

Speaker 1: Bulletproof Radio, a state of high performance.

Dave Asprey: Today's episode is awesome. You are going to hear about several unpublished studies around what meditation and lifestyle does for your mitochondria and for the length of your telomeres. When you listen all the way through to the end, that when a lot of the good stuff comes out about this unpublished research that might not hit the academic journals for years, but you'll learn about it here and just a fascinating conversation that goes in directions I did not think it would. You'll really enjoy this episode.

You're listening to Bulletproof Radio with Dave Asprey. Today's cool fact of the day is about telomeres. One of the things that happens with telomeres is that they promote the replication of cells, so cancer researchers are a little bit worried about that. Scientists just discovered a protein called, this is a mouthful, it's called ZBTB48 can regulate telomeres. This compound not only prevents further telomere lengthening in cells that already have abnormally long telomeres, but it might be able to zero in on your cancer cells regardless of their telomere length. What we're dealing with here is, new science says well, we want longer telomeres to be younger, but maybe some cells, like cancer cells, have other things going on. What's happening is that our understanding of these really tiny, seemingly almost invisible things inside cells have a profound effect. We're starting to hack those and that's why the episode today is going to be really cool.

Now, before we get into today's episode, if you haven't heard about Bulletproof FATwater, this is something that we worked on for a long time at Bulletproof. The idea is you don't want to get sugar in what you drink, but you might want to enjoy something that has more than just water in it. We suspend micro droplets of Brain Octane Oil that creates ketones, so you get fast energy from that instead of sugar. You get a few B vitamins, which also can have an effect on cellular biology, about 20 calories in a 16 ounce bottle, sugar free. On bulletproof.com, we'll ship this stuff to you. Shipping is, I believe it's free, or ridiculously affordable on this stuff. When you look at this, we've got new flavors. This one is blueberry that just came out. There's mango. There's dragon fruit, lemon. This is something, my kids love it.

If you wanted to stay hydrated and just get a little extra boost from Brain Octane without having a full Bulletproof coffee, this is a cool thing and it's totally worth a try. A lot of people now are putting these at their start-ups. You owe it to your employees, if you're an entrepreneur. You owe it to yourself, no matter if you're an entrepreneur or any other person who's alive. Don't drink diet soda. That stuff is just bad for you on every level. This is a new take on water. It's cool. It's called FATwater. You get it at bulletproof.com.

If you'd like to watch today's episode, you go to bulletproof.com/youtube and that'll take you directly to the YouTube channel. You can check us out or if you are listening in your car or at work or something like that, keep listening.

Today's guest is Dr. Elissa Epel. She's a Stanford and Yale-educated health psychologist studying stress pathways. She's also a professor and the director of aging, metabolism, and emotions at UCSF. She's been looking at stress and what it does for aging and your metabolism for the past 15 years. She found something called early aging syndrome and is looking at clinical trials at UCSF, and has co-authored a book with Elizabeth Blackburn on telomeres. Elissa, welcome to the show.

Elissa Epel: Thank you, Dave. I'm so happy to be here and get to talk to you almost in person. I got to be honest. When I hear about what you're doing, I just think this guy is crazy. Then when I talk to you, this is the second time we've gotten to talk, I just stunned at how clear-headed and logical you are, and just your attitude about experimentation. It's just so exciting. It's awesome.

Dave Asprey: Well, thank you. It's totally normal to think what I'm doing is crazy. I'll be really straightforward. When I was 25, 26 years old, I made \$6 million at the company that held Google's first server, and I lost it when I was 28. At the time, I'd had arthritis in my knee since I was 14. I'd hit 300 pounds. I was diagnosed as being at high risk for stroke and heart disease. I had cognitive dysfunction that was so worrisome, I bought disability insurance because I had no lapse. I had no information anything was wrong with me, yet I just felt like I can't bring it the way I know I could, so I was young when I was old.

Having run an anti-aging nonprofit group for like 20 years now, called The Silicon Valley Health Institute, I've met 80, 90-year-olds who are going all out to be young again. I'm like wait, I have more in common with them than I do with my peer group. I've got to get on top of this. My risk tolerance was that of an 80-year-old. It was like I got nothing to lose here, because I felt like I had nothing to lose. I am married to an ER doctor who's only saved my life once at home. I do take more caution than maybe you might believe, but I am a relatively radical biohacker, because that's what works for my biology. The results have absolutely exceeded every expectation I could've had. I have more energy, more focus, more cognitive power, and I look better, everything I can measure. I'm like wow, I love my life. Yeah, I could've broken something. Who knows, maybe I did.

