Dr. Andy Galpin: How to Assess & Improve All Aspects of Your Fitness | Huberman Lab Guest Series

In this episode 1 of a 6-part special series, Andy Galpin, PhD, professor of kinesiology at California State University, Fullerton and world expert on exercise science, explains the 9 different types of exercise adaptations that can be used to transform the functional capacities and aesthetics of our body, and benefits each adaptation has for our health. He explains the best evidence-based protocols to optimize your progress in building strength, endurance, muscle growth, flexibility and for optimal recovery, and he provides zero-cost and low-cost tests to assess all aspects of your physical fitness. This episode provides a foundation and tools for establishing a comprehensive assessment of your current fitness level, allowing you to select the ideal fitness programs to implement toward your goals. Subsequent episodes 2-6 in this special series explain goal-directed protocols to reach those goals.

#HubermanLab #Fitness #Science

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ANDREW HUBERMAN: Welcome to the Huberman Lab Guest Series, where I and an expert guest discuss science and science-based tools for everyday life. [MUSIC PLAYING] I'm Andrew Huberman and I'm a professor of neurobiology and ophthalmology at Stanford School of Medicine. Today's episode marks the first in a series with Dr. Andy Galpin. Dr. Andy Galpin is a professor of kinesiology at Cal State University Fullerton and one of the foremost world experts on the science and application of methods to increase strength, speed, endurance, hypertrophy, and various other aspects of fitness, exercise, and sports performance. Across this six episode series, Dr. Andy Galpin pulls from his expertise working with everything from professional athletes to recreational exercisers and teaches us the mechanisms, logic,

and specific protocols for how to achieve any of the number of different exercise adaptations that I mentioned a moment ago, ranging from strength to endurance, hypertrophy, and everything in between. We get really far into details, but at all times paying attention to the macroscopic issues. That is, how to create a program for endurance or strength or hypertrophy or speed, or one that combines all of those. We also talk about supplementation and nutrition and how to maximize recovery for each of the different types of exercise adaptations. During today's episode, Dr. Galpin teaches us how to assess our level of fitness and, more generally, how to think about fitness so that we can best achieve our fitness exercise and performance goals. Dr. Professor Andy Galpin. Super excited to have you here. You're such an immense treasure trove of information on physical training and optimizing for specific goals and outcomes with physical exercise. I'm curious, however-- so many people have different levels of fitness. Some people are professional athletes, of course, but most people are not. Many people exercise regularly. Some people are trying to do that more. Some people are doing too much of that; they're overtraining,

00:02:04 Assessing Fitness

they're not recovering enough. If we were to take a step back and each and every one of us ask how fit are we, with the word fit, of course, being a very broad encompassing word, could encompass endurance, certainly it does, strength, the ability to run fast, even if for short distances, it might even include hypertrophy or directed hypertrophy, trying to balance one's musculature to offset asymmetries, recover from injuries, et cetera. How should I, or anyone else for that matter think about their level of fitness? I know my resting heart rate, but what do I do in terms of really assessing whether or not I'm as fit as I could be and should be both for sake of health and performance? And here I'm asking you the question not as an athlete, but as somebody who's been pretty consistent as an exerciser. But if we were to throw our arms around this question of how do we assess our fitness, what would be the different levels of assessment that we should think about and do? ANDY GALPIN: When it comes to exercise, people generally have two major goals in mind. Goal number one is achieving some sort of appearance. Right? This is I want to be big, or I want to not be too big, or I want to be lean. Something, right? It doesn't matter what that goal is, but there is an aesthetic component to almost everybody. They want to look a certain way or not look a certain way. The

other one is functionality. So I want to be able to perform a certain way. Now, again, that definition differs per person. So I want to be better at strength, I want to be better at mobility, I want to be able to have energy throughout the day, whatever it is. So there's some sort of appeal to aesthetic and there's some sort of appeal to functionality. So within both of those categories, we want to be in a position where we can understand, where do I need to go with my exercise training so that I can be as fit and as healthy and achieve these goals that I want now, as well as be in a position where I can maintain them for a long period of time. So this blends both immediate goals. So say you're just interested in squatting a lot of weights. Say you're interested in running a 5K time the best run. It doesn't matter. It blends that with the desire to have a long wellness span, to be fit throughout life, to achieve all those things for as long as possible. So then the question kind of comes back to saying, well, how do I know which area I need to focus on the most, and why am I not achieving these goals, or how can I get there more effectively. And if we look at the big picture, we have to understand that there are several major components to physical fitness that are going to be required in all of these categories. And to achieve that, there are a handful of components that have to happen to be able to hit those goals. Now there are infinite methods. So the saying we actually use here a lot is, the methods are many, but the concepts are few. So what I'd love to do today is, over the course of our discussion is hit exactly what those concepts are and then cover a whole bunch of different methods. And we could do that for hours. But we'll cover a number of them for various goals. ANDREW HUBERMAN: So one of the reasons I went into neuroscience and not into exercise science is because of this thing neuroplasticity, the nervous system's ability to adapt. But the more time I spend with you and the more I learn from you, I realize that many, if not all of the organ systems of our body have this incredible ability to adapt. And when we're talking about physical exercise, there are incredible adaptations that, of course, involve the nervous system,

00:05:40 9 Exercise-Induced Adaptations

but also involve muscle and connective tissue and so many other cell types and tissues. That said, when we talk about fitness, what are the major types of adaptations that underlie this thing that we call fitness? And later, I know we're going to get into how different forms of exercise can trigger different types of adaptations, but what are the major adaptations that one can create in their body using exercise? ANDY GALPIN:

There are many reasons why one should exercise, and we could perhaps cover that later in our chats. But the physiological adaptations can be bucketed really in a nine areas. So the very first one is what I call skill or technique. So just learning to move better, more efficiently with a specific position and timing and sequence, or whatever that is. This could be running more effectively, this could be practicing a skill like shooting a ball or an implement, swinging a golf club. Anything like that, I call that skill development. The second one is speed, so this is simply moving at a higher velocity or with a better rate of acceleration. That's very similar to the next one, which is power. And power is speed multiplied by force. The next one then, of course, on top of that, is force or strength. So those are really synonymous terms. How effectively can you move something? Now, this is often confused-- strength, rather-- as muscular endurance. So what I mean by that is strength truly is a marker of what's the maximum thing you can move or what's the maximum amount of force you can produce one time. It's not how many repetitions in a row you can do. That's actually another one of our adaptations called muscular endurance. So that is typically under the order of say five to 25, maybe 50 repetitions. Think of a classic how many push-ups can you do in a row? How many sit-ups can you do in a minute? Things like that are muscular endurance. Muscular endurance tends to be localized, so this is specific to just, say, your triceps and your deltoids. It's not a overall cardiovascular endurance marker or anything like that. So that's strength, number four. Number five is muscle hypertrophy. And this is the first time now we're talking about an appearance rather than a functional outcome. So moving better, moving faster, and moving heavier are indicators of how well you can move. This is the first one that's just simply how big is your muscle? And that's muscle hypertrophy or muscle size. After that is muscular endurance. So this is how many repetitions you can typically do of a movement. So think of how many push ups in a row you can do, how many sit ups in a minute you can do, things that are typically in five to 50 repetition sort of range. And it is often or it is almost always local muscle. So what I mean by that is a push-up test is really how many reps that your triceps and pecs and deltoids can do. It is not a cardiovascular endurance. It is not a global physiological endurance. It's specific to, typically, one or a few muscle groups at a time. And this is why you have to do multiple tests for every group there. After that, now we've moved into number seven, which is what I call anaerobic capacity. This is more synonymous with maximum heart rate. And now we're actually looking at, rather than a single movement or muscle group, it is a total physiological limitation. So it is the maximum amount of work you can do in,

say, 30 to 45 seconds, maybe even up to 120 seconds, of all-out work. Think of your classic interval type of stuff here. So how much work can you do at a maximum rate, where you're going to enter tremendous amounts of global fatigue? The next past that is maximal aerobic capacity. And this is probably actually something like in the eight to 15 minute range, where you're going to reach probably both a maximum heart rate as well as a true VO2 max, which we'll talk a lot more about what that is later. So that is different from the previous one, where you can't reach this in a matter of seconds. It simply takes multiple minutes to get to a position to where your VO2 max is actually going to be sufficiently challenged or an indicator there. And then the last one, number nine, is what I call long duration. And this is just your ability to sustain submaximum work for a long period of time with no breaks, no reduction whatsoever. This is often called steady state training or a lot of people just think of this when they think of, quote, unquote, "cardio," but your ability to continue to move without any breaks or change or drop is the last and final adaptation. ANDREW HUBERMAN: And for long distance steady state, I'm guessing it exceeds 15 minutes because-- ANDY GALPIN: Correct. ANDREW HUBERMAN: --the previous one was eight to 15 minutes or so. What sort of rate ranges are we talking about in terms of this long duration? ANDY GALPIN: Well, that's actually wonderful. You're going to be anything past 15 minutes. So really, if you look at a minimal number there, it's generally 20 minutes of what we're looking for, but a more typical would be 20 to 60 minutes. But anything past that would still be limited by your long-duration endurance, so your ability to sustain work over time. ANDREW HUBERMAN: OK.

00:10:56 Assessing Fitness Levels per Category; Fat Loss & Health

So given that there are nine different major adaptations that can be induced with exercise of specific types, is there any one global test or assessment that people can take or do that allows them to determine what level of ability, of fitness they have in each and every one of these nine different categories? ANDY GALPIN: There are probably dozens or more tests that you can do for each one of those nine categories. And what I would actually like to do is walk you through my favorites for each and giving you both the scientific gold standard-- so if you have the ability, unlimited resources, what should you go do? As well as some that are equipment-free, that are cost-free, things that anyone can do across the world. In addition to that, I want to walk you through what

those numbers should be, how do you identify if you're really poor in something or if you're great. And then if you aren't as good, maybe, in a category and you want to get better at it, exactly what to do in terms of protocols for how to achieve optimal results in each of those steps. ANDREW HUBERMAN: So I noticed in your list of the nine different adaptations to exercise that you did not mention fat loss or health-promoting benefits, which are two reasons that a lot of people exercise. Was there a specific reason that you did not mention those? ANDY GALPIN: Absolutely. It's because those things are actually not specific training styles. They are byproducts of these nine. So what I mean by that is if you understand how fat loss occurs, which we can certainly talk about, you'll realize some of these nine protocols are effective for fat loss and some are not. General health is the same thing. When we understand what it actually means to be healthy from a physiological perspective, then the rationale for what to train for is going to determine itself. So what I mean is, looking at things like, in order to be healthy, you have to have sufficient strength, you have to have cardiovascular fitness, and you have to have sufficient muscle and et cetera. Therefore, training for one's health is determined by those restrictions. So for you, Andrew, you may need to do more strength training to be healthy, where me, because I'm strong already, way stronger than you, I may not need to do as much strength training. So our, quote, unquote, "health-based protocols" are based on our current status or limitations in physical fitness among these nine areas. So what I would like to do today is to cover a brief history of exercise science. And the reason is it's going to explain a lot about why people are not getting the goals in their exercise programs that they want as well as gives you very specific direction about what to do instead.

00:13:33 Momentous, LMNT, Eight Sleep

ANDREW HUBERMAN: I can't wait to hear all the things that I'm doing incorrectly and to have you help me remedy that. Before we begin, I'd like to emphasize that this podcast is separate from my teaching and research roles at Stanford. It is also separate from Dr. Galpin's teaching and research roles at Cal State Fullerton. It is, however, part of our desire and effort to bring zero cost to consumer information about science and science-related tools to the general public. In keeping with that theme, we'd like to thank the sponsors of today's podcast. Our first sponsor is Momentous. Momentous make supplements of the absolute highest quality. The Huberman Lab podcast is proud to be

partnering with Momentous for several important reasons. First of all, as I mentioned, their supplements are of extremely high quality. Second of all, their supplements are generally in single-ingredient formulations. If you're going to develop a supplementation protocol, you're going to want to focus mainly on using single-ingredient formulations. With single-ingredient formulations, you can devise the most logical and effective and cost-effective supplementation regimen for your goals. In addition, Momentous supplements ship internationally. And this is, of course, important because we realize that many of the Huberman Lab podcast listeners reside outside the United States. If you'd like to try the various supplements mentioned on the Huberman Lab podcast, in particular supplements, for hormone health, for sleep optimization, for focus, as well as a number of other things, including exercise recovery, you can go to livemomentous-- spelled O-U-S-. So that's livemomentous.com/huberman. Today's episode is also brought to us by LMNT. LMNT is an electrolyte drink that contains the exact ratios of the electrolytes sodium, magnesium, and potassium to optimize cellular functioning for mental and physical performance. Most people realize that hydration is key. We need to ingest enough fluids in order to feel our best and perform our best, but what most people do not realize is that the proper functioning of our cells, and nerve cells, neurons in particular, requires that sodium, magnesium, and potassium be present in the correct ratios. Now, of course, people with prehypertension and hypertension need to be careful about their sodium intake, but what a lot of people don't realize is that if you drink caffeine, if you exercise, and, in particular, if you're following a very clean diet, that is not a lot of processed foods, which, of course, is a good thing, chances are you're not getting enough sodium, potassium, and magnesium to optimize mental and physical performance. LMNT contains a science-backed ratio of 1,000 milligrams-- that's 1 gram of sodium, 200 milligrams of potassium, and 60 milligrams of magnesium, and no sugar. If you'd like to try LMNT, you can go to drink LMNT-- that's drinklmnt.com/huberman to get a free LMNT sample pack. With your purchase. Again, that's drinklmnt.com/huberman to claim a free sample pack. Today's episode is also brought to us by Eight Sleep. Eight Sleep makes smart mattress covers with cooling, heating, and sleep-tracking capacity. I've been using an Eight Sleep mattress cover for about the last eight months, and it has completely transformed my sleep. I'm sleeping about the same amount, but I'm sleeping far deeper, and I'm now getting the proper ratios of so-called rapid eye movement, or REM sleep, and slow-wave sleep and waking up feeling far more recovered mentally and physically. The underlying mechanism for all that is very

straightforward. I've talked many times before on this podcast and elsewhere about the critical relationship between sleep and body temperature, that is, in order to fall asleep at night, your body needs to drop by about one to three degrees in terms of core body temperature. And waking up involves a one to three degree increase in core body temperature. With Eight Sleep mattress covers, you can adjust the temperature of your sleeping environment to be one temperature at the start of the night, a different temperature in the middle of the night, and a different temperature as you approach morning, each of which can place you into the optimal stages of sleep and have you waking up feeling more refreshed than ever. If you'd like to try Eight Sleep, you can go to eightsleep.com/huberman and check out their pod three cover and save $150 at checkout. Eight Sleep currently ships in the USA, Canada, United Kingdom, select countries in the EU, and Australia.

