

Announcer: Bulletproof Radio, a state of high performance.

Dave: You're listening to Bulletproof Radio with Dave Asprey. Today's cool fact of the day is that just one sweaty workout could boost some people's memory. At least in older people, these brain boosts from exercise can be almost immediate, according to a new study. Cognitive neuroscientist Michelle Voss at the University of Iowa, enlisted 34 people average age 67 to go through brain scans, memory tests and exercise. And they underwent the big daddy of these things called Functional MRI Scans and took memory tests around remembering faces they'd seen before.

And the researchers in part of the study looked for effects of a single 20-minute stint on a stationary bike rigorous enough to make them sweat. And they did similar brain tests on a different day after participants spent 20 minutes on a bike that pedaled for them, that sounds like fun. On average, after 20 minutes of intense exercise, people are better at remembering the faces, especially when the task was hard than when the bike pedals for them, and certain connections between different areas of the brain got stronger too.

What's interesting here is that they looked at results after three months. And to their surprise, the people who improved a lot after 20 minutes had similar memory improvements and similar brain changes after those three months, and those who didn't improve after 20 minutes were less likely to have improved after three months. What does that mean for you? Well, the similarity between a single bout of exercise and months of training suggests that you don't have to wait three months to see an improvement in your brain. And you can get an improvement almost anytime you move a little bit more, which is kind of cool.

That means if you're looking for the latest and greatest, cognitive enhancing nootropics smart drug, perhaps you should in addition to Mother Nature's finest, that would be coffee, hop on a bike and move a little bit or walk around or do something like that. And because you know that I am the grand champion of foreshadowing, we might be talking a little bit about what happens on a bike and how you can get more done in less time today. And if you'd like to see some pictures of the kind of stuff I'm talking about, make sure you follow me on Instagram. It's Dave.Asprey, I'm pretty easy to find there. On to the show.

Today's guests are serial entrepreneurs with a bunch of experience, including in healthcare and startups. But they've put something together that I'm pretty excited about, something that I use at home that even my 12-year-old daughter uses, believe it or not, as well as my wife, Lana. My son hasn't gotten into it yet, but he just hasn't had a chance because well, he hasn't asked to try it yet. This is a new kind of exercise looking at that minimum effective dose powered by AI, and the ideas how do you get your cardiovascular system all it needs on a daily basis in a very short period of time.

This is possible due to the work of Ratna Singh who's a microbiologist by training, but spent most of her career working with big brands figuring out how to make stuff work better. And Ulrich Dempfle who's figured out how to build a big piece of equipment that you can use. I think this is something that is going to really change how we think about

exercise. I'm actually really excited to have you guys on the show. Ratna, Ulrich, welcome.

Ratna: Thank you, Dave. We're very excited too.

Ulrich: Thanks for having us, Dave.

Dave: All right. You guys started a company called CAR.O.L. I heard about this about a year ago and I said, seriously, another exercise bike. This is just what the world needs. I remember my, my parents got one when I was maybe my son's age, maybe 9 or 10. And it had a little compression dial and you'd like squeeze the tire with it like a little screw, and then you'd pedal on it. My parents would sit there on this thing for like an hour watching Jazzercise videos or whatever they did back then. I tried it a couple times and thought it was kind of ridiculous.

So I have not been a huge fan of cycling although I've done my share of it, indoor cycling, outdoor cycling I've always liked. But when I saw your thing, I said, all right. I'm feeling inspired because what you guys talked about, minimum effective dose. Tell me what is the minimum effective dose that you believe that we need for cardio, and how did you come up with it?

Ratna: Well, we believe that for cardio benefits, fat loss, even the cognitive benefits that you were talking about earlier, Dave, is 40 seconds split into two-20 seconds sprints. That's the minimum effective dose of actual exercise. Our system, however, has you on the bike for about nine minutes. But the majority of that time is warming up, recovering and cooling down. The actual work is just two-20 seconds sprints. So that's your minimum effective dose of exercise.

Ulrich: Yeah, and you don't have to do that every day. So we believe, and actually so that's been proven by scientists, very serious scientists around the world that three times a week, maybe as little as two times a week. These two times 20-second sprints are enough to get you basically all the cardio benefits you can and that you'd like to get.

Ratna: Recovery is as important, Dave. So we do not advocate that you do this so many times, even though the time is so short and most people say, seriously, can I do it every day? We say, you don't need to. You really don't need to.

Dave: Wait a minute. If exercise is good, more exercise must be better. I mean, is that math? But in all seriousness, what you said there about recovery. The whole point of Upgrade Labs, you know the Bulletproof spin out in LA, by the way, we have a CAR.O.L there, it's exactly that. Is to say, recovery is the harder thing than to start out with, let's just kind of hit ourselves over the head some more. But in Head Strong, this is my New York Times bestselling science book, I went really deep into it. And I agree that you need some high intensity interval training, probably twice a week. Three times I would say is probably max for most of the research I did.

And the amount of time was 10 or 15 minutes, most people can do 15 minutes of intense intervals. You can do what you're doing for nine minutes because it's got these two intervals and AI controlled heart rate monitoring and all kinds of cool stuff in there. But the idea that it's only two 20 seconds sprints, that's even lower than numbers I came up with. How did you come up with numbers that low? What's the backing on those? Because this is world changing. Most people, even if you're obese and you're really tired three times a week, you spend nine minutes with it and you don't get sweaty?

