of the person that's involved. What's actually best for them?

The bottom line, though, I think, though, Marc, and again, from anecdotal evidence that I've heard from you and others, is that when you really start doing the intermittent large muscle group, high-intensity-type exercise, that's when people start getting into these ripped, cut, nice body composition adjustments.

***Marc Perry**:* That is really great. Again, I want to thank you so much for your time. I think the research you're doing is really amazing and extremely helpful. I'm going to certainly do my best to try to promote it.

***Dr. Chris Scott**:* Yes, thank you.

***Dr. Chris Scott**:* All right, take care.

***Marc Perry**:* Bye bye.

About BuiltLean

BuiltLean is a private company based in New York City that develops fitness programs and produces free articles and videos that empower busy professionals to reveal their fitness potential. BuiltLean offers personal training, nutrition counseling, and group fitness services, and is the producer of BuiltLean Program, an 8 week body transformation program that requires only 3 short workouts per week.

About Marc Perry

Marc is the Founder & CEO of BuiltLean. Marc is one of the most sought after fitness experts and coaches in New York City and has been featured on TV for his expertise in helping busy professionals get lean, toned physiques with efficient strength training workouts.

A Yale graduate and former investment analyst, Marc has dedicated his life to helping others improve their health. He is a Certified Strength & Conditioning Specialist (National Strength & Conditioning Association) and a Certified Personal Trainer (American Council on Exercise).

You can connect with Marc on Facebook (www.facebook.com/BuiltLean), or Twitter (www.twitter.com/builtlean). Press inquiries should be directed to press@builtlean.com.

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