00:17:20 Lifetime Endurance Training: VO2 Max & Other Health Metrics

Again, that's eightsleep.com/huberman to save $150 at checkout. Before we get into how the history of exercise science informs the mistakes that we are all making and how to remedy those mistakes, I'm curious as to whether or not you have any favorite one or two studies that point to a naturally occurring example of how people can become very fit in one area and not another. I'm familiar with seeing endurance athletes that apparently have terrific endurance but, at least to my eye, don't look like they are particularly strong. I'm also familiar with seeing individuals that are very, very strong, particularly on social media, but that don't look like they could walk up a flight of stairs, much less run a mile. Do you have any examples of studies in or outside the laboratory that point to that in a concrete way? ANDY GALPIN: There's a lot to discuss here, but I'll answer really clear. If you look across the literature-- and this is actually back to as early as the mid 1950s. In fact, it actually goes back previous to that, to the Harvard Fatigue Lab, 1927 to 1947 area. People actually were advocating, at that point, a combination of strength training and endurance. ANDREW HUBERMAN: In the 1920s? ANDY GALPIN: Way back then. In fact, it actually goes prior to that. In the late 1880s, there is scientific evidence back then. It became more well-developed in the mid 1950s and '60s. In fact, there was the initial stages of what's called the Exercise As Medicine Movement, which is the movement now, but the initial stages of that actually route back to the 1950s. And I could actually go into that whole discussion and the story of how that all came about, but

that's the Health Is Wealth mantra that came from the 1950s, from the scientific community then. All those data points are going to suggest you need a combination of some sort of broad strength training and broad endurance. Now, if you have a specific goal five months from now, you want to compete in a race or hit a certain physique thing, that's fine to focus on one area of training. Certainly, if you're an athlete, that's different. But if you want to maximize health and overall functionality throughout time, it needs to be a combination. And to really, really highlight this, I can actually talk about a couple of studies that I've done. One of them we actually did in Stockholm, Sweden. So I did this at the Karolinska Institute, which you probably are aware of. It's actually one of the founding places of all of exercise physiology. Generally, it started there. It was called something different back then, but really, our entire field came out of Stockholm and the Karolinska Institute. And we worked with a whole bunch of cross-country skiers that were in their 80s and 90s. And so they were competitive skiers in the 1940s and '50s, and they had been skiing competitively for that entire duration. So you're talking 50 to 60 consecutive years of competing. So these are 80 to 90-year-olds, living alone and healthy. And we compared them to a group of individuals here in America who are the same age but were not exercising. And what we wanted to do is to see and of look at, what are these lifelong endurance individuals? What do they look like? And when we brought them into the lab, which is, by the way, amazing, to do a VO2 max test on a 92-year-old, especially in a language that they don't speak, you can imagine, you're doing this in the hospital. And you're running people through, this is a cycling task. And so for a VO2 max test, you have a mask on your face, you're hooked up to a metabolic cart so we can collect all the gases that are coming out of your mouth, and you're chanting these people on. And basically, every minute, the workload gets harder and harder and harder until you can't complete it. And we're doing this in a cardiology center, and the cardiologists are usually waiting for their heart rate to get slightly elevated and they stop them because they're 85, 86 years old. And not only are we not stopping them, but we are screaming in their ears, just go, go, go. ANDREW HUBERMAN: In Swedish or English? ANDY GALPIN: In English. And then the translator-- but it doesn't take a lot of translation when someone's screaming at your face, go, go, go. So we ran them through a whole bunch of VO2 max tests. And we did the same thing for those folks back here in America. And what was incredibly clear from that study was the VO2 max-- you can think about these numbers, and this is what's called relative. And the relative terms are milliliters per kilogram per minute. And so a standard number is about 18, is what we call

the line of independence. So if your VO2 max is below 18 milliliters per kilogram per minute, it's very hard for you to live by yourself. So your fitness is so low, you probably are going to need to have somebody living with you or you'll need to be in some sort of assisted living home. So if you are in a VO2 max of 20 or 21 or 22, you're not below that line of independence, but you're on that threshold. And so what we found was our folks here in America, the group average was right around that number. So they were living at home, by definition. We picked them to be people living by themselves in their 80s and not in a living home, but they didn't have any bandwidth. So if they got a cold or they had anything pop up where they lost a little bit of fitness, they were going to drop below that line and would probably have to go to some sort of assisted living situation. The folks in Stockholm, the cross-country skiers, the group average was much closer to 35 to 38 milliliters per kilogram per minute. Now, that number is about the VO2 max you would find for a normal college male. And so these folks that were literally 80 or 90-- the joke, if a sabertooth tiger ran in the room or whatever and it chased it down and we all had to run to see who didn't get eaten alive, the college men would probably have gotten eaten before the 90-year-olds. And in one case, we had a 92-year-old individual. And I think his VO2 max was 38, which was, in our estimation, a world record, the highest VO2 max for somebody over the age of 90. ANDREW HUBERMAN: May I ask what is the typical resting heart rate for somebody very fit, like these older Swedish cross-country skiers? If somebody has-- let's say their number is 35 millimeters per kilogram in this VO2 max test, but since most of us don't have access to that kind of equipment, but we can measure our pulse rate. ANDY GALPIN: Yeah. ANDREW HUBERMAN: What was a typical resting heart rate, resting pulse rate? ANDY GALPIN: Sub 60. ANDREW HUBERMAN: Sub 60. ANDY GALPIN: Yeah. I mean, typically that's a good number to go off of for anybody, regardless of age. Any time I see somebody above that, I'm going to start asking questions. Certainly above-- you'll see in the literature people will say 60 to 80 is normal, and I don't agree with that at all. If your resting heart rate is 75 beats per minute, there's either something going on or you're not fit. ANDREW HUBERMAN: How much cross-country skiing were they doing, on average, in the previous, let's say, if we take the previous 20 years since they'd been longtime cross-country skiers. Divide that by 20 years. ANDY GALPIN: Yeah, ANDREW HUBERMAN: On average, are these people cross-country skiing five hours a day, two hours a day, an hour a day? ANDY GALPIN: Yeah, that's actually a good question. I don't remember. It's been many years, but they were not doing it every single day. And the volume would not have shocked

you. It was the consistency over 50 years that got them there. Now, obviously, these people were, again, world champions and Olympic gold medalists in the 1940s and '50s, so they were elite. They just continued consistently over time, but it wasn't a shocking amount of physical fitness. They also didn't go out of their way to train hard. They were busy chopping wood. They were busy doing a number of other things. And then they just happened to do some of these races and ski along the way, but it wasn't a crazy amount too where you're like, oh, that's great, but I could never hit that number. It was something much more reasonable. ANDREW HUBERMAN: So is the takeaway to be consistent about getting cardiovascular exercise? And we can define what "consistent" means in terms of days per week a little bit later, and I know we will. ANDY GALPIN: Yeah. ANDREW HUBERMAN: What are some other examples? I love these examples from the real world. ANDY GALPIN: So here's the downside, though. So I only told you about the VO2 max. What I didn't tell you about is their leg strength and functionality. And that part was no more superior than it was their counterparts who were not exercisers. So what that showed really, really clearly-- and many other studies have been done since then that look at the classic, what we call lifelong endurance exercisers. You will see, in general, their VO2 max, their cardiovascular function, their resting heart rate, their blood pressure. It will be markedly healthier than folks who don't exercise. It is extraordinarily clear that type of exercise is very important for chronic disease management, no doubt about it. However, it is not sufficient for overall global health because it does almost nothing for leg strength, for any other marker of health, which we can talk about, what are the things that are actually going to predict mortality, morbidity than most. So was a big smashing indication that's like, hey, this is great. However, you're leaving things on the table for your overall health. Now, one could argue, they're 80,

00:26:10 Genetics vs. Lifestyle, Endurance Training & Identical Twins

and they're doing pretty well, but they weren't doing as well in these areas. And so a study we did later, actually, as a follow-up was looking at monozygous twins. So this is actually interesting. Being a scientist, this is a classic example of one of my graduate students who had been in my lab for probably three or four years. And she was in our single fiber physiology lab. And you can imagine, she's isolating individual muscle fibers, from an athlete, one by one with a tweezer. And she's going to do several thousand individual cells. So you're down there for hours, and things happen down there. You kind

of lose your mind. And she was going on one day with one of my colleagues and just talking, and she's like, oh yeah, my uncle is really, really fit and something or other and then. Oh yeah, he's a twin. And I was like, oh, is he a monozygous? And she's like, yeah. ANDREW HUBERMAN: For those that don't know, monozygous are identical twins. ANDY GALPIN: Yeah, which is interesting. So you basically have-- what I'm setting up here is this is the perfect exercise scientific experiment. Monozygous, identical twins mean they have the exact same DNA. So an egg was fertilized, split, and then two humans grew out of that with the exact same DNA. And so now we can start answering the question, well, yeah, OK. What about, maybe, these cross-country skiers? Maybe they were just genetic freaks. Maybe it didn't matter. It's like some people have-- well, genetics are always a component to it, but how much? Well, now we have a scenario lining up where it's like, wait a minute. You have monozygous twins. So we have a replica of a human being, exact same DNA. The only differences that we would see in their physiology now would be due to lifestyle circumstances. Interesting. So monozygous twin dad and uncle, right? Uh-huh. Great. Do they exercise? Well, one of them does. He's a lifelong endurance exercise, runner, cyclist, swimmer, Ironman, all these things. What about the other one? Nope. He doesn't exercise at all. And at that point, I wanted to kill my graduate student because I'm like, you've been in my lab for three years or more, probably, and you've never told me that in your household is the perfect scientific experiment for exercise you could ever create. And Jesus, the look on her face when my colleague and I were staring at her. She's just like, oh my god. So I'm like, call them right now. They are coming into the lab. Fly them in from Chicago. I don't care what we have to do. We're getting them in. And so I wanted to-- actually, going back to the model that was first developed by the Harvard Fatigue Lab, one thing that's interesting about that community is they started off with the concept of trying to examine human performance through a holistic lens. And so it was the antithesis of looking at either organ by organ, so we're going to only look at the cardiovascular system. We're only going to look at skeletal muscle. And then we're saying, we're looking at this entire picture. And so that model, we wanted to carry through in these twins. And I said, all right, I want to bring them in the lab, but I'm not just going to look at one system. I want to do everything. So we took stool samples. We took blood. We did vertical jump tests. We did maximum strength tests. We did MRIs of muscle mass. We did VO2 max tests. We did efficiency stuff. We did genetic testing. We did an IQ test. We did psychological battery. We wanted to look at everything to figure out of these things, what differ

between the twins? And if so, the second key question there is, by how much? So can I improve my VO2 max? Sure. Everyone knows that, but how much? Can it change by 5%, 80%? Where is the number? And so putting some quantification on this was very important. And so again, we had another example of a classic endurance-only training paradigm compared to a non. So this is a person who's, I think, he's truck driver by vocation. I think, actually, he drove for a potato chip company, which was even funnier. The endurance athlete actually was great because, like any endurance people, he had physical books of all of his training mileage for the last 35 years. And we just went through them, and we calculated the total amount of miles he ran, his averages, his heart rates per time. We had this unbelievable thing, what races he was in. He had the documentation. He was just totally nuts, something that endurance people are like shaking their head right now going, oh, yeah. I got that too. ANDREW HUBERMAN: And endurance folks are pretty nerdy. ANDY GALPIN: Yeah. Super nerdy, right? So it was great because now we could validate, as close as one could, to actually how much you ran and things like that. So they had about a 35-year discord. They both exercised up through high school. About 18, they stopped doing it, and by the time I got them in the lab, they're in their mid-50s. So it was about 35 years of difference. And when we ran them through the testing, if you look at the measures that were similar to the Sweden study, it was almost identical. The exercising twin was significantly better at things like a lipid panel, resting heart rate, blood pressure, VO2 max. Any of those markers, as predicted, were much better. What was very interesting, though, was the things that were in the middle. First of all, their total amount of muscle mass was almost identical, to the gram, within the margin of error of a DEXA scan could possibly ever be. The non-exerciser, though, was a little bit fatter. So the difference in actual body weight was explained almost entirely by body fat or non-lean tissue, really, same sort of deal. So OK. No one's surprised there that the exerciser was a little bit leaner, even though it didn't change total amount of muscle mass at all. When we looked at some of the more functional tests and we looked at things like muscle quality-- so this is a metric you can get from an ultrasound. You can kind of think about this as how much fat is inside the tissue, which is sometimes an advantage for an endurance athlete to have a little bit more of what are called intramuscular triglycerides because it's a fuel directly in the tissue. But in general, the muscle quality he was not in favor of the exerciser. If you looked at the performance testing and if you looked at strength, it favored the non-exerciser. And so now, again, we have the same finding we saw in our Sweden study,