Ratna: Yes. So the way we came up with this, and a little bit of background might be helpful, neither Ulrich nor I come from the fitness industry. Neither are we massive fitness freaks for the same reasons why people don't want to exercise. It's time, it's inconvenient, and it's just dull, boring, mind numbing, for me at least anyway. So we ran into a professor called Dr. Niels Vollaard from the University of Stirling in the UK, and he had been experimenting with different lens of exercise. His goals in life was defined literally the minimum effective dose.

Most of the high intensity training intervals that you probably are aware of tend to be either three sprints or 30-second sprint or more. And what he did over years and years is to see, what's the minimum? And he found that 10 seconds is not enough, three-20 seconds sprints is not necessary, 30 seconds are absolutely not necessary, other than completely fatiguing you and making you exercise-phobic, they do nothing else. So the two-20 second sprints are all that are required.

And the reason for that Dave, and you know this, because you've looked into the research, and you understand the science, it's not about duration, it's about intensity. That intensity provides a very potent stimulus to your body, which releases chemicals that lead to a fitter, leaner, smarter you. Because that powerful, potent stimulus stimulates our evolutionary flight or fight response that says, Dave's going to be extinct as a species if I don't give him what he's asking for, which is more power, more oxygen, more energy. And so your body changes, we adapt. We are fantastic at adapting as humans, otherwise we wouldn't be here. And so that's how it all works.

Now, Niels has gone further. And he did some meta studies of 34 different types of papers that have been published looking at various different durations. It just came down to the fact that all the chemical changes that need to happen, happen in the two-20 second sprints, and I can go into more detail of that in a minute. Beyond that, it really isn't necessary. So that's your minimum effective dose. Just to say that in the first 10 seconds of the first sprint, pretty much everybody will reach their peak power at the intensity that is set for them. And that will be for a split second, and they'll start to trail off.

When you reach your peak power, you have done what's called glycogen depletion, you've depleted your sugar, your energy stores. In the next 10 seconds, signaling molecules are released, AMPK being one of them. You then have a recovery so that you can have a good second sprint, and in that second sprint, you activate molecules. The main molecule that gets activated in the second sprint is something called PGC-1alpha. It is a master switch that cascades a series of other changes in your body. It is a very

important signaling molecule, because it helps to preserve the integrity of your muscles as well. So it's really about the molecular changes that this very potent stimulus elicits and that's why it works.

Now, I'd like to say one thing, which is that HIIT has been misled. Because everybody talks about high intensity training, and they refer to the scientific literature, they refer to the scientists. But every single scientific experiment, every single scientist that works in this field uses specialized equipment. And they use a formula that has been developed by the Wingate Institute in Israel in something like 1975. Yeah, it's empirically tested formula. And the idea is that the more muscle you have, the heavier you weigh, and therefore, the resistance that you can exercise against can be quite high. And that tends to be a range. So X percent of your muscle mass or your body mass.

And in the laboratories, they see you, they'll see Dave who's six foot three, he's got muscle. I'm going to apply that high resistance and that's going to be the point at which the glycogen will be depleted. Unless you choose that maximum resistance setting, which is unique for everybody, I won't be to pedal at the resistance set for you.

Dave: Yeah, you should see these caps. I mean, I agree. You just couldn't do it.

Ratna: Your curves are beautiful. You could be on [inaudible 00:13:13] longer. Seriously. So hand models, we've got curve models. So that's the idea. It's about maximum intensity, which is why it's so short. If it was high intensity, you could do it for longer. You can. Like, Tabata is high intensity. I know CrossFit is high intensity, but they will longer. And the reason they are longer because they're not intense enough. So within those 20 seconds, we literally put you in a pressure cooker.

Dave: There's one exercise program out there, I'm not going to name it. Actually, I made it as a friend. But they talk on a commercials about, we took high intensity interval training, and we turned it on its head. So the brakes are brief and the exercise is the long period. And you're sort of like, this is just kind of kicking your own ass over and over and over. I don't believe you'd get the same results from that, that you would from these short, brief spikes.

In terms of intensity, what I really appreciate, you mentioned evolutionary stuff earlier. I mean, you hop on the ... You put on the headphones, it looks at your heart rate and figures out how much you can pedal. It's that real time feedback that's changing the world. It does for neuroscience and neurofeedback. This is really feedback-based physical exercise too. But the headphones are saying, imagine you're walking through the forest and you're pedaling annoyingly slow. I mean, you're sort of like, I'm barely moving. And that's the warm up period. And then, look, there's a tiger, run. And there's drums of endeavor.

It sounds a little bit almost cheesy when I'm describing it. But when you're doing it, it works. All of a sudden, okay, you feel your heart rate go up and you do that sprint, so I know what it feels like. But what I really know is when I watch my wife Lana doing it, she's just kind of cruising along and you hear this like grunting and pushing really hard.

You can tell, it's all out as if just like the body's is designed. Somebody's going to eat you right now. And so to trigger that, you get the hormonal cascade and then ... The other thing that I appreciated, and I want you to talk about the science in this is, after the brief sprint where you get away from the tiger, you guide people to breathe more slowly and to calm back down.

You're actually monitoring the speed at which your heart rate drops you back into the normal zone, which is very different. Like most humans, a tiger almost hate me and then the rest of the day, a tiger almost a man and you're actually agitated. But other animals, you see like on National Geographic, the tiger misses the deer. And when the deer knows that safe it kind of whole body shakes. And let's go of stress hormones and then start eating grass. And it's just done. I feel like whatever you're doing in the cool down is taking the heart rate up and then right back down. So you get a very high peak to tell the body, be ready for peaks, but be chill the rest of the time. What is the cool down period? What stuff are you doing in there?