but in identical twins. And so it really, really highlighted the fact that if you want to move forward with optimal health, simply picking one silo is not going to get you there. ANDREW HUBERMAN: One silo meaning just running, just cycling? ANDY GALPIN: Right. ANDREW HUBERMAN: Does this mean that the twin that did not exercise could jump higher or win an arm wrestling competition? Not that that's a vital thing to be able to do, but just in terms of measuring strength, it's our isometric strength. Was the non-exercising twin stronger or at least as strong as their exercising twin? ANDY GALPIN: Yes, particularly in grip strength. Yeah. And any of the measures like the vertical jump, leg extension power, and a number of things, they often favored the non-exerciser, which you're still a little bit of a chicken and egg. You don't know if, necessarily, the endurance training reduced that other twin's strength. It doesn't even really matter, per se. I think the highlight of it is, can you change some of these metrics of VO2 max? Yeah, not even close. These things are very responsive regardless of your genetics. Your genetics will give you a starting place very clearly. Even the non-exerciser was a pretty healthy guy. So they were in a good spot. Mid-50s, doesn't exercise, doesn't really pay attention to his diet at all, and he was in a pretty good shape. However, if you want to actually move progress and move forward high functionality, you have to do something besides just run, just distance run. Now, I could say the same thing for strength training. That alone-- because I don't want to make this thing like I'm saying endurance exercises. It worked. In both cases, both these studies, those folks were much better off in metrics that are incredibly important to mortality,

00:33:49 Aging, Muscle Fibers & Exercise

how long you're going to live, VO2 max, et cetera. It's just not going to get there in terms of strength. We took a look at muscle fiber physiology as well, which is very interesting. So what I mean is there's generally two types of muscle fibers, fast-twitch and slow-twitch. And one of the things that is a hallmark of aging is a selective reduction in fast-twitch fibers. And that's because it's difficult to activate them unless you're doing high-force activities. You're going to activate slow-twitch fibers doing almost any activity of daily living. And so they stay around. Fast-twitch fibers, unless you're doing something of high force or going, not be used. And they're not going to be kept around. And that's a problem because when you look at things like the need for leg strength through aging, the ability to catch yourself from a fall, these things are incredibly important. If you don't

have fast-twitch fibers, you don't have the speed to get your foot out in front of you on time, and you don't have the eccentric strength to stop the fall from happening. And so if you look across, again, the aging literature, they're very clear about the importance of maintaining strength and fast-twitch fibers over time. So we know that this is an important distinction here overall. And people will often talk about, how much of that is genetically determined? Can I change my fiber type? And the answer there is resoundingly yes. And can I change it with exercise? And the answer is, absolutely you can. And then the next question is, how much? So now, again, we're going to see an order of magnitude. In general, without going too far down an area that maybe we can save for later, each one of your muscles in your body has a different percentage of fast-twitch and slow-twitch, for example, your calf. If you look at your soleus, which is the smaller one that goes in the back, that's generally mostly slow-twitch, typically 80% or so slow-twitch. The gastroc, which is the other one right next to it. So if you were to point your toe next to your face and that part that kind of flexes out in the middle pops out, that's your gastroc. That is almost the inverse. So it's generally 80% fast-twitch, maybe 20% slow-twitch. Generally, anything anti postural or postural, rather, anti gravity, spinal erectors, things that are meant to keep you up or moving all day, are going to be slow-twitch. And things like your hamstrings, which are for explosion, are going to be fast-twitch. Well, we biopsied the quad in these individuals. And in that muscle, it's generally about 50/50, fast-twitch, slow-twitch, as a really broad number. Well, one of the things that we found was in the non-exerciser, it was almost textbook what you would predict. It was about 50% or so slow-twitch, a little bit of percentage of fast-twitch, and then about 20% or what are these called hybrid fibers, which are a hallmark of an activity. All right. Great. In the exerciser, it was about 95% slow-twitch. And so it's extremely clear-- again, I don't know if maybe their set point was a little bit higher towards that, and the non-exerciser devolved down to his place or the other one, but it doesn't matter. I mean, you're going from 40% slow-twitch in one case to 95% slow-twitch in another case. It shows you that the limits of physiological adaptation are darn near boundless given enough exposure. In this case, 35 years of extremely consistent training, and his muscle morphology was completely different than his identical twin with the exact same DNA.
ANDREW HUBERMAN: Those are two beautiful examples of people doing endurance work for a number of years

00:37:12 Lifetime Strength Training & Outcomes

and what that gives them in terms of benefits and functionality. Has the opposite experiment been done or observed, where somebody's just weight lifted or just sprinted for a number of years? I don't know that there's a identical twin control. That's a little-- ANDY GALPIN: No. I wish we had a third twin. ANDREW HUBERMAN: --too much to ask for. Right, triplets. So triplets out there, if you're exercising in different ways or people who have triplets, maybe you assign one kid to be a runner, one kid to be a weightlifter, and the other one to be sedentary. Please don't do experiments like that. But the expectation, as I understand it, would be that the person that sprints or that does heavy squats, explosive work, would then have more fast-twitch muscle fibers in their quad. And their non-exercising counterpart would have fewer. That would make sense. But what happens if you assess the endurance level in somebody who's just done strength training or just sprinted? ANDY GALPIN: Yeah. So we don't have those data specifically. We're actually just starting to have studies come out on lifelong strength trainers. And there's actually a very good reason for this, which is a whole story we can get into, but the quick answer is, we don't have a lot of people who've been lifting weights for 30-plus years. We have a whole swath of people who've been doing endurance training for that long. ANDREW HUBERMAN: Is that because fewer people have been weight training or are the weight trainers all dead? ANDY GALPIN: You've got to go back to 1953, 1954. You had two major things happen that changed the entire course of exercise physiology and exercise science and, really, exercise as we know it. It's important to understand the history of our field. A lot of the questions I get are based on false assumptions of what exercise can and can't do. As an example, questions like momentum. Should I use momentum or that's cheating, right? Or it doesn't work. It compromises my results. It's actually totally untrue. There are excellent reasons when you should use momentum when you lift. There are reasons when you should not. It is sometimes very beneficial to go fast with the exercise repetitions. Sometimes very slow and controlled is better. Any question I get-- in fact, I'm very infamous for always responding with, "It depends." The reason I say it depends is it depends on the goal. When you're training for speed or power or muscular endurance, the answer to some of these very common question differs. What people fail to realize is they think they're asking the right question because they don't understand this history, what's being planted in your brain subconsciously, is driving that question. And it's not necessarily the right one. So if we walk through that a little bit, you'll see what that field has led. Why you

think certain things matter

00:39:58 AG1 (Athletic Greens)

when they actually don't or maybe your assumptions are incorrect and then exactly what to do about them. ANDREW HUBERMAN: I'd like to take a brief break and acknowledge our sponsor, Athletic Greens. Athletic Greens is a vitamin, mineral, probiotic, and adaptogen drink designed to help you meet all of your foundational nutritional needs. I've been taking Athletic Greens daily since 2012, so I'm delighted that they're a sponsor of this podcast. The reason I started taking Athletic Greens and the reason I still take Athletic Greens once or twice a day is that it helps me meet all of my foundational nutritional needs. That is, it covers my vitamins, my minerals, and the probiotics are especially important to me. Athletic Greens also contains adaptogens, which are critical for recovering from stress, from exercise, from work, or just general life. If you'd like to try Athletic Greens, you can go to athleticgreens.com/huberman to claim a special offer. They'll give you five free travel packs, and they'll give you a year supply of vitamin d3k2. Again, if you'd like to try Athletic Greens,

00:40:51 Exercise Physiology History; Strength Training Popularity

go to athleticgreens.com/huberman to claim this special offer. ANDY GALPIN: So in 1953, 1954, you had Roger Bannister breaking the four-minute mile, so subfour-minute mile. And then you also had Sir Edmund Hillary and then his sherpa, Norgay, summit Everest in the same, basically, two-year span. That exact same year after that was the formation of what's called the American College of Sports Medicine. Now, that is still around today. It is the preeminent group for this Exercise As Medicine. So if you're interested in things like exercise for obesity prevention, for cancer treatment, for things like that-- it's not really sports medicine. It's more for clinical exercise-- that's the place to go, American College of Sports Medicine. So we have this launching of both a ton of people wanting to start doing endurance exercise and start swimming and cycling and running. And then you have a launch of people coming off of the back of the Harvard Fatigue Lab. So the fatigue lab actually shut down in 1947. So you have these people interested in physical fitness, but nowhere to go. Well, all those people left the Harvard fatigue. lab and started their own labs at other places. So you've launched the careers of

people like Dave Costill and John Holloszy and some of these very famous exercise physiologists. And they start building laboratories. And we start, for the first time ever, studying the science of exercise. So years go by, and these people happen. The 1960s the 1970s is what we call the runner's boom. So people start-- in fact, if you look at the numbers of people who are doing marathons, it explodes through these two-decade spans because it's like, we could do these endurance feats. Notice both those feats were endurance, running short term as well as going over there. No one has thought anything about strength training and here's why. In the late 1880s, there was a very famous physician named-- George Winship, I think was his name, who was a big proponent of strength training. Well, he died in the age of 50 something of a heart attack. And that terrified people of strength training for 70 years because they're like, whoa, whoa, whoa. That stuff will kill you because he was a doctor, he was trying-- he was running around the country, doing these exhibitions and reporting it, and then he died. ANDREW HUBERMAN: It's sort of like Atkins-- ANDY GALPIN: 100%. ANDREW HUBERMAN: -- dying. Although some people say he died of a heart attack. Other people said he fell through the ice into cold water. That's debated, but the fact that a heavy proponent of a given nutrition plan dies suddenly. ANDY GALPIN: Yep. ANDREW HUBERMAN: Not good for business. ANDY GALPIN: So now the little storm is brewing. 1940s-- and I'm going back a little bit, but bear with me for a second-- there's a guy named Peter Karpovich, and he's a scientist out of Springfield, the decorated physical education, PE, that's a legendary place, Springfield College. And he is anti strength training for a lot of the same reasons. In his entire career, he talked about, don't do this. He's the one that launched these ideas that strength training will make you lose flexibility, it will be bad for kids, all these things that we know now are clearly not true. He's a proponent of these things. And there is a show that happened at Springfield College, and a guy named Bob York-- and if you-- York Barbell, that's still around today-- is going around the country and putting on these exhibitions. They come to Springfield, and it's sort of like a new-age social media thing, where it's like, the students know what's about to happen because Karpovich shows up to this event. And everyone knows he hates strength training. And everyone is like waiting for it to end, just to see what he's going to say. So this whole exhibition goes on, and these people are doing-- you've got to remember back at the time, bodybuilding, weightlifting, power lifting, strength, strongman, it's all the same thing. There's no differentiation yet. And it finishes, and Karpovich stands up, and the crowd goes silent. And he just asks one question. And he just points to one of the guys

and says, scratch your back. And now he's just assuming and waiting for the guy to be like, ah and not be able to put his hand behind his head. And I think he pointed to John Grimek, who's a famous bodybuilder. And he reached back and scratched his back, no problem. And then they proceeded to grab two dumbbells-- I think they were 50-pounds dumbbells-- and do a backflip, standing backflip with both in each hand. They started doing the splits on stage, and they start performing all kinds of physical function tests. And Karpovich is stunned. He's like, holy-- he has nothing to say. He leaves there, and his whole life has changed. All these things he was claiming were shown, in his face, to be false. He does a 180 on his career. He starts running study after study on strength training and starts finding immediately there are no detriments to strength training in terms of global health. Of course, you can do it wrong and things like that. And in fact, here comes a whole bunch of benefits. So through the 1950s, while this thing is going on with the endurance folks, no one's still strength training because there's no record to see. There's no American College of Sports Medicine. There's no societies. There's no science. We're not sure it's safe. And meanwhile, Karpovich is just hammering study after study after study showing you it's safe, it's safe, is safe, but it hasn't picked up yet. And then everything changed in 1977. Thank you, Arnold Schwarzenegger. He came out with the trifold. He hits you with pumping iron, which I know you know that movie, right? Pumping Iron. ANDREW HUBERMAN: It's an interesting movie. Even for those not interested in bodybuilding, it's a very interesting movie because it really gives a window into not just him, but the way in which weight training started to show up as a regular practice. When I was growing up, the only people who weight trained were people preparing for football, bodybuilders, who basically didn't exist in the town where I grew up. And the only people who did yoga were yogis doing Bikram, but now you drive through any major American city or European city and there is yoga studios, there's gyms with free weights. ANDY GALPIN: Yup. ANDREW HUBERMAN: Arnold Schwarzenegger is largely responsible, I think, for initiating that shift. ANDY GALPIN: Yup. Because think about it. He hit us with Pumping Iron, Conan, and then The Terminator, almost in back-to-back-- very close, within years. So you've got this whole cascade of the '70s of people running, cycling, and swimming. Now, science is starting to come out that it's not dangerous and maybe, actually, some benefit. And then boom. Not only is it not bad for you, it can make you into a real world superhero. I mean, think about the psychology of a child growing up, watching somebody like Conan. Think about what Batman looked like in the 1950s and '60s. And then boom. I can look like that?