Ratna: The cool down period is exactly to bring your heart rate back down to normal. We have mindfulness, breath places that also balance your nervous system. So it has a longer exhale and a shorter inhale. Because we want you to have had a mind and a body workout too. It's pretty intense, as you know. And it's great to feel relaxed by the time you have left. The other thing that happens is that your blood pressure normalizes during those three minutes. And so we do want to keep you there, and we keep you at about 60 RPM, that's the ideal RPM for your blood pressure to come back again. We don't want you passing out or stuff like that.

Ulrich: So the other thing that's really critical in those recovery periods, we obviously track how quickly your heart rate recovers. We know how much power you've exerted and how much power you've produced. And that creates ... So first is the exercise stimulus is there. And it gets you amazing results in terms of how fit you can get with very little time investment. It also is basically like a controlled experiment, like a fitness test that you repeat like two to three times per week. It gives you a highly quantified score of your fitness.

So we can see kind of how much faster your heart rate recovers, how many less heartbeats you need to produce a certain power profile. And that's a very precise score off your cardiorespiratory fitness. And that you can track over time, and we can track overtime for you. So for me, that's a great hook to actually stick to the exercise because you see very quick results, very measurable, very convenient repeatable results. And therefore get that instant reward that you're doing something for you. You actually can measure it, you can track it, and you have your results there.

Ratna: Dave, what Ulrich is referring to there is what we call our octane score, but it's really a measure of your power per heartbeat. As you get fitter, the more power you produce with fewer heartbeats. Most people will improve that over time. In fact, everybody does, even the fittest people. As you said, we're tracking quite a lot of information.

Dave: In the Bulletproof Diet, I wrote about something called the ejection fraction. One of the reasons I've been against chronic cardio for a very long time, even though I used to do it,

in chronic cardio there's long distance things. I've had several interviews, there's a good one with Mark Sisson a while back about that. When you jog for long distance or just kind of cruise around at that 70% maximum thing, your heart learns to beat faster and to spit out smaller amounts of blood per heartbeat. And when you're really fit, you can go from normal heartbeats to one single heartbeat can shoot a huge amount of blood through. Now, is what you're talking about the same as increasing the size of your ejection fraction?

Ulrich: It's exactly that, its power per heartbeat. So kind of one of the adaptations is that your heart as muscle gets stronger, and can just pump with a single stroke more blood through your veins and through your arteries. And that's exactly what we're measuring and can then precisely track over time. That gives us great confidence while we see that we can replicate exactly the lab results in the real world and continue that over time. So we see it across all our users after about 8 to 10 weeks. And that's literally what the scientists in the lab see as well, about 10 to 12% improvement in cardiorespiratory fitness.

If you then continue for users who stick with it, we see it up to like 20, 25%, which is very remarkable. Even the 10 to 12%, that's bigger a change or as bigger change as stopping smoking. So if you consider what you do for your health, it's a really big thing.

Dave: Wait a minute, you're saying if I use CAR.O.L and I start smoking, I could stay even.

Ulrich: That's exactly the best message we want to convey. Thank you, Dave.

Dave: Don't do that. Smoking's horrible.

Ulrich: I think the wise thing would be not to smoking and to us CAR.O.L, and then kind of just live a few years longer.

Dave: I'm in alignment with you on that one. In these numbers that you're citing, are these people using it twice a week or three times a week?

Ulrich: So we have both. Depends a little bit where people are using it. At home, we see most people are using it three times a week. If they're going to studio, so we have across the country, kind of a number of high-end studios-

Dave: Like Upgrade Labs in Santa Monica or in Beverly Hills. But you have those all over the country now.

Ulrich: We have a number of them. Yeah, we're growing. Like many of the big cities have a studio with CAR.O.L in them. And there we see more like once or twice, kind of in line with the rest of the schedule that people use CAR.O.L.

Dave: Now, when they use CAR.O.L that often, those numbers you cited though around this 10 to 12% improvement. These are from basically one to three times a week.

Ulrich: That's the average, yes.

Dave: If you're willing to disclose this, how many people continue past six weeks?

Ratna: Most people continue past six weeks. But what we do is say to them, because we track all the data, if we feel that they're not getting any fit up. Because remember, CAR.O.L also changes your resistance in every ride.

Dave: Yeah, based on the real time stuff.

Ratna: Exactly. So if you are getting fitter, she's continuing to challenge you. If you're struggling, she will ease up. Or if you are where we want you to be, they'll be no change. If we find that those people have got to the point where it's about as fit as they're going to get. We put them on a maintenance plan, which is twice a week. And most people can do twice a week without any problems.

Dave: So this is the least sucky way of exercising in the minimum possible amount of time?

Ratna: Well, Dave, in all honesty-

Dave: I'm really the master of good positioning it, aren't I?

Ratna: No, you are amazing. We love you. I won't lie to you in that those 40 seconds hurt.

Dave: Yeah, they're tough.

Ratna: They're tough. I mean, I've got people ... I myself sometimes scream for an epidural. But I know that I'm not going to do anything else. And so for me, it's a bit like ripping the plaster off. Just boom, get it over with and I can get on with my life. So let's not make any mistakes. This is max intensity, personalized. It's hard. You trade time for intensity.

Ulrich: Yeah, exactly. And therefore it becomes very doable. And then the other thing, so the vast majority of people who have a CAR.O.L bike at home, continue to use it. So we have really good usage stats for the home users. Some of the bikes, like your bike at the Beverly Hill, there are a few people who just stay overnight in the hotel, and they use it once. So they push our average a bit down.

Ratna: But they like it. We get great feedback.

Ulrich: I've got my bike at home. I just do it every other day, get out of bed and that's a habit. While I don't have to negotiate with myself anymore whether I do it or not, just because it's established, kind of it is still hard because CAR.O.L kind of personalizes, optimize us and makes it harder for me most times, yeah.

Dave: What I think is impressive, now that you've shared that data with me, and I didn't ask you that ahead of time for the show at all. I remember my parents exercise bike, and after a very short period of time, it became a clothes rack. And most exercise bikes at

home have that. But I think something about the AI engagement that you're doing and the way that the ... It gets easier if you're just not on a strong day, and it gets harder if you need to be pushed. And the fact that you know, I'm just going to do these two nine-minute things, I can deal with that. It's a replacement for going to the gym that I wasn't going to do this week anyway, because I had a meeting at the same time and all that. So the that makes sense.

I bought one for Bulletproof headquarters here in Seattle. So we have one here. Now, the problem is, I don't have a good space for it. We just opened another floor of the building. So I'm putting it in a good space. Before it was sort of right there next door shipping and receiving which isn't where you want to go spend nine minutes, sort of kicking your own butt. So I actually think it's that worthwhile that I was willing to go in for the Bulletproof employees.

What I wanted to know more about, though, is that you guys just had straight up that the government guidelines of five sessions of 30 minute moderate intensity exercise are just obsolete. Yet my research, I went pretty deep on this in Head Strong to say, how do I keep my brain healthy? I found one set of very clear data around high intensity things. But I found another set of data that said, if you just go for a walk for 20 minutes a day, there was a mitochondrial set of changes that happen from just going for a walk where you can talk with the person next to you, not a walk with weights and super fast or anything like that.

But just like stepping around a little bit. That, that was going to something different than the high intensity training. Are you saying I can be sort of a couch potato? And then do my training or ... What's the line there between this government moderate intensity over that means and going for a walk? Is there one?

Ratna: We have been very bold to make that statement, but we have made it because it's been scientifically validated. And yes, you can be a couch potato, and only do this exercise. You can go for a walk for leisure purposes, for walking your dog, because you want to, shopping malls, et cetera. Not because you have to. Now, why do we say that the government guidelines are obsolete? The American Council on Exercise, you must know them. They are a huge nonprofit body in the US. They're known as the watchdog in America. And the wonderful Dr. Cedric Bryant, who's the president got to hear but CAR.O.L, and he was very intrigued by it.

Particularly because government sources are realizing that in the next few years, healthcare systems are going to be on their knees, they're already crippled, right? Inactivity no longer is a noun, it's now a disease category. And he just wants to see truly people don't exercise because of time, et cetera. Can CAR.O.L do what she says on the 10? So he paid for a research project that was conducted by Dr. Lance Dalleck at the University of Colorado. They have a massive Sport Science Department.

And what they did was, it was a randomized controlled trial. It lasted eight weeks. They took 16 volunteers, sorry. Yes, 16 on CAR.O.L and 16 people doing the government guidelines of 30 minutes per day, five days a week, totaling 150 minutes a week. And



CAR.O.L three times a week. The results were spectacular. I mean, they even blew us away. The most important from a health perspective is what's called your MET score.

It's the score that predicts your likelihood of getting those chronic diseases later on in life, diabetes, cardiovascular disease, dementia, other types of things. And CAR.O.L rider's MET score had dropped by 62% after eight weeks. The government guidelines group, their MET score dropped, of course, by 26%. So the difference was pretty phenomenal. In terms of cardio fitness, the CAR.O.L group improved by 12.6%, the government group by 6%.

Dave: So twice the improvement in-

Ratna: Twice the improvement.

Dave: You're getting about over 14% of the time?

Ratna: Yeah.

Ulrich: Exactly.

Ratna: Exactly. These have been such meaningful results, that the same university then decided to do what you alluded to, Dave. I know you don't know about this, and I shouldn't talk too much about it, because they haven't published the results. But they decided to see if a ride on CAR.O.L in the morning can reverse the effects of sitting all day. Now, they've got phenomenal results, they told me. What they are exactly, I don't know. But they are going to be published probably late summer, early autumn. And we'll see. But if that is the case, then yeah. Be a couch potato, do a CAR.O.L, you're done and dusted.

Dave: All right. I imagine you're going to need some yoga or stretching or something in there. Some lymphatic drainage. In fact, I kind of know this thing called the Bulletproof Vibe that helps with lymphatic drainage as well. Because there are times when ... I live in Canada, it rains all the damn time. So I stand on this thing indoors and I'm on a phone call, and I know that I'm getting some things that would have been like what I was gotten if I walked down a rainstorm. I mean, it's entirely possible for us to do what we want to do, which is quite often not exercise, and still do this.

But I'm actually really blown away, they doubled their cardiovascular improvement in 14% of the exercise time. So if you look at just the return on investment, which is you have to look at exercise from an ROI perspective. Unless you just like to go to a spin class, the camaraderie and the sweat and the suffering or something great, then you're doing it for pleasure. But you don't have to tell yourself you're doing it because it's going to make you healthier. It might, but it also could wear things out too.

Ulrich: So this has been published in kind of quality peer-reviewed journals, maybe we can attach that to the show notes. Let's see.