Now, not everyone wants to look like Arnold, but you see the power that can land in people. No one had ever seen or thought you can make your body transform like that. You could maybe be born like that, but no chance. That's within the grasp of all of you. ANDREW HUBERMAN: When I was a kid growing up, one of my favorite books was The Guinness Book of World Records. ANDY GALPIN: Yeah. ANDREW HUBERMAN: I still have images in my mind of the coldest animal. ANDY GALPIN: Yeah, sure. ANDREW HUBERMAN: The longest lifespan, et cetera. And there was a picture in there of Arnold Schwarzenegger. And you know what his record was? It said, perfectly developed man. ANDY GALPIN: Yeah, yeah, yeah. ANDREW HUBERMAN: Which is, as you point out, that isn't the physique that most people aspire to. ANDY GALPIN: It doesn't matter, though. ANDREW HUBERMAN: But it did inspire this shift. The other thing about resistance training that I think has a certain allure for some people, men and women, is that it's one of the few forms of exercise that because of the enhanced blood flow to the muscle that occurs during the training, the so-called "pump," it gives you a transient but somewhat real window into what your results will be. ANDY GALPIN: 100% ANDREW HUBERMAN: When you run and you're gasping for air, you aren't experiencing what it's like to be faster than you are that day. ANDY GALPIN: That's correct. ANDREW HUBERMAN: But when you weight train, you get an aesthetic picture into how your functionality and aesthetic will change. It disappears a few hours later-- ANDY GALPIN: Sure. ANDREW HUBERMAN: --as the so-called "pump" subsides, but it's a very interesting form of exercise in that way. It's almost as if you go in to learn a language and during the process of learning, for brief moments, you're actually fluent, and then it gets taken away. ANDY GALPIN: Yeah. ANDREW HUBERMAN: So it puts the dopamine carrot out in front of you. ANDY GALPIN: Yeah. ANDREW HUBERMAN: This is just me hypothesizing as to why weight training might have taken off the way that it did. ANDY GALPIN: Yeah, I mean, it's like if you got paid every hour on the hour when you were working. And then at the end of the day, They take the money back, but you still-- as the time clock is going on in your day, you're looking up, and you're watching your bank account grow in real life. You can see why it's so addicting to those folks. So to finish the story here, going back to your actual question answer. This is happening in the late '70s, early '80s. And so now Joe Wieder, all these gyms, they're exploding because people want to look like that or they realize they have the chance to change how they physically look. That had never been a reality before. ANDREW HUBERMAN: Mostly men at that point, I'm guessing. ANDY GALPIN: Almost exclusively, yeah, for a

large number of reasons, cultural acceptance, et cetera. Even with endurance stuff, you could get fitter and run faster and that's better, but it wasn't going to change how you looked unless you were losing fat. Now you can change how you look, which is so incredibly addicting. In fact, there's a very famous quote. I think it was actually Joe Wieder who said, "Show me one man who wants to be strong, and I'll show you 10 who want to look strong." It's like, that's very, very powerful. There's this a whole-- there's tons of this history I can go into, which is sort of explaining to you. But now you know you're in the mid- '80s, and you have what I call my generation. So you have my generation, who fall in love with strength training in the 1980s and '90s, but there's really no scientific field for it. It's not really come about yet. The science of endurance and exercise physiology is now humming along at a massive rate because these people came up in the '70s and '80s, and they're five, 10, 15 years in their career. They're producing. They're generating graduate students. They're starting their own labs. And they exercise physiology, still to this day, is 80% endurance, steady state stuff almost exclusively. Well, now my generation, you love sports. You love lifting. You love all these things. And now what we see happen is the Chicago Bulls, Michael Jordan starts picking up strength training. Ooh. That's on TV. He's on SportsCenter in the mid 1990s, lifting weights. And we go back, actually, to the late 1970s. And I'm not sure if you're a football fan, but any football fan will recognize the Nebraska Cornhuskers in the 1970s and '80s changed how football's played. Well, the reason is because they started strength training. And they started doing it with a guy named Boyd Epley, who was the founder of the NFCA. So the National Strength Conditioning Association is formed in the late 1970s as well. So just like ASCM was developed the year after those two events happened, 1978, the year after Arnold comes out, boom, NFCA is formed. And now you have a scientific organization dedicated to strength and conditioning. You've got NFL strength conditioning coaches that are starting to come on board.

00:51:26 Bodybuilding & Misconceptions; Circuit/Group Training

You've got scientists that are starting to come into labs. And strength conditioning becomes a scientific field. Well, everything swings now, from an exercise perspective, into bodybuilding. And so almost all of the things-- in fact, we were sort of talking before, I could run a whole bunch of tricks on you. And I could ask you a whole bunch of questions about things that you think are absolute standards or guarantees about

training. I'm supposed to do this. I'm never supposed to do that. ANDREW HUBERMAN: For instance? ANDY GALPIN: For instance, is it OK to train a muscle group on back-to-back days? Most people are at home thinking, no, you're not supposed to train a muscle-- ANDREW HUBERMAN: It needs to recover. ANDY GALPIN: And that's total nonsense. Other things like body part split training, training one muscle group per day, other things like cardio, endurance training influencing, will it ruin my gains for my lift? All of these things are on at a base of assumptions that come from bodybuilding. Now, that's a fantastic world, but because everything started in the late 1970s as bodybuilding, in terms of-- basically strength training was that. Weightlifting and powerlifting were not at all around. They were, but nobody cared. Again, show me someone who wants to be strong. I'll show you 10 who want to look strong. The physique thing just dominated, and we're not getting out of that yet. We're not all the way out of it. We're starting to, though, because here's why. People started to realize, this bodybuilding thing is fantastic. I can change my physique. I'm getting better, but damn, these workouts take an hour and a half, two hours. And I'm going to spend that whole time on one or two body parts, which means I'm going to have to lift six days a week, and I'm going to have to do that consistently. Now all of a sudden, boom. Two hours on my elbow flexors. Damn, my elbow's starting to hurt. ANDREW HUBERMAN: And yet, my understanding is that it doesn't really require two hours a day-- ANDY GALPIN: Not at all. ANDREW HUBERMAN: --of training in order to get benefits, even just for hypertrophy. ANDY GALPIN: Totally. But a lot of the times, you're going to have to get some amount of time in because you're spending so much isolation. So we've gone away from training movement, running as a movement, cycling as a movement, training my biceps as a muscle or muscle group, training my hamstrings or a muscle group. That's not a human movement. So we've done a 180 in terms of selecting the exercises from movement-based prescription to now muscle group-based training. So when you're isolating muscle groups, that means a whole chunk of your body is really not doing much throughout the day. So what happens if you're doing, say, legs on Monday and you miss Monday because you're on a flight? Now your legs have to wait a whole other week, So this starts to become problematic. People start getting beat up. People start realizing, I actually don't feel that great. I'm not super fit. I'm sweating just walking up the stairs. I'm out of breath. Why? Because all that training, you've done nothing for your cardiovascular fitness. You've done nothing to improve heart rate, oxygenation, blood flow. And so that paradigm swung way too hard into the exercising, especially lifting

weights, is single joint, often machine, often slow, often high-volume isolation stuff. And that left a giant opening of people going, well, wait a minute. What if you could get in the gym, I can promise you the same or better result in under 30 minutes? And, in fact, you'll also feel better. You'll lose more weight. And that opened up group exercise classes, kettlebell stuff, CrossFit type of stuff, circuit training because you can come in, you won't get so beat up because the volume is lower, the time is much lower. You get multiple adaptations at the same time. Great. The problem with that, though, fast forward 10 years, is it started burying people because you've now de-emphasized movement quality, and you've overemphasized scores. So this is a classic example. If you go and you watch Pumping Iron or any bodybuilder, you'll see if they're doing a bicep curl, they don't even really pay attention to the rep range. They don't really pay attention to the load. They are looking at their muscle. They're trying to figure out, how do I get that thing to fire? They're squeezing. They're flexing. They're posing at the end of every set. They're trying to figure out, am I getting enough pumps? It is exclusively founded on exercise quality. The rep brains, the numbers, almost irrelevant. When you go to the other model, exercise technique, it doesn't matter. Just get the most amount of weight up or the amount of reps or the fastest time, et cetera, et cetera. High-intensity. ANDREW HUBERMAN: This would be CrossFit. I've walked past some CrossFit. I've done two CrossFit classes. ANDY GALPIN: I don't want to get sued. So you said "CrossFit." I didn't. ANDREW HUBERMAN: Oh, no I enjoyed them. I definitely felt like I was working hard. ANDY GALPIN: Oh, you will. ANDREW HUBERMAN: I observed a lot of people in very close proximity doing Olympic lifts and doing kipping-- that's where you kick your legs, folks, say, sort of like bucking and kipping type pull-ups. No. I enjoyed it. It wasn't for me for the long term, but it did seem that there was a lot of ballistic movement in close proximity to other people. So the hazard to me seemed more about that than the actual movement. ANDY GALPIN: Well, again, the point I'm setting up here is, that was actually a really brilliant solution for a lot of the problems the classic bodybuilding hypertrophy introduced. So it got away from isolation movements and got people doing big movements, which are more effective, generally better. It got people doing things fast and explosive. That's more athletic. That is more important for longevity. It solved a lot of the problems. Joint health wasn't getting crashed. The issue they went with is they just pushed the pace on score rather than quality. They pushed the pace on how many people can be in here at the same time. So now you're doing higher-risk movements, higher intensity, higher fatigue, and with a total-- not that they don't care about

technique, but it's not the thing that they're most concerned about. It's getting the number and the thing done. They solved the time issue, though. You can get tremendous results in three days a week, under 45 minutes each session, et cetera. Burn people out, though. Way too much high intensity, way too often.

00:57:22 Women & Weight Training

And the other problem, safety concerns, all kinds of orthopedic issues and other stuff. ANDREW HUBERMAN: Can I interrupt you for a moment and just ask a question, as we go through this arc of the history of why endurance training predominated or strength training or bodybuilding type training or CrossFit type training because I think this is fascinating, and I know we're about to arrive at where we are today-- ANDY GALPIN: Yeah. ANDREW HUBERMAN: --and what the future looks like for people and what they should focus on and do. At what point, if any, do you think resistance training started to become adopted by women? There was no equivalent of Arnold Schwarzenegger there was Linda Hamilton in The Terminator. ANDY GALPIN: Yeah. ANDREW HUBERMAN: There are some impressive physiques, certainly, on female actresses and athletes. The Williams sisters, very impressive musculature and physiques. And, of course, their tennis playing speaks for itself. Has that happened yet? What I mean is, do you think, since you work with both men and women, do you think that most women understand that weight training, done properly is going to be extremely beneficial for them, maybe even especially for them, in terms of offsetting bone density loss and things of that sort? Or are we still waiting for the popular stimulus for getting 80% of young women thinking, I want to lift weights? ANDY GALPIN: Yeah. Hard for me to answer because I'm not a woman. Now, I have a daughter. She's four, so we'll see. What I can say is, I've probably worked with-- I don't know how many professional athletes in total. A lot. I've worked with them probably 14 professional sports. I've worked with Cy Young winners, MVPs, all the credentials. I bet 35%, 40% of the athletes I've worked with are female. So I've worked with Olympic gold medalists. I've worked with bronze medallists in multiple sports. I've worked with the most decorated powerlifter of all time in a number of these areas, fighters, world championship, all of these things. For me, I feel like that burst has already happened. My students, if you look at my classroom, I don't know what the numbers are, but there is no small number of females in exercise science and excess physiology. If you look at our laboratories, that's one thing you will see. There are very few female