Dave: Yeah, we'll put the links in there. Because I looked at this before. I agreed to let you guys come on to the show and sponsor the show is that I really wanted to dig on it. I can see that it works. I mean, I tried it, I tried it on my daughter who loves it and my wife. I dug in on this for quite a while and we put it at labs to see how customers liked it. So I think you've passed the bar there. But all of the science I'll put in the post, because it's important that people listening just understand, you couldn't do this by going to a park and running for 20 seconds. Because you won't hit your peak output. It's just not possible without the tight computer generated feedback.

Ulrich: And then maybe just one thing. When we say the government guidelines are obsolete, we think it's just not the best advice and that you can do better than that. And you can get the better ROI. But don't forget, even the group that just went from sedentary to doing this five times, half an hour, moderate intensity, they did see quite a remarkable improvement. So if you can't get a CAR.O.L, don't just stay on the couch. I think the couch is the real killer.

Dave: So the government guidelines are quite often, but not always better than doing nothing. Sometimes they're worse than doing nothing. And they're always 30+ years out of date. Just always, that's how it works. I mean, we've still got in the US, you're not allowed to put the word healthy on any food that contains any saturated fat with no differentiation between the different types of saturated fats. The fact that MCT oils are also saturated, even though they don't even act like other ones.

So we have this whole sort of weird cult like belief system. And we also know in the US that anyone who exercises every single day for an hour a day, that they're a good person. What? Where did this come from? I look at that, and I may piss off some of my loyal listener here, I look at that is wearing a Harris shirt or that self-flagellation activity from old religious things. I've got two kids. I could go play table tennis with my son or I could go for a walk with my wife, I could do all kinds of cool stuff. I could do another episode of Bulletproof Radio. I just don't want to do that, because I have so many other things to do.

But I will do that if it's necessary. And what you guys are saying it's not really necessary. We haven't talked about insulin sensitivity. And I know the reason that you got involved in the company because I did my research, was you saw that first study around 24% insulin sensitivity from a special bike, but you've since commercialized it. Have you done anything around improvements and insulin sensitivity for people who use CAR.O.L?

Ratna: Well, again, the ACE and University of Colorado study did that. No, no, this was the second one. The other one was a few years ago, the 24%. They've done it. And it's an input that goes into the MET score insulin sensitivity. The triglycerides, the HDL, total cholesterol, blood sugar, every single parameter was measured and every single parameter was massively better than the government guidelines. So it works.

Dave: Are you just tickled pink about that? You must be.

Ratna: Well, we are tickled pink about it. I think we were really shocked as to how good it all was. And the reason I believe it's the case is because even the laboratory people, once the resistance is set for an individual, they don't change it, whereas CAR.O.L changes it every time. So if you're getting fitter, she continues to challenge you. And so you really do get that potent stimulus every time you get onto it. Because this, Dave, better than anyone, your body will give you what you asked for it. If we kept you on the same resistance, that's what your body will respond to, it will adapt to that.

So we change the goalpost every time and therefore we keep chasing you. My own insulin, I hate to admit, was 11, which was bordering on insulin resistance. This is a couple of years ago. I hit CAR.O.L like a fiend three times a week and it dropped to 4.3. In five weeks.

Dave: That's pretty incredible from 18 minutes of time or two to three times a week. But it's probably more cost effective than some of the cutting edge diabetes drugs. If you were to look at that, and they don't drop insulin and they don't change insulin resistance to that degree. In fact, most of them do much less than that.

Ratna: Yes. That's what Dr. Niels Vollaard says. He says that no drug can deliver this level of insulin sensitivity improvement in such a short time. He's gone on record to say that.

Dave: One of the beliefs that I have that is born from all the scientific research around behavior of mitochondria, is that like the mitochondria, they control insulin resistance. If they burn sugar and they feel so motivated to do so, magically, you'll have lower levels of glucose and insulin levels will drop. Like it's just a normal thing. The problem is that when mitochondria aren't working well, for whatever reason, and quite often, they have we'll say, lazy couch potato mitochondria sitting around, they don't have any inputs that says, you need to get out of the way and allow young, healthy, strong mitochondria to come in. And when you practice fasting, the ones that can handle it, they die and get replaced by new ones. It's a mitochondrial autophagy.

And then if you look at what happens when you do cryotherapy, the ones that can't generate heat, and then they die, they get out of the way and young new ones come in. And then in the case of CAR.O.L, the mitochondria who cannot make energy to get away from the tiger, they realized, there might be tigers here. Keep in mind, mitochondria are dumb. They're bacteria, they don't have a lot of storage capacity and a little brain, right? So they see, there might be tigers here, therefore, I better get out of the way and be replaced by a young strong one. I think it's the mitochondrial biogenesis, which is the new ones and autophagy, which is removal of the old dysfunctional ones, that that would explain why you're getting stronger heart muscle, why you're getting better circulation, why you're getting the improvements in insulin sensitivity.

And it's because of the AI, you're tweaking that peak each time, instead of just doing something that, I'm already optimized for this, I don't need to change it. It's that tiny little tweak in the pressure that you put on yourself. And frankly, I used to think, well, I have willpower, I'm a big strong guy. I'll just muscle my way through it, I'll make myself do it. But newsflash, mitochondria also control willpower. Like, they're ultimate in charge. But when you use the AI system, they're not in charge of that. So they just do

what's told. It's a neat hack to sort of get yourself out of the decision loop around mitochondria.

Ratna: That's a really interesting point. And I'll just say that, we see people, Dave, from all walks of life. A 60-year-old lady, for example, who comes here to do this, 20 seconds, because it's timed, it's controlled, it's finite, people finish it. Even if you're a couch potato, they just finish it. If you left it up to them, they might not, they might give up earlier. But they seem to feel like they have an obligation to CAR.O.L. They finish it.