exercise scientists. There are very few female strength conditioning coaches, but that number is coming down at an astronomical rate. You have people that are being hired in every sport. You pick the NFL. You pick Major League Baseball. Every few months we're hearing, first female hired for this, first female hired for that. The Yankees, Rachel Balkovec is fantastic. ANDREW HUBERMAN: Yeah, Rachel's been out to my lab. She's terrific. ANDY GALPIN: Yeah. Oh, yeah. She's fantastic. I mean, she's now being hired as the-- I think she's a hitting coach now, actual sport coach. She's going to be a GM. This is her goal. She's a terminator. So that's already happening. And my students that are coming through our program are getting placed in these roles. They haven't gotten through yet a lot in terms of being an actual scientist, but they're getting there. Sports scientists in the NBA are being hired, females, in terms of big data collection. And sports science and tech, we'll cover in another discussion, but I think it's happening. Whether or not the cultural and social-- I can't speak to that end of the equation. What I can speak to, though, is one of the things I think is most fun coming forward scientifically is a number of years ago, NIH came through with their mandates. They're saying, it's no longer acceptable to exclude women from scientific research because we just did that for decades. ANDREW HUBERMAN: Well, what happened-- just to fill this in because I think it's worth noting is that for many years, studies even on rodents were mainly carried out on male rodents because the assumption-- and the assumption turned out to be wrong-- but the assumption was that the physiology of female rodents-- because they don't have a menstrual cycle. It's not 28 days. They have an estrus cycle. It's four days, a different type of cycle-- that would somehow disrupt the data. It turns out that's entirely wrong. Now it's actually required. When you sit on a grant study panel, which are the people who evaluate grants, they ask. They literally say, did they meet the criteria for sex as a biological variable? Here we're not talking about sex as the verb. We're talking about sex as biological sex. And if you don't say yes, that's a strong hit against the grant. And if you say yes, then it checks off that box. So it's now required that both male and female rodents and humans be studied in a given study unless the study is specifically geared toward understanding that only exists in one or the other population-- ANDY GALPIN: Reproductive study, things like that. ANDREW HUBERMAN: --such as menopause, for instance, ANDY GALPIN: Yup, totally. ANDREW HUBERMAN: -- menstrual cycle, andropause, for instance. But no, this is extremely important. I'm excited to hear that. ANDY GALPIN: So where I was going to go with that is actually, so that was step one, which is cool. You've got to include them. Where we haven't gotten to

yet, but I've seen more and more grant applications come through for this, it's just the funding hasn't it yet, which is, it's one thing to let women be in the same studies. That's great. It's another thing, though, to start performing high-performance research specifically for female questions. That has not happened yet. And that's just a funding issue. We haven't gotten money yet. People aren't supporting that. We don't get a lot of financial support for sports science, but we can't track down the money yet of me going, I want to do a study in female athletes that answers female athlete questions. These won't help men. These are questions specific to the female. That's the next step. That's where we've got to get to so we can say, maybe we should do things differently around training or recovery or we shouldn't or it doesn't matter. There's a handful of-- not lower-quality, but some studies. I don't love them yet. There just needs to be a ton of work. Birth control is a very good example the information for women at female athletes or even just hard exercisers-- you don't have to be a competitive athlete-- around what is birth control doing? What types? How should I manage that? What conversations should I be having with my doctor? Almost nothing. Women have nothing to go on for high-performance stuff. So what if I'm trying to compete in an event or run a race? All those types of questions should be answered. Normative value, normative data, performance testing. It's just not there on the female. So that's an area. I think-- if somebody really wanted to make a change, the scientists want to do it. I know it. I've talked to so many in our field that would really love to explore it because it's getting there. Like I said, the coaching side is getting there. They're seeing it. They're hiring these people. I'm seeing it in my students. My followings is not all men. It's a very large percentage of females, and all I do is post about exercise science. This is all I do. ANDREW HUBERMAN: Well, this podcast is very-- we know very clearly the audience is 50% women, 50% men--

01:04:19 Exercise Physiology History & Current Protocol Design

ANDY GALPIN: That's nice. ANDREW HUBERMAN: --which is great. ANDY GALPIN: So just to jump back in our history discussion and to finish that point of where we're at now and where I think we're going to go or should go. So we walked through the bodybuilding running everything and people walking into a gym. Any time they lift weights, they're making all of their choices based on the assumption that maximizing muscle size is the goal. And clearly, that's not the case. There are other adaptations you may be after. So we talked about how that had problems, and then we talked about how

some of these other forms of exercise filled those gaps and then what problems those things introduced. Well, I think we're actually at a point where that pendulum is slowly shifting into the middle. What I mean by that is, if you want to maximize muscle strength, we look towards the power lifting community. If you want to maximize muscle power, we're going to look to the weightlifting community. If you want to look for muscular endurance, well-roundedness, maybe we look into the CrossFit communities and some of these obstacle course races or functionality things. So what we can do now is generate protocols that get us the exact adaptations we want and not ones we don't want, because we can look back at each of these different styles of training and pick and choose optimal protocols or combinations for them. So if somebody simply wants to get healthy, like we talked about when we listed the nine adaptations and I mentioned health wasn't one of them, that's because what determines your health versus what determines my optimal health differs. So if I need more hypertrophy, I can look towards bodybuilding concepts, but if I have enough or maybe for personal reasons, I decide I have too much or I don't want to add any more, then I can say, hey, how can I get stronger without getting bigger? And boom, I look towards powerlifting concepts. How can I get more powerful? How can I get faster but I don't, again, want to lose fat? OK, great. Or if I want physique changes. So we have all these different areas we can pick and choose from that have expertise

01:06:15 InsideTracker

in specific adaptations and develop ourselves perfect protocols based on that information. ANDREW HUBERMAN: I'd like to take a brief break to acknowledge our sponsor, InsideTracker. InsideTracker is a personalized nutrition platform that analyzes data from your blood and DNA to help you better understand your body and help you reach your health goals. I've long been a believer in getting regular blood work done for the simple reason that many of the factors that impact your immediate and long-term health and well-being can only be analyzed from a quality blood test. One issue with a lot of blood tests and DNA tests out there, however, is that you get information back about various levels of lipids and hormones and metabolic factors, et cetera, but you don't know what to do with that information. InsideTracker makes knowing what to do with all that information exceedingly easy. They have a personalized platform that lets you see what your specific numbers are, of course, but then also what sorts of

behavioral do's and don'ts, what sorts of nutritional changes, what sorts of supplementation would allow you to bring those levels into the ranges that are optimal for you. If you'd like to try InsideTracker, you can visit insidetracker.com/huberman to get 20% off any of InsideTracker's plans.

01:07:18 Movement/Skill Test

Again, that's insidetracker.com/huberman to get 20% off. So with the understanding in mind as to how we all, myself included, arrived at such lopsided fitness, too much endurance, not enough strength, too much strength, not enough endurance, it's really hard to imagine that anyone's perfect in this regard. Can you walk us through the nine different adaptations that you mentioned earlier and give us a way to assess our level of ability or our level of adaptation in each of those nine? ANDY GALPIN: All right. The very first one we want to talk about is movement skill. Now, set aside sport specific. So I'm not going to give you an assessment for optimal golf technique swing. This is really about human movement so that you stay injury free and you can continue to train for as long as possible. So what are the minimum requirements? Now, if you can have access to a highly-qualified physical therapist or movement specialist, that's the best route. Go to them. Have them identify all of your movement patterns, overhead pressing, squatting, running, all these things. That's your gold standard. If you want to do it yourself, though, here is a very simple four-step solution. So the way that I teach this is I go joint by joint. And so I think of this as the major ones, your shoulder, your elbow, your low back, hip, knee, and ankle. Now, what you can do is do a representative movement for you. So if you bench a lot, use the bench. If you do pull-ups, use the pull-up. If you squat, do that. I would recommend doing an upper-body press, an upper-body pull, a lower-body press, a lower-body pull. An example would be a push-up, a pull-up, or a bent row, a squat, and then a deadlift. That would be a very, very well-rounded approach. What you're going to do is do that movement. And I would record it for yourself. And record a frontal view and a side view. Probably do three to 10 repetitions per angle, slow and controlled. You don't need any body weight. What you want to do is move, and you want to look for key things at every joint. So again, imagine I'm doing a squat. I'm going to do a squat, and I'm going to focus on just my ankle. And I'm going look for these four things of the ankle. And then I'm going to go back and watch my knee and look for these same four things of the knee through the hip, et cetera. So what are

these four things? Number one is you want to look for symmetry. So symmetry is front to back, left to right, and your right limb and your left limb. And so what we want to look for are if they aren't moving perfectly, that's fine. But you want to see is one moving further ahead than the other one? Is one turning to the side and one's not? Is one fidgeting and twitching around differently? So you want to look just to check, to see and make sure that they're stable. That's one. Number two, you want to look for stability. So a key indicators here are things if you can't get through Squat, a controlled squat, where your knees don't start shaking. That would be an instability issue. So can you do the movement slow? Can you pause at the bottom, maybe three seconds, maybe five seconds or 10? You should have complete control of that movement and all of these joints. Are your hips sliding to one side when you stand up? Is one elbow closer to your body when you're benching and the other one's more flared out? These are the things I'm talking about. I'm not worried about what angle they should be at or not. You're simply looking for asymmetries or instabilities. So again, as you're pushing up, does one elbow start flipping and twitching and going all over the place? The third one is what I call awareness. So there are a lot of movement technique issues that, simply, people don't know. And so you'll watch them squat. I do this in my classes all the time. I'll have 100 kids out there, squatting. And you'll see some horrible squat technique. And then when you just tell them, hey, did you realize your heels are supposed to be on the ground all times when you squat? They're like, oh, OK. And they can correct it. It's not actually a movement flaw. It was just simply an awareness. I didn't know, and then I actually didn't realize that was happening that position. So we want all of our joints to be going through a general full range of motion, which is number four. So the ankle-- during a squat, your knees should be able to go as far over your toe as possible while maintaining good position, your feet flat on the floor, your three points of contact, your whole flat foot, and you're not compromising another joint. So that's all you're going to look for are those four things, symmetry, stability, awareness, and range of motion through each joint, through each movement. It sounds difficult and time-consuming. It's really not. You can generally clear these things in one or two repetitions in a couple of seconds. And what you're really going to look for-- there's lots of scoring schemes you can test, that physical therapists will sort of do. I just look for absolutely terrible, can't do it at all, minor flaw, or pretty close to good. That's really all I'm looking for. So my scoring system is zero, one, three. Zero is like, you're not going to do this exercise because you're at a very high acute risk. You might get hurt on rep one tomorrow. Number one, a

score of one is like, there's a minor flaw here. We can probably do it, but we need to be cautious of load and volume. And the other one is, maybe it's perfect, maybe it's not, but go ahead and it on a reasonable protocol. You'll be fine. So that's generally what you would

01:12:38 Speed Test, Power Test

need to do as a cost-free method of identifying good movement technique within any of the things that you would do. ANDREW HUBERMAN: What about speed? ANDY GALPIN: I actually don't think this is one most people should test. If you're a high-performance athlete, we can run a 40-yard dash or we can do some different things with a velocity transducer on a barbell, if you're a weightlifter or something. For most people, pure speed is really maximum velocity or acceleration are the two ways we break it down. It's generally not that necessary to test. ANDREW HUBERMAN: What about number three, power, which I believe before you told me was speed times force. ANDY GALPIN: So the reason why I don't worry too much about speed is because you can infer a lot of it from a power test. And a power test is easier to do as well as easier to train for for most people. So the cost-free version here is a simple broad jump. So this is stand with normal position, jump out as far in front of you as you possibly can, and measure the distance between where you started and the back of your heel, where it lands. A super basic number to look for there is your height. So you should be able to broad jump how tall you are. If you're 5' 5," you should hit 5' 5," 6' 5," et cetera. It's not perfect. That's going to ratchet down a little bit, about 15%, for females. They just simply don't have the power, in general, that men have. And so you're going to want to bring that down a little bit, but it's a very crude number. If you were to look at a high-performance NFL player, if they're six feet tall, they're going to be jumping nine to 10 to 11 feet. If you can jump your body height-- we're not looking for optimization in this particular test. You are looking for red flags if you can jump your body height, you're going to be just fine. ANDREW HUBERMAN: That's incredibly straightforward and yet, I have one question. ANDY GALPIN: Yeah. ANDREW HUBERMAN: I'm assuming that I can squat down as low as I need to before I jump, I can swing my arms from back to front as harder, with as much momentum as I can muster. And when I land, you said I'm going to take the measure from where the back of my heels. ANDY GALPIN: You want to measure the distance you actually covered. So to clarify, there's no running approach

here. There's no steps into it. You're going to stand at a still. Yeah, you can swing, bounce as much as you'd like to do. You're going to projectile off. So you're going to measure the distance from the tip of your toe-- so basically, stand behind the line and then the furthest point back where you land. So basically, the worst possible score, not the best possible because your feet won't land symmetrically. One's probably going to be a little bit farther. Now, technically, if you fall backwards and your hand touches the ground, we mark that number, but in this case, just use the furthest point back over your back heel, and go from there. ANDREW HUBERMAN: I'll be trying it tomorrow morning. ANDY GALPIN: Now, if you have access to a little bit more technology or you just really want to know a better number, a classic vertical jump is a good starting place. So you can actually do this in a simple, cost-free way. You can just measure two of your hands. Put them together so that both of your middle fingers are touching. Overlap them, and put them directly over your head. And then you want to reach up as high as you can get. And you mark that on the wall. My brother and I used to do this all the time. We would take a highlighter, the yellow ones, and color as much as we could on our fingertips, touch the wall so that the highlighter would stain the wall-- if you actually go back to my house from my childhood, you'll see these markers all over our house. ANDREW HUBERMAN: I'm sure your parents were thrilled. ANDY GALPIN: My dad didn't care. Single dad, he didn't care. He's just like, whatever, you guys. Do whatever you want. So you want to measure that. And then, of course, you're going to jump with those two hands and touch as high as you can up. And you're going to measure the distance between your standing reach and the actual height that you jumped there. Now, the reason you're doing it two-handed by the way, is because if you do one-handed, you can actually reach pretty high by offsetting your shoulders. And now you're getting into differences of who has more shoulder mobility, who has the ability to get up there. A two-handed standard approach is there. Same thing, no running approach here. You can dip. You can drive. You can do all those things. You can swing your arms, but you're going to be a two-handed touch, is a general way to do that. You want to look for a number of something like 24 inches or higher. If you're past the age of 50, that number can come down a little bit, to closer to 20. And again, for females, it's going to be ratcheted down about 15% everywhere you go. If you're a middle-aged female, and you're jumping 20 inches, you're in a pretty good spot. You're going to be looking really nice there. Now, if you can do that on a force plate, that's even better. So these are, basically, scales that will go out to multiple digits, sometimes five to nine digits past zero. And you're going to

stand on these things, you're going to do the exact same test. And these are very interesting because they'll tell you not only how high you jump, but they'll tell you how much force you put in the ground. They can also tell you how long it took you-- and this is called your rate of force development-- as well as impulse and speed and a bunch of other stuff, which are important to help you understand where on the power spectrum you need to be. So you would do that in addition to using some sort of velocity transducer on a barbell. So a very classic thing to do would be, let's say, you're going to do a squat. And you're going to put this device on the barbell, and that's going to measure the speed at which the barbell moves. And you're going to do that at 40% of your one repetition max, 50%, 60%, 70%, 80%, 90%, up to 100%. And that allows you to create what's called a force-velocity curve. And you can start to see at what point, when you start loading things heavy, do you start slowing down too much. And that will tell you what part of the force-velocity curve that you want to train in to optimize your power. Why that's important, a lot of people will do things like, when I'm training for power, how heavy should I lift? Well, the general answer people say is, 30% of your one-rep max, but that's actually not true at all. What's most optimal for power development-- which we'll discuss more much later-- is depending on where you're flawed in the force-velocity curve. So if you have access to technology like that, that can give you a lot more insight and information. If not, do the broad jump test or the highlighter on your fingertips and jump it up and touch the wall test. ANDREW HUBERMAN: At Andy Galpin's house. ANDY GALPIN: Hey, just come along.