Ulrich: I loved how you kind of suggested there the different hacks that you could stack. So this is not a massive research study. This is like N equals one. But I've been doing CAR.O.L for a while and getting kind of really good results from it. After Christmas, after a period of traveling where I couldn't do it and too much turkey, I mix two other things into my regime. One is intermittent fasting.

So I do actually do the Bulletproof Coffee in the morning, and then have a longer fasting window. The other kind of cold therapy, it's just like really cold showers for a couple of minutes every morning. So that took me on a new kind of S curve in terms of fitness levels, in terms of weight and body fat and just general wellness.

Dave: You saw a difference.

Ulrich: Absolutely. So I had my genes tested from kind of the most advanced research scientists in this field and they've said like, you should be a low to moderate responder. I got my VO2 max tested with CAR.O.L and then stacking intermittent fasting and cold exposure. I've improved my VO2 max by 50%. That is-

Dave: How old are you?

Ulrich: I'm 42.

Dave: Okay, so we're about the same age.

Ulrich: I'm now in better shape than I've literally ever been. And then the other things that happen is, since Christmas, I've lost about 28 pounds of weight.

Ratna: He's obsessed now.

Ulrich: No, I'm obsessed. These days is very easy.

Dave: 28 pounds in about six months. Okay.

Ulrich: Body fat from 26 to 15%. It was actually comically effective. I have to say.

Dave: I love that word.

Ulrich: I think we'll have on our website soon a little case study where you might see-

Ratna: You'll see his six pack, which is now [crosstalk 00:40:50].

Ulrich: Yeah, exactly. I'll follow your lead, Dave. I'll have a six pack photo. So stacking those different little hacks. This is really, it's not very invasive, and it doesn't cost a lot to skip breakfast, have a cold shower and do three times a week like eight minutes exercise. So the ROI on that is pretty phenomenal.

Ratna: And so is this mug smile on his face?

Dave: It does. I love the words comically effective, because ... I mean, I had a guy a while back lose a pound a day for 75 days on the rapid fat loss protocol thing that I published. Literally, every week he'd go back to the store and buy another pair of pants because the ones you were last week don't fit.

Ulrich: Exactly. I had to go to a wedding in completely inappropriate dress because all the fancy suits-

Dave: They don't fit anymore. Like, the hang on you. Right?

Ulrich: Two, three sizes too big. Yeah, absolutely.

Dave: Well, congratulations on that. And the idea of stacking those, one of the things at Upgrade Labs that I'm intrigued with is we've got probably a dozen different pieces of tech at this point. But it's using machine learning, artificial intelligence to navigate our clients. So you walk in the door, we can say, all right, do the CAR.O.L first, do the CAR.O.L last. You skip the CAR.O.L today. You did it yesterday. Whatever the right things are to say how do you get the highest ROI for the stack.

But right now what I understand about how to stack things, is that when I'm going to do the CAR.O.L, I want to do it in a fasted state. However, I want to do it with caffeine in my system. You talked about the AMPK impact of your exercise. It turns out there's a study from 2008 that shows caffeine enhances endothelial repair via an AMPK dependent mechanism. There's another study from UC San Diego that shows that the amount of caffeine in two small cups of coffee doubles ketone production. And that's without Brain Octane which itself cranks ketone production up.

So what I'm going to do before I do this is I'll have my Bulletproof coffee. And I don't do collagen before, I'll do collagen after. So now I've had my coffee, I've got the caffeine in for the AMPK mechanisms, then I will do it. What I don't know yet is, do I want to do cryotherapy before or after? It doesn't seem to matter. But there are some early studies that say you might want to do it first. Which means take your cold shower first. And the reason for that is that icing after exercise may reduce the improvement from exercise. However, a cold shower isn't icing and you guys aren't creating delayed onset muscle soreness and all that stuff because you don't even sweat when you're doing it.

I don't know with CAR.O.L but I know if I was going to go lift, I would probably want the cold to come first. It'd be first caffeine, cold, exercise.

Ratna: Sounds great.

Ulrich: Yeah, we'll try that. So at the moment my regime Miss CAR.O.L, cold, caffeine. But I'll permutate it a bit and see. I'll tell you what I get to.

Dave: Try it out. Now we're getting a little off the CAR.O.L topic specifically. But there's something called mTOR. Have you looked at what CAR.O.L does for mTOR levels?

Ratna: No, we have not. Again, it's something that I'm sure Lance Dalleck would love to look into. It's coming over time. But we have not.

Dave: I don't know that it would do much except in the heart. But mTOR is the mammalian target of rapamycin. It's one of the anti-aging things. I just read about that in my new book called Superhuman that is now on Amazon. Just that blatant plug there. It's a pre-order-

Ratna: Very good. Another blatant plug. It's very good.

Dave: When you look at mTOR, and this actually goes back to the Bulletproof Diet too, I read about that. What you want to do is you want to suppress mTOR and then you want to let it spring back, and the things that suppress into our exercise. So I am almost certain that CAR.O.L is going to suppress mTOR and then when you're done exercising, it comes back up. So you want a brief spike in mTOR which causes repair. But if mTOR is always high, like if you're a bodybuilding in terms of protein, then it can lead to cancer and things like that. So you want low mTOR, high mTOR, low mTOR.

This brief intense thing you're doing with CAR.O.L seems like you'll do it. But the things that suppress enter our caffeine and exercise and fasting are the three things that suppress it. And that's why you do all those together. You do the caffeine before the exercise. So the fasting pushes it down like a spring, then next, the caffeine pushes down like a spring. And then at the end, the exercise pushes down like a spring and then you're done. You go eat, and then it surges forward, you get in this case.

I would imagine it'd be more of a cardiovascular effect from the mTOR and then all the good stuff happens from there when you let it go. But then it returns back to low normal levels, which is going to make you live longer. That's why I think about things the way I do and why I think your technology that prevents over exercising, I think it's pretty fundamental. I'm excited about it.

Ratna: Thank you. Thank you very much. We're going to take what you've just said on board and try it out ourselves. I'm going to propose it to Lance Dalleck to see if he'd like to research it. Measure it.

Dave: Excellent. Now, I have another question. AI is one of those buzzwords where people saying, I have an artificial intelligence in my shoes. No you don't. What's real in the AI that you're doing?

Ulrich: Yeah, of course. So most visibly is the personalization and optimization of the exercise for kind of each individual user, every single ride. So using machine learning and big data, we've developed algorithms that will basically keep challenging you and keep adjusting the exercise for you every single time, so you don't plateau. That's the that's the most visible thing.

Ratna: The other visible thing is, back to what I said earlier, Dave, remember when the scientists are doing the research, you are in front of them, and they can see that you are either ... You've got heavy mass, body mass, either because you are tall and you're mostly or you're short and fat. So they can adjust the resistance. Remember, they use the Wingate formula, and they can adjust the resistance on that range based on you because they can see you. We don't have that luxury.

When you register with CAR.O.L, you give us your weight, your age, your height, we'll calculate BMI, but we don't know if you're short and fat, or whether you're taller muscly. So we have what's called calibration rides. And those are the rides where your first recalibration rides, we get to understand you. If you're likely to be short and fat, your power is not going to be very high. If you are strong and muscly, your power is going to be very high. Your total power, your peak power, all of this stuff.

And so we use all that information to then when you do your proper ride, which is really your seventh ride, you've got that maximum resistance that's been calculated by CAR.O.L. It's using the Wingate formula. And she applies it in less than a second using the motor. That's the other machine learning bit. CAR.O.L really, she's just tracking everything the whole time. So she's understanding your ability.

Ulrich: The next is about giving like really meaningful and accurate metrics. We spoke about that already, that it's almost like a fitness test every time you use it. Then there's a bunch of things where we use advanced machine learning kind of under the hood to make the bike as accurate as possible and as safe as possible. We're constantly developing that. Every bike is connected to the cloud, we're pushing quite frequent updates on and we have a very exciting roadmap for CAR.O.L, where she will be ...

At the moment she controls the exercise for you. But where she will be your comprehensive kind of artificial intelligence health coach that can give kind of really meaningful feedback based on your behavior on the bike, based on your physiological signs, and can even answer questions that you have. And the good thing is, as we develop that, we push that out to all our users, and CAR.O.L will just get smarter and smarter.

Ratna: So including heart rate variability, we'll be measuring that very soon. She will say, not today, Dave, you're too tired.

Dave: That is so incredibly cool. I'm excited to get that upgrade on my CAR.O.L. I use an Oura Ring that shows me in the morning when my heart rate is, I'm sorry, my heart rate variability is. So I get some sense of data from that. At Upgrade Labs, we get heart rate variability, sometimes we look at people's heart rate scores. And it's true, there are

some days where through no fault of your own, you really ought to not do it. And to have a system that smart enough to say, hey, come back tomorrow. I mean, what a blessing? Because what we would otherwise do without any knowledge, we'd go and we push ourselves, which is going to further deplete you, which is going to make you act like more of a jerk later in the day.

It's almost guaranteed that it's that way. The more energy and more willpower you have, the more of a nice person you are. When you are weak physiologically at a cellular level, you just have less willpower. So you're more likely to snap at your kids or yell at your boss or do whatever that thing that you wish you hadn't done. So yay, turn on that HRV and a piece of exercise equipment that tells you not to use it. That is actually really cool. One that says use me less. Seriously, that's what the world needs. That's the whole reason that I started this whole Upgrade Labs concept and that's why I put you guys in there.

Because that mindset, that's, what is ... Just because some exercise is good doesn't mean that all the exercise in the world is good for you. And it doesn't mean none is good for you. And it's the same with cholesterol. Like, just because crazy high amounts of oxidized cholesterol can be bad for you, it doesn't mean that you want zero cholesterol, because there's a name for that, it's called death. So finding the comfortable middle for your biology, for your exercise, for your food, for your fat, for your carbs, for everything. That's where we're going and you're at the forefront of that. And so I'm soaked.

But being at the forefront comes at a certain cost, and that leads to the final question for the show today. You might live longer than you counted on and be because my new book is around my quest to live to 180, I've been asking guests on the show for quite a while, a really in your face question. So how are you going to live? What do you think?

Ulrich: So that comes as a complete surprise, that question. I look at the data. I'm 42 now. I'm way fitter and healthier than when I was 32 and also when I was 22.

Dave: Me too.

Ulrich: So if I just extrapolate that, it's going to be a very, very long life.

Dave: Like, oh, darn. Right?

Ulrich: Yes. I think you're onto something. I don't think your target is off the wall. So I can kind of ... If I get those types of improvements that I've seen, I can see myself reach like the 120 level. And then if the magic happens, in terms of what else is around there, with some help of technology, I think we can live a very, very long time. At the same time, I think we have ... I speak for myself as a very blessed and fulfilled life actually. Three wonderful children, wonderful wife.

Ratna: And you work with me.