01:18:42 Strength Test

The walls are already messed up. Just go ahead and come up to Washington, and we'll do it. ANDREW HUBERMAN: Fantastic. What about strength? ANDY GALPIN: Right. So strength is really important. You need to measure this in multiple areas. And we'll start off with grip strength. So you can do this in two ways. You can buy a hand grip dynamometer. Now, these are anywhere between $20 to $100, anywhere. These actually used to be, when I was in school, hundreds of dollars. And now you can literally buy them on any website for $25. So my honest recommendation is technically, that's not cost-free. I know your whole thing about the cost-free protocols, but $25, I'm calling that basically cost-free. You can bring that in and test that. And that's just a little device where you're going to squeeze, and you're going to do it. And I would do your right hand

and your left hand. You want to look for asymmetries there, but you want to look for something like-- typically, they're going to give you a value in kilograms. And you want to look for something like a minimum score here of 40 kilograms. Ideally, you're up past 60 would be a really good spot to be in. You want to make sure that there's no less than 10% variation between your left and right hand. Your non-dominant hand actually shouldn't be that much weaker in this test. So what you'll actually see, a lot of times, is the non-dominant can be oftentimes stronger because the dominant hand is more for movement precision, writing, things like that. So you want them to be close. If you are a male and you are under 40 kilograms on a hand grip dynamometer, we're going to need to train that. If you're a female, it's not that much lower, but about 35 kilograms is the cutoff point. If you're above 55, we can add it to your training, but I'm not worried about leaving it out of your training. If you're a female, if it's above 50, that's my cut off of where we want to go. So that's a fairly cheap one. Another one that you can actually do is just a dead hang. So you can hold on to any bar, ideally, one that is thin enough to where you can wrap your whole hand around it. So you don't want to be using a giant fat grip. You're going to have a false reading here. So something like going to the gym and jumping on any pull-up bar or pull-up rack. And you want to hang, and this is a simple time test. So in general, we should be able to hang for a minimum of 30 seconds is what we're looking for. 30 to 50 seconds is my good, but we could probably get better here. If you're cruising above 60 seconds, I'm generally pretty happy. This is actually a good example of when females tend to be better. Grip strength on women tends to be strong, and they can hang for quite a long time. So those standards don't really change that much for women. Now, if you are exceptionally large, this thing doesn't scale perfectly. If you're 240 pounds and even if you're lean, it's just hard to hang and hold 240 pounds. Conversely, if you're 145 pounds, even if you're unhealthy, you're going to be able to hang for a long time. It's just not that much weight to carry. So just rough numbers to start off with. ANDREW HUBERMAN: So that's grip strength. What about strength elsewhere in the body? ANDY GALPIN: The primary ones, you can do an upper body strength test if you would like, although it's not technically something we do very often. I'm happy to do it one at max bench press or something like that. That's great. What I'm generally more interested in is a leg extension test. And the reason I like this is, a back squat is better. A barbell back squat is-- look, that's my jam. That's my life. It's just very technically demanding, and it's challenging. You need spotters. You need comfort. A lot goes into this. So for the average person, a leg extension test is fairly standardized. You

don't have to worry about technique, and people can just get into it and go. And so what you want to look for there is a couple of standards you want to hit. Again, a very simple answer here is body weight. Can you do a leg extension with your body weight? ANDREW HUBERMAN: One repetition? ANDY GALPIN: One repetition. ANDREW HUBERMAN: I can answer that right now. ANDY GALPIN: Can you? ANDREW HUBERMAN: No. ANDY GALPIN: You can't? ANDREW HUBERMAN: No. I can hack squat a reasonable amount of weight, but I was on the leg extension this morning, and it was a Nautilus machine. And I certainly could not leg extension my body weight. ANDY GALPIN: Let me clarify. Were you doing a single leg? ANDREW HUBERMAN: No. ANDY GALPIN: So bilateral, you can't leg extension your body weight? ANDREW HUBERMAN: No. But I certainly can hamstring curl my body weight. ANDY GALPIN: OK. So we maybe have some deficiencies in our quads that we need to go after, but that's a pretty good number you want to be at. If you go up in age past age 40, every decade that can come down about 10%, and you'll still be in a pretty good slot. So if you're 50 years old and you're 170 pounds, if you can do 160, you're in a pretty good spot. And then you could just, again, take it down about 10% every decade after 40, but prior to 40, there's really no change in strength, but certainly, somebody in their 40s to 50s should be able to leg extension their body weight. ANDREW HUBERMAN: Noted. I look forward to our discussion a bit later, talking about how to build strength. ANDY GALPIN: Yeah. Any of these strength tests, they don't have to be done to a technical true one-rep max. You can use what are called repetition conversion equation. So put on a load that you think is kind of close to your maximum and just do it for as many reps as you can. As long as it's under five reps total, you can then actually go online and enter that into any number of calculators anywhere, and it will tell you, OK, you did three repetitions at 200 pounds. Your one-rep max is probably 215, whatever. So there's estimate equation. So if you don't want to spend the time or you're not truly comfortable absolutely going to your true one-rep max, just get to a number that's fairly close and do as many as you can and then go on line, again, one-rep max estimator equations are everywhere. If you get past five repetitions or so, the accuracy of those equations starts going down. So don't put on something and go, oh, I did 12 reps of it and then try to figure out your one-rep max. It'll get close. You start moving past that, you're just getting worse and worse and worse accuracy. So I want to make sure whether you're doing the leg extension test or a front squat test, you don't technically have to do it in absolute one-rep max. If neither of those are an option, another one I like a lot here is simply a

front squat or a goblet squat hold. So you're going to hold a weight in front of your chest. A kettlebell is great here. A dumbbell is fine here. And you want to hold about half of your body weight, go all the way to the bottom position, and try to hold that for about 45 seconds. So it's a pretty good indicator of number one, your position. It's hard to be in a bad position for that long at that load as well as core strength and low back stability. So it's a very different indicator than, say, the leg extension test, but it's a really nice one. It doesn't require many moving parts. It's more difficult than the leg extension, but it's quite a bit more functional. And it's going to give you insights into a lot more areas than just the quadriceps. ANDREW HUBERMAN: So 45 seconds down at the bottom of the squat and then returning to a standing position. ANDY GALPIN: Yep. And if you can't do the return, actually, I'm not that worried, but as long as you can hold that good position without a technical breakdown in that 45 seconds, that's a really good spot. As an intro, I want a third of your body weight for 30 seconds. ANDREW HUBERMAN: Terrific. I plan to attempt all of those strength tests very soon. What about hypertrophy? ANDY GALPIN: Sure. Actually, before we get into that, I want to jump back really quickly. It's important to add a couple of caveats to the strength training stuff. So there's two that I want to do. Number one, these are assuming you are technically proficient. So I don't want you to do any exercise to exhaustion or to maximum strength if you're not comfortable with your technique. So adjust these accordingly. If you're not comfortable with the front squat, do the leg extension. If you're uncomfortable with that, do something different. So we never want to utilize maximum testing if it's going to come with a consequence of serious acute injury. So that's the most important flag. The second one is, your warm-up protocol will have a huge effect on your actual results. And so whenever you do these tests, especially if you're going to do a test and then a test again down the line, you want to make sure that warm-up protocol is standardized. Now, again, the NFCA-- and I can give you resources-- has specific guides for exactly what to do for your warm-up protocol prior to one-rep max testing. So we can go there, and you can look that stuff up. We can add that to show notes or something. ANDREW HUBERMAN: Yeah. And I think when we get into a deeper discussion about strength and hypertrophy and resistance training in general, maybe we could touch into the best warm-up protocol. I know I have mine, and I'm certain it's going to be suboptimal based on everything-- ANDY GALPIN: Maybe that's causing the problems. ANDREW HUBERMAN: --based on every conversation we've ever had, where I learned all the things I'm doing incorrectly. But I do make changes on the basis of what you tell me.

ANDY GALPIN: It's not incorrectly so much as it is suboptimal.

01:27:16 Hypertrophy Test

ANDREW HUBERMAN: That's a very kind way of telling me it's incorrect. Thank you. What about hypertrophy? ANDY GALPIN: So the thing you want to pay attention to here is, you have the aesthetic portion of hypertrophy. That's entirely up to you. There is no rationale. You can decide what you feel like looks good or doesn't look good. That's irrelevant. There is a sufficient amount you need to have, where below that, it's detrimental to your health, regardless of your outcomes. And so the best way to do this is a couple of ways. Any sort of body composition tests can do this. So whether this is a scan through like a DEXA scan, which is a gold standard or other ways of biological, bioelectrical impedance or otherwise. So there's a ton of different tests you can get that are pretty close. So what you want to pay attention to when you get a DEXA scan is a number called FFFMI. And so that stands for "fat-free mass index." So you can look at again, any number of online calculators. These are all standard, so it doesn't actually matter where you pull them up. You don't have to worry about looking it up and whether or not it's right or not or something. And so that's going to actually tell you if you have sufficient muscle mass. And so a number you want to look for, in general, is something like if you're a man, your FFMI should be something like 20 or higher. If you're a woman, you want to look for something like 18. So those are the targets. If you get past 24, 25 for a man, that's a lot of muscle mass, assuming you're reasonably lean. Now, if your FFMI is like 24, 25 but your body fat is 40%, you're actually just a very, very large individual. You're not in a great spot. So when we say these sort of numbers, it's the assumption that you're probably sub 30% body fat for a man and sub 35% for a woman. So those are the numbers. There are online calculators. All you really need to know is your total body weight, your body fat percentage, and then your height. And you can enter those three numbers, and then they'll tell you your FFMI score, and it'll correct for an adjusted value. And then most of those will actually tell you the grading rubric and then they'll say, good, average, bad, et cetera, but those are the numbers we look at. If you are, as a man, sub 17, as a woman, sub 15, now we're in an area of pretty severe physiological detriment for insufficient muscle. And in some of our later discussions, we'll talk about why that matters. ANDREW HUBERMAN: So that's not sub 17% body fat.