Ulrich: And a wonderful co-founder and partner. Absolutely. Even if it didn't come like that, I'd be grateful. And would say, life's not too short. It's a blessing. It's been a blessing so far and it's wonderful what we can do.

Ratna: My answer to that question, Dave, and there's no reason for it. But I'm just going to say, hundred 111 because there's three ones. I just like that number. But it's beyond 100. And funnily enough, because CAR.O.L, there's a name to this to the AI. We hope that our users form a relationship with her. So CAR.O.L has a personality and she's quite funny. She has about 300 what we call CAR.O.L.isms and their one-liners, witty quotes. And one of them says, "What's it like to be 100 years old?" And then she says, "At this rate, you'll find out."

Dave: I love it. 111. I haven't heard anyone say, I just like the sound of those three numbers together. But I'm increasingly hearing people say, I think past 100, it could happen. Even just in the last year of asking this question, I've seen a shift in it. It's very clear that if people don't believe something can happen, it does not happen. And even becoming more intelligent. The studies are crystal clear. If you tell kids that they can get smarter, they get smarter. If you tell kids they can't get smarter, they simply don't. So looking all the math, looking Ulrich like you, where I am in better shape now in 46 than I was when I was 26. On every measure that I can think of that like, well, wait.

Knowing all the people I've interviewed and other people I haven't interviewed, but I know who are working on these technologies, and you stack those with things like CAR.O.L, and think things like cold showers and the coffee stuff and all the other techniques and just changing environments so that you sleep better and everything works better. I just don't think it's unreasonable to say that most people listen to the show who were especially under 30 today, if they follow the basic stuff, and we don't deplete our top soil and poison our oceans to the point that no one's alive, then I think that the average listener is going to make it past 100. And not only that, they're going to do it with a brain that works and walking into their own power.

Ratna: That's fantastic. You said, I love that. I love that walking into their own power. Yeah. You know, my husband's a neurologist, and we have lots of medics in my family. Of course, I'm Indian, so that's not surprising.

Dave: Your last name is Singh.

Ratna: I know. Every time I go to America, people just asked me if I'm a doctor, and just start laughing. Said I'm not but I'm married to one. I think all the doctors and my husband thinks it's possible. It's possible as long as it's healthy. And this is why our health care systems need to be viable. We don't want them on their knees. Otherwise, what's the point in living to 111 without the ability to enjoy it?

Dave: Yeah. It's that idea that the picture of aging that we have is no longer being the wise village elder, it's diapers and tubes and hospitals and all the really unpleasant stuff. That didn't exist except for like the last 30, 40 years. That's never been how it was. So we're undoing that really rapidly. It's really amazing. But thousands of studies will show that

remaining active is required for the brain to work. Like, we open in the cool fact of the day.

So if you can get people to do that in 18 minutes a week, and it leads to those shifts and outcome, that is an act of service for humanity. So you give me those results in less time, I'm more likely to do it. And it's not just me, it's everyone listening is more likely to do it. So I'm just on board with this. I think we're looking at a world coming up here that's going to be a lot cooler than people think it is, in part because of stuff like this. So thank you for making CAR.O.L.

Ratna: And part because of you as well and people like you who bring new things to people. Because some of it is a bit hard to believe. But you're the proof. You've got people who are following you and they're the proof. So it's thanks to you, Dave.

Dave: I appreciate that. But really, Ulrich is the proof. Yes, I did away 300 pounds and all my crap. But at this point, more than a million pounds people have lost on the Bulletproof Diet. And you get these critics who say, it doesn't work. And you're like, I'm pretty sure all the people who just lost all this weight and have brains work, they're going to come and find you if you keep saying that, because they're a little pissed off that you're calling them liars. So I'm just at peace with the fact that this stuff works, it's directionally accurate and it'll get more tweaks.

For instance, the conversation about at what time should you do your caffeine versus your exercise? We don't know. We have theories and ideas. But machine learning is going to help us dial that in. And Funny enough, there's a big data set of information. I think you guys are very soon going to have an incredible data set, because you're looking at it differently than guys like Peloton where it's like an entertainment feedback thing, you're getting the physiology. And then we have a whole bunch of brain scans on the 40 years of Zen side of things and my friends at Muse and all these other things.

Then Upgrade Labs, we're gathering a bunch of other data sets, and there's hospitals and medical things and stuff all over the place. We put all that stuff together and dump it into a big machine learning system. It's just going to be nothing but a cool world. So I think you're a very meaningful part of that and I'm grateful that we're all going to get more results this way.

On that note, for people listening, if you've enjoyed this interview, I think that you really should check out the CAR.O.L bike, it's at [carolfitai.com](http://carolfitai.com). It's very reasonably priced. It will save you so much time. And if you're like me, where, look, I don't really want to sleep, I have cool stuff to do. So I found a way to sleep more in less time and I get what a 20 year old gets. In eight hours, I can get in six hours and I'm 46. And if you thought you had to invest six hours a week in getting your cardio an hour a day to drive to the gym and change and go do whatever you're going to do. None of that. You can get rid of it.

So this is just a much higher efficiency to free up time to do this stuff that you really care about. That's [carolfitai.com](http://carolfitai.com). So go there, check it out. If it's a good fit for you, great. If not, take a cold shower, skip breakfast, do something good like that. And if it worked,

tell someone, leave a review for the Bulletproof Diet, leave a review for the podcast. Just do stuff like that. Just tell people, hey, this stuff works. And that's how we can all combat the trolls and skeptics and the people who tell you the 40-year-old advice that says, work out for 30 minutes a day, 6 days a week. Yeah, right. Whatever. Have a great day.