01:29:38 Muscular Endurance Test, Push-Up

That says specifically, the FFMI. ANDY GALPIN: That's correct, yeah. ANDREW HUBERMAN: What about muscular endurance? Is this where you're going to tell me I need to do wall sits? ANDY GALPIN: So this is really nice. You can do any number of tests here. A standard plank it is a good test of muscle endurance. So can you hold a front plank for 60 seconds? Can you hold a side plank for 45 seconds? Pretty easy. If you're able to do a push-up. So if you can't, that sort of tells you alone. It's actually interesting. If you can't do a single push-up, that's not a muscular endurance issue. That's actually now a strength issue because that's a one-rep max problem. So we want to be able to-- again, for a general male, we should have no problem doing 25 plus consecutive push-ups. ANDREW HUBERMAN: I apologize for interrupting you, but as long as we're talking about push-ups, could you just mention form? Are we talking chest touching the ground? Elbows breaking right angles? What is a proper push-up, according to your laboratory? ANDY GALPIN: Unless you have a very specific reason to limit range of motion, I want all my testing done through a full joint range of motion. This is different for the person. So it's individualized to them, but in general, for a push-up, this would be a full complete lockout of the elbows on the top and a full chest touch or close to it at the ground. You can do it different. It doesn't really matter, but just keep it standard from your pretest to your post-test if you're trying to mark progress, but for us, unless we have a very specific reason, we're going full range of motion for all of these tests. ANDREW HUBERMAN: OK. So 25 push-ups for a male. ANDY GALPIN: 25 push-ups for a male is the standard. And even something like 10 is a number we're looking for, again, as minimum categories for an upper body muscular endurance. ANDREW HUBERMAN: And not to get too down in the weeds, but I have observed other people-- of course, never myself. No, I'm kidding-- but observed other people pausing maybe at repetition 15, catching their breath and then continuing. ANDY GALPIN: That would be a fail test. ANDREW HUBERMAN: So continue like a piston. ANDY GALPIN: That would be a fail test. ANDREW HUBERMAN: So no pauses. ANDY GALPIN: Correct. ANDREW HUBERMAN: Just up down, up down, and trying to hit at least 10, but ideally 25. ANDY GALPIN: I learned this lesson in one of our studies, probably nine years ago, where we didn't clarify that. And so we actually had an individual-- he wasn't being nefarious. He just figured out, if I do a couple, take a quick break and do a couple, he quadrupled his post-test results from his pre-test result because he figured out that little hack. So you

want to standardize it. It's not that I'm against or have some sort of strong belief. It's just trying to keep protocol standardized, which means any break, failed test. ANDREW HUBERMAN: So 10 to 25 push-ups, minimum, for males. What about for females? ANDY GALPIN: So I'll clarify. If it's sub 10 for a man, that's again, and you're like, very severe red flag problem. We really, really like to see a number above 25. That's where we're anchoring. Anything between 10 and 25 is like, yeah, but not severe. ANDREW HUBERMAN: It means they have work to do. ANDY GALPIN: We have work to do. ANDREW HUBERMAN: And for females? ANDY GALPIN: For a female, you're going to scale that back. So a female, the answer could be as little as zero. So you're going to see that, can you do a full position? If they're in that position, we're generally not going to do a muscular endurance test from the knees. We already know the answer is you're zero. We'll actually default to another test, which I'll talk about in a second here. So for those folks, that's going to scale down a little bit. So basically, you're looking at 15 is that marker, like 25 was for the male, where I want to see above 15. And if I do, we're good. Anything between five to 15 is the number of, OK. If you're sub five, we generally have some problems. And if that is different, between one and zero, then zero is a problem. So we should be able to do that. ANDREW HUBERMAN: So if a female cannot do 10 full push-ups. ANDY GALPIN: Yeah. 10 full push-ups hard for a female, depending on size. ANDREW HUBERMAN: OK. Let's say a female can't do five full push-ups. You said, rather than go to a knees-down version, what would you do to assess their muscular endurance? And would you then also encourage them to work on their strength? ANDY GALPIN: Well, absolutely. So again, if they can't do-- they can do anything less than three, you're going to be strength. In fact, if you want to look at muscular endurance in general-- so this is a bit of an off topic, but I promise I'll keep it short, and I'll come right back. When I was a doctoral student, I had two lab mates. One of them was a runner, a female, 120 pounds, something like that, small. The other one was a male, and he was basically like a straight bro, he lifts weights, doesn't do any other sort of training. Does a very classic not training program, but kind of training. And they were bantering back and forth for a while. And basically she was saying, you're so unfit. You can't run at all. And he's saying, you're so weak. You can't do a pull-up. And so they challenged each other to a competition. They said, at the end of the year, the girl is going to do 26 pull-ups, and the guy had to run a marathon, so 26 miles. So that was the thing. And then there was some sort of consequence for whoever failed. So the guy quickly tried to figure out, how the hell am I going to run 26 miles when I have not run a

mile in many, many, many years? So he just started running, three miles, four miles, whatever. Well, of course, both of them ran immediately to me. And then she was like, how the hell? I can't do a pull-up. And I was like, great. And I gave her a very specific maximal strength protocol. And she was like, whoa. I want to go to the assisted pull-up machine and work on doing sets of 25 because I've got to get my muscular endurance up. And I tried to explain to her, your muscle endurance is irrelevant if you can't do one. It's never going to matter. She did the muscular endurance protocol, the entire thing. Didn't listen to me. The end of the year came. She still produced exactly zero pull-ups. So the point is, if you look at muscular endurance, where is it strength and where is it actually muscular endurance? The general number that you're looking for is under 80%. That's going to tell you, is this a muscular endurance problem or is it an absolute strength problem? ANDREW HUBERMAN: Under 80% of a one-repetition maximum? ANDY GALPIN: Yup. So what I mean by that is this. In fact, this actually is in your question. The other way to assess muscular endurance is take the exact strength tests you did from the talk five minutes ago, which one did you do? Load that to 75%, and then do that for as many repetitions as you can. And that is a tremendous barometer of muscular endurance. So if you were able to do 200 pounds in your leg extension test, put 75% on that and do that as many reps as you can. You want to look for more than eight repetitions. If you are below eight repetitions, then we have a muscular endurance problem. If it is higher than that, if you've got 15 or 20, then we know we have probably some problems in your peak strength or the test itself.

01:36:23 Anaerobic Capacity Test, Heart Rate

So that is a good-- eight to 12 number is where you want to be looking at for there. ANDREW HUBERMAN: What about anaerobic capacity? ANDY GALPIN: This one's more challenging. You either have to go to a laboratory and do something like a Wingate Test. So this is a 30-second maximal test where you're going to see how much work can you possibly do in that 30 seconds. If you don't have access to laboratory, you can do this on any protocol you want. This could be sprinting. This can be on an air bike. This could be on a rower, anything like that, anything where you can exert maximal effort and you don't have to worry about technical problems. So I generally don't like to do things like a kettlebell swing or something like that. There's just too many other variables. You need to be able to go as hard as you possibly can, knowing you're going to get to a

place of tremendous fatigue. Now, in the lab, we often use what's called a Bosco Protocol. And you're going to stand on a force plate, and you're going to do as many vertical jumps as fast as you can, as high as you can, for 60 seconds. And you are absolutely destroyed by second 45. So we'll either use that Wingate Protocol or that Bosco Protocol. If you want, though, again, take any of those other places, 30 seconds or so, up to 45 seconds, up to a minute if you want, it doesn't really matter. And you just mark down the distance you cover. That's all. We don't really have standards for these things because it's going to be different. How far you can travel in 30 seconds on a treadmill is just going to be so different than sprinting in the field or on the assault bike or whatever. So what you really want to worry about there is, can you complete it? And then how awful do you feel afterwards? So what you really want to think about here is not those protocols, but this. You want to think about can you get close to your predicted maximum heart rate? So the number we throw out is 220 minus your age. So if you're 50 years old, 220 minus 50, you should be able to get to a maximum heart rate of around 170 beats per minute. Now, that number is extremely generic. If you don't get there, that doesn't have any indication of your fitness. If you get higher, that doesn't mean you're any more fit. It's just a rough number. So here's what I want you to do. In this case, your heart rate recovery is the better metric. So I want you to get up to a maximum heart rate and then test your heart rate recovery. And what you should be looking for there is about a half a beat recovery per second. So you're going to get up to a place where you reach absolute terrible exhaustion, maximum fatigue, test your heart rate, and then count. Have a timer going. Within 60 seconds, you should have, again, that half a beat per second. You should have a heart rate recovery of 30 beats per minute. Within the next minute, so two-minute recovery, it should be, again, half that, so 60 beats. Those are rough numbers to go by. And your three-minute recovery is, again, half of that again. So that is the closest way. If your heart rate recovery is worse than that, then we know we have a problem in your anaerobic capacity

01:39:29 Maximal Heart Rate Test, VO2 Max

or your cardiovascular capacity. ANDREW HUBERMAN: I love it. What about number eight, maximal heart rate? Because what you just described sounds a lot like maximal heart rate. ANDY GALPIN: So this is your VO2 max. So the gold standard here is to actually go into a laboratory and get this thing done. So we can actually run a VO2 max

test, where you put a mask on, collect all your gases, and run you to there. And there is a very specific protocol for completion of a true maximum test. And any scientist will know that. If you don't have access to that, you can do a couple of tests. One of them is called a 12-Minute Cooper's Test. So this is simply time. You're going to run for 12 minutes as far as you can, and you're going to record the distance you covered. Again, you can go online to any number of calculators, enter that distance in. And that will tell you your proximal or estimated VO2 max. ANDREW HUBERMAN: So that's a 12-minute sprint. ANDY GALPIN: 12-minute sprint, maximum distance you can cover in 12 minutes. ANDREW HUBERMAN: Keeping a steady pace the whole time or going-- ANDY GALPIN: Do whatever you want. The goal is to get maximum distance covered in 12 minutes. So that's anywhere between a mile to two plus miles, depending on how fit you are, but you just do that Cooper 12-Minute Test. ANDREW HUBERMAN: Got it. ANDY GALPIN: I told you. So if you remember, aerobic capacity is eight to 12 minutes where you're going to see a real true test of that VO2 max. You simply can't get that in under a few minutes. So if you want, you can do a little gentler version of that. So there are a number of submaximal tests. In fact, there is a one-mile walk test you can do. So again, all you're going to do is-- in this case, you have to have of either a stopwatch or, ideally, a heart rate monitor. And all you have to do is-- this is a walk for one mile submaximal test. So you're going to walk a mile, record the time, record your heart rate at the end, enter those in. And those will give you, again, estimates of your VO2 max. So that's the like, oh my gosh, I can't run for 12 minutes as hard as I possibly can or I don't want to do it. We have a lot of these in our executive program. It's like, my knee hurts too bad. I've got back pain when I run or whatever. Can I-- OK. And you do the walk test. And it's pretty accurate if you do it correctly. So technically, all you have to actually do is measure your heart rate on you neck and count 60 seconds, but it's just easier to-- with everyone's watches and stuff now, just wear the heart rate monitor, plug in those numbers. And again, those are all standard calculations. So anywhere you find those, you don't have to worry about the source. So you just enter your stuff in, and they're going to be running off the same equation. ANDREW HUBERMAN: I like the idea of the 12-minute run. I'm going to give it a shot, see what happens. ANDY GALPIN: For years, we did a one-mile version of this, and there's just a lot more science on the 12-Minute Cooper Test. So we did that. It's pretty good, and it is not even remotely close to fun. ANDREW HUBERMAN: It sounds like fun for other reasons. ANDY GALPIN: Yeah, yeah. Well, it is it. ANDREW HUBERMAN: Fun in the sense that it reveals a lot. ANDY

GALPIN: Yup. ANDREW HUBERMAN: It's powerful, potent. ANDY GALPIN: Super. There's no hiding. You can hide with the leg extension test. It doesn't hurt that bad. But you cannot feel anything but the 12-minute "run as far as you can" test. ANDREW HUBERMAN: So these are really, actually, psychiatric diagnostic tests--

01:42:42 Long Duration Steady State Exercise Test

ANDY GALPIN: They are. ANDREW HUBERMAN: --of a sort. ANDY GALPIN: For sure. ANDREW HUBERMAN: Number nine, long-duration, steady-state exercise. I think of this as a.k.a. endurance, but as you mentioned before, there are other forms of endurance. So long-duration, steady-state exercise. ANDY GALPIN: Yep. So you really want to think about this as not a standard number. You should maintain consistent work output for over 20 plus minutes. And this one I want you to just pick something that it was in your lifestyle. So is there a loop around your house that you can do? Is there some protocol that you like to use before? And you're simply going to test your ability. Can you maintain work without stopping? That's all it needs to be. Now ideally, I personally like to throw a little twist in here, which is, can you do this with nasal breathing only. That's when I feel really good. If you can go 30 straight minutes without needing to take a break-- walking doesn't really cut it unless you're very, very unfit, in which case, if walking 30 minutes without a break is a challenge, OK. There. But if you can, I want you moving at a non-walking pace. I don't care what zone this is, two, three, four, five. I don't care. Show me you can maintain minimum of 20 minutes of work

01:44:00 Fitness Testing Frequency & Testing Order

with no breaks, no intervals, no downtime and, again, ideally breathing through your nose only. ANDREW HUBERMAN: I love this list, but it worries me a bit. Not because any one of these tests is necessarily that overwhelming, but because I'm unclear about how to arrange performance of these different tests. ANDY GALPIN: Yeah. ANDREW HUBERMAN: For instance, do I separate them so I'm doing one test, like long-duration output on one day and I'm doing strength on another day? Those seem pretty obvious to me, but are there ones that one can combine on different days? How much time should one give oneself in between these tests? And how often should one do an assessment? Just as we don't want to necessarily evaluate body weight changes by getting on the

scale three times a day, maybe once a day at the same time each day is more practical. How often should we be assessing our fitness for each and every one of these? ANDY GALPIN: Well, the way that I would say this is, you want to pick the one that is the worst and do that more frequently. So if, for example, you do the upper body strength test and you are fantastic, if you can bench press double your body weight, I don't need to test your bench very often, for the average person. If you're not a powerlifter, maybe once a year or something. Maybe not even that. We just don't need to get there. However, if we then test your VO2 max and in your 12 minutes, you cover a total of a half a mile, then we might want to test that every month. And so we're going to let our priorities emphasize which one we're going to do more often. I would recommend doing this full battery once a year. ANDREW HUBERMAN: Full battery, meaning the entire list on one day. ANDY GALPIN: No, not on one day, but within a week. So you could take a week. Now, you could do these, technically, all in two days. Three-day split here is probably best. So if you were to just say, hey, this is testing week. I actually love this for beginning of the year or whenever it is that you change your training, but I think once a year, just like once a year you should probably go to a physician and get full bloodwork, a full heart scan and everything like that. And then if maybe you had a heart issue, they would come back in and test you more frequently, whatever the case is. You should probably run through this. And you're going to be thinking, yeah, but I don't want to give up on my exercise routine that week. Well, I promise you, you're not going to finish this week and think, I didn't do very much work this week. It's going to feel great. And then you're going to have a very nice barometer of exactly where you need to change and prioritize your training for the next quarter or half a year or wherever you want to go. If you want to actually do this every six months, we end up, actually, doing this, quite honestly, more like every six months as a general test. That's a really good way to do it, but minimum, if you're arguing with me, give me once a year that you want to do this. So which order to do them in? The non-fatiguing tests, you can do whenever. So this is the body composition scan, the FFMI, the body fat composition. All this stuff can be done whenever. I generally like to do that, though, as your very first activity. The reason is we know that acute exercise can heavily influence things like body composition measurements because of inflammation, water storage, et cetera. So it's easiest to just get that off of a 48 hour rest. You want to make sure you don't do any hard exercise the day before a body composition test and probably 48 hours before that. So just start yourself off with that. Your movement tests can be the same thing. You don't want to try

to do a assessment of how well you're squatting if you're incredibly sore from your brutal squatting test. So tend to do those things when you're the most fresh. Then what you want to do is any skill or maximum strength or power goes at the very beginning of the day. And any fatiguing thing happens at the end. And so you could easily do this. All right, I'm going to do my power test, my broad jump, great. You're not going to be fatigued at all from that. And on the same day, since I'm already pretty warmed up, now I'm going to roll right into my leg strength test. And since I'm really warmed up, I'm going to do my leg muscular endurance test right there. So this is a very common strategy we use. We do our one-rep max leg extension, five minutes, seven minutes, whatever we need to do, come back, load it to 75%, do as many reps as you can. Boom. You could roll right into, then, your upper body test or your grip strength test or anything else that you want to do there. Is there a little bit of influence? Yeah, but really, for most people, it's not that bad. What influence I mean. If you do a leg strength test, coming back and doing an upper body strength test afterwards, it's not that big a deal. Give yourself 15, give yourself 20 minutes. Give it plenty of time. So you can knock out your strength testing and muscular endurance testing all in one day. You could do your performance, your skill diagnostic, your power jump test, your strength, and your muscular endurance, and all that stuff is knocked out. You're going to have to come back on a separate day and do your anaerobic tests. This is 30-seconds maximal endurance, things like that. You could, though, if you wanted, do that after your long duration tests. You're long duration test again, is just going to function as a big, warm up. Or you could flip those things or you can do them on separate days. You're going to have to do your VO2 max test on its own day, for the most part, unless you wanted to do, again, your movement or your body composition before those things. So you really have the ability to mix and match. Ideally, this most realistically probably takes three days. If you want to separate them into four or five, the more separation you do, the better data you're going to get. It's just a question of how pedantic are you really trying to get here? And are you willing to lose 5% to then save a whole day? Then you can do these things in multiple stacks. So that's how I would break it up. ANDREW HUBERMAN: So what I'm hearing is, better to do it than to not do it. ANDY GALPIN: Most definitely. ANDREW HUBERMAN: And be rational. Don't try and do your strength output late in the day when you're fatigued. If you're going to combine some of the steady state endurance and maximal heart rate, fine. Understand there might be a slight deficit there, but test it the same way each time. And what you're really looking for is improvement. ANDY GALPIN: Yep. And you can

also do the heart rate recovery under any of the modalities. So you could do the heart rate recovery after your VO2 max as well. So you finish that thing, and then just, again, do the same test for up to three minutes. ANDREW HUBERMAN: These are fantastic tools. I'm almost tempted to say that I'm willing to post my numbers, but that actually violates the core principle that I think we're getting at here, which is that it's highly unlikely that anybody is going to be phenomenal across the board. I mean, certainly there will be individuals that are, but based on everything we talked about earlier, specificity of training and how extensively somebody has been training a certain way will, without question, lop side them, if you will, toward being better in some of these assessments and less good in others. And that's just simply the way that these adaptations work. ANDY GALPIN: Yep. You don't need to be optimal in all of these areas to be, quote, unquote, "optimal health" from this perspective. You just want to make sure, again, there's no severe performance anchors. This is what we call them. We don't want any of these severe constraints because you're going to get limited by that thing. And so what you want to do is move that up to just sufficient or concerning and get it away from that. If you do that, that thing's not going to catch you. You're going to be able to continue to pursue optimization in any of the one things that you have a specific passion for, which is generally what moves people. You train so that you feel better. You train because you know there are all these benefits to it. And jeez, this audience probably could list hundreds of them. But you also train because you generally like to get better at something. A lot of us have something. And so you want to make sure that you're not going, hey, I know you're good at endurance, but you really shouldn't train anymore. We don't want that message, not at all. I want you to love your training. We just want to make sure that you're not loving that so much that you're not taking some blinders off and missing another area, which would actually-- again, you pull that performance anchor, this whole ship sails faster, with less effort and less friction. ANDREW HUBERMAN: What I love about this is also that, as you've described it, it's not just for athletes or people that are super into fitness. It's also for people that just want to be healthy and want aesthetic changes. And that's why they're exercising, which, I think, accounts for a fairly large percentage of people out there. So I think what you described is incredibly well-structured, incredibly clear, and incredibly actionable. So I want to thank you for that I'm serious about my willingness to do this and at least share those numbers with you. And I think for most people that are seeking what you listed off before aesthetic changes, functionality,

01:52:44 VO2 Max Measurements

and longevity, it's clear that all nine of these are going to be important in some regard or another. ANDY GALPIN: So before we close out, I want to go back and finish off the metrics for VO2 max because I don't actually think I gave you numbers on that. So in general, for men, a minimum number we want to look at here is 35 milliliters per kilogram per minute. And for women, that would be about 30. So we can actually push a lot higher on those things. In reality, I want to see men above 50. ANDREW HUBERMAN: If I could just interrupt you for a second. When you say 40 milliliters per kilogram, milliliters of what, specifically? ANDY GALPIN: Yeah. So what, actually, those metrics mean is the first one, milliliters, is oxygen. So it's amount of oxygen. Kilograms is body weight. So it's, how much oxygen can you bring in per kilogram of body weight per minute? So does a volume of oxygen per your size in a time duration. In fact, the way that you calculate it is you multiply your cardiac output by what's called your a-vO2 difference. Your cardiac output is your heart rate times your stroke volume, so how much blood you're pumping out per pump is your stroke volume. How many times you're pumping or you're beating. You multiply that by your a-vO2 difference. Your a-vO2 difference is artery minus vein difference. So it's the amount of oxygen in your arteries minus the amount of oxygen in your vein, which is going to tell you how much you took up in your capillaries, in your muscles. So you take those two factors, multiply them together, and there's your VO2 max. ANDREW HUBERMAN: As you were describing that, I imagine you getting to an fMRI machine and seeing that equation lighting up in your brain because clearly, it's committed to memory very well. Thank you for that clear description. ANDY GALPIN: Yeah. So to finish those numbers, I really, truly want to see a man above 50-- and I'm not even really stoked until I get above 55. In fact, it's sort of funny. Dave Costill, whose lab I did my PhD in-- he was retired by the time, but he's, again, one of these legendary figures in exercise physiology, started in the '70s. He would always say, "There's no human excuse to be below 60," which I was always like, damn. That's really, actually, pretty hard to get to. ANDREW HUBERMAN: Was he at 60 or above? ANDY GALPIN: Oh, yeah. he's still, actually, setting world records in these last couple of years, all the Masters records for swimming and cycling and stuff. So he was a super, super fit guy. So he was always above 60. He's probably like 50 something now, even though he's 80 or whatever. ANDREW HUBERMAN: 80 years old. ANDY GALPIN: Yeah. ANDREW

HUBERMAN: With a VO2 max of 50. ANDY GALPIN: He's probably really not 50. He's probably-- but he's probably going to-- remember earlier on we talked about how I had the 92-year-old who had VO2 max of 38. Dave's probably going to break that record when he gets there, I'm sure. I'm sure. In fact, I guarantee you he has that number in his brain. I haven't talked to him in 15 years, but I guarantee you that number is in his brain, and he's probably training for it. ANDREW HUBERMAN: I love it. And I love it because it proves that exercise pays off. ANDY GALPIN: Oh, yeah. ANDREW HUBERMAN: It's one of the few things in life where there's a direct relationship between work and outcome. ANDY GALPIN: Yeah. As Henry Rollins described in his wonderful essay, if you're familiar with that. Oh my gosh, you're a punk rock guy. You know Henry, I'm sure. ANDREW HUBERMAN: I mean, I certainly know who he is, and I know his work. ANDY GALPIN: Yeah. He has incredible one-page paper. It's something to do with the iron. And he basically describes that as, this is the one thing where it's truth. It is the most true thing you'll ever do, which I love that. ANDREW HUBERMAN: It's almost like a principle of nature. ANDY GALPIN: 100%. Yeah. So with the women, I really want to see the women-- if I want to see men above 55, I really want to see women above 50 as the target. And if you like, you're there, I'm pretty good. So you can do the math on, then, the middle ground of what's like OK, but we need to work on it. In fact, if you look across the literature, at different athletes, you're going to see the really high-level endurance folks, they may pass 70 or 80. In fact, there was talk a few years ago of a guy breaking 100 as an 18 or 19-year-old, but I actually don't think it was ever fully confirmed or repeated, but certainly, you'll see plenty of people 95, in those extremes. If you look at other sports, like football or basketball, they're probably going to be in the 55, 65 range. So if you, as, an average person are 55, that's a really good marker to be in. If you get even close to that, you're in a good spot. I'm sorry if I let you down, Dave. ANDREW HUBERMAN: No. I just love how you're describing this average person, you're looking at me with just a little bit of sympathy, like if you reach the standard of average, Andrew. Listen, you're giving me prompts all over the place to try and improve my metrics, whatever they happen to be. And I think that's one of the great values of getting objective numbers, even if they have to be measured by some of these back-of-the-envelope techniques that, I guess, we always teach people in the laboratory, that a tool can be not extremely precise, but as long as it's reliable, there is still value there. I mean, of course, you'd love to have the most precise and most reliable tool, but if you can't, then at least go for a reliable tool and measure for consistency. ANDY GALPIN: Yeah. For the real world,

reliability beats validity as much as we can. For a lot of the things we're talking about, especially for using it as a metric of did I get better, as long as that tool is reliable. Body composition, just all of these things have inherent error in them. Some of them are smaller, some of them are larger, but as you mentioned, having standardization within the testing protocol is going to allow

01:58:04 Protocols for the 9 Adaptations

you to measure progress. And that's going to tell you sort of where you're at. Now that we've covered all these areas of adaptation, we walked through the history, and we walked through a bunch of the explanations for why people are maybe not getting the results that they want to get through their training, the way I would like to go with the rest of our conversations would be to just go through each of those adaptations step by step and make sure I cover very specific protocols for, if you have run through this testing and identified an area of weakness. So maybe you've been lifting a lot because you like lifting, and you maybe realize that your cardiovascular fitness or your heart rate recovery is not where it really should be or the opposite, like we've talked about. Maybe you're doing a lot of that type of work, and your strength isn't there. Your movement quality is not there. So you've identified a problem. How do I specifically solve it? What are the evidence-based and most effective protocols that I can put myself in for each one of these categories? And I think that would give people a lot of take-home value, but it's going to take us some time to cover. So it's going to have to come across over multiple conversations between you and I. ANDREW HUBERMAN: Great. Well, I'm looking forward to each and all of those conversations. And I want to add just one more metric to our discussion today, which is really just my way of saying thank you because if there were a metric for amount of useful information per sentence spoke, you would be at the upper level of that metric. You have this amazing ability to provide so much knowledge in a clear and concise and, today, listed-out format that is both interesting, grounded in science, and actionable. So on behalf of everyone listening, and certainly for myself as well, I just want to say thank you. ANDY GALPIN: Well, I appreciate the compliments. And I'm looking forward to the next conversation, jumping right into speed, strength, and hypertrophy

01:59:58 Zero-Cost Support, YouTube Feedback, Spotify & Apple Reviews, Sponsors,

training and what are the evidence-based and best practices for protocols in those areas. ANDREW HUBERMAN: If you're learning from and/or enjoying this podcast, please subscribe to our YouTube channel. That's a terrific, zero-cost way to support us. In addition, please subscribe to the podcast on Spotify and Apple. And on both Spotify and Apple, you can leave us up to a five-star review. If you have questions for us or comments or suggestions about topics you'd like us to cover or guests you'd like me to include on the Huberman Lab podcast, please put those in the comment section on YouTube. We do read all the comments. Please also check out the sponsors mentioned at the beginning and during today's episode. That's the best way to support this podcast. I'd also like to inform you about the Huberman Lab podcast free newsletter. It's called the Neural Network Newsletter. And each month, the Neural Network Newsletter is sent out, and it contains summaries of podcast episodes, specific protocols discussed on the Huberman Lab podcast, all in fairly concise format, and all completely zero cost. You can sign up for the Neural Network Newsletter by going to hubermanlab.com, go to the menu and click on Newsletter. You provide us your email. We do not share it with anybody. And as I mentioned before, it's completely zero cost. By going to hubermanlab.com, you can also go into the Menu tab and go to the Newsletter and see some example newsletters from months past. Thank you once again for joining me for today's discussion about fitness, exercise, and performance with Dr. Andy Galpin. And as always, thank you for your interest in science. [MUSIC PLAYING]