I'm hoping that we all learn from this kind of thing. I'm an N equals 1. I mix 10 studies at the same time, because I want the results, like a hacker, rather than I had to know it was this one variable. Hey, I changed five things and it worked. Then now I'll take away one. This is totally anti-science. As a clinician, as someone who's studying in academia, what's the one variable that matters? I'm like what's the one result that matters? You can figure out the variables later, but in the meantime, I'm going to feel this way right now.

Elissa Epel: Right. You look at packages. I get it. You want to know maximum effectiveness. We're going to get into the weeds. We're going to talk about mitochondria and cell aging, but what strikes me is you love your life, and for someone to be able to have that just meta view of everything is what matters. All of the hacking on your brain plasticity to get equanimity, that, to me, is the grail and not necessarily how many years do we live. Is it really working? Are you going to live to 105 instead of 95? I don't really care, but I know it's cool and interesting. Scientifically, it's interesting, but what matters is what do you do every day and how are you affecting the world.

Dave Asprey: My goal for aging right now is, assuming a truck doesn't hit me or something, I think that I can live to 180. I'm counting on a few technology advancements in the next 140 years, just given what's happened over the last 140 years to get there - but I think about 120 is achievable if you take your biology and you start at a younger age now. I don't want to live to 180 if I hate my life the whole time. The more you love what you're doing, the more you love your life, the more you want to live it until you're done.

I love that you're thinking that way, and that's probably because you manage stress and you look at that interaction between metabolism and stress, which is missing from so much of the literature out there. That's why I'm really stoked to have you on the show. What's fascinating to me about your work is that even though you're focused on stress, you're also focused on telomeres. Can you define a telomere for listeners who don't know what those are? A lot of us have heard of them. They know it's some kind of an aging thing. Give me the slightly medical definition, but one that everyone can understand.

Elissa Epel: Sure. Okay. Look at your shoelace. The chromosomes that have our genes that make us who we are are protected at the very ends, at the very tips, by these telomeres. You look at your shoelace. Think of that string as your chromosomes, so there's all your genes there. At the very tip is this plastic aglet that protects them. When it wears down, it frays, right? We can't use the shoelace anymore. We can't use that cell anymore, when the telomere gets too short. Telomeres shorten with either cell divisions, so let's just talk about immune cells. We know so much about immune cells. That's what we can measure. It's kind of like looking under the lamp post, but this is an important system of aging.

Our immune cells divide when we need to fight an infection, so the more infections we have, more immune cells divide, the shorter our telomeres get. They can't fully repair themselves to their original length, and do that full protection of the genome. As we age and go through different stressors, stress can also act as we call it sterile inflammation. It can cause an inflammatory response, even though there's no antigen. Nothing entered the body, but our thought infected the body with this sterile inflammation response. Not good for telomeres.

Bacteria, infections, excessive inflammation - all these things are shortening our telomeres before our time. If we were really taking great care of them, they're

going to stay longer throughout the decades, and so what we're really talking about when we talk about telomeres is this slow-aging process, where they're going to shorten a few base pairs, maybe 20 base pairs a year, but that adds up over time. If your rate is let's say 40 base pairs a year, that's going to have an effect when you're older. When we measure telomeres in midlife, they're a pretty reliable predictor of who gets disease early and, in some studies, who dies early, so they do matter when we're older.

When we're younger, they appear to matter, too. For example, in a study that took young, healthy people, they're all like in their 20s. They're locked up in a hotel and they have to spray cold virus, rhinovirus, in their nose. Who gets the cold? Who gets infected? The people with the shorter telomeres get these raging colds. They need more tissues. They have more symptoms. They're miserable, poor immune functioning, regardless of age. Short telomeres don't just matter about this long view, but they do reflect how robust our immune system is, even now.

Dave Asprey: This is a really important key for everyone listening. A lot of my work is around resilience and feeling like you have the energy to bring it, no matter what life has for you today. In fact, that whole state of being bulletproof is really about that. None of us are truly invincible, but you're like wow, I just have this unlimited well of energy that I can tap into. You're saying, it sounds like, if your telomeres are shorter than they ought to be, that your ability to tap into that might be limited.

Elissa Epel: Certainly for immune robustness. When we look at people and we stress them out, and we do have this question in stress research of how resilient is your stress response system? What we want to see is a really big peak. We need the stress response, right? There's all sorts of reasons why that's healthy. You want a big peak, and then you want a big recovery. You want to come down like that, and so we measure how quickly do you recover? The people who recover more slowly appear to have the shorter telomeres. We don't know what's causal here, but we know that this kind of stress resilience is walking hand in hand with the healthy telomeres.

Dave Asprey: That's remarkable. This is something that may be hackable. What we don't know, it sounds like you're saying, is if you did something to make your telomeres longer, is that going to translate into a better immune function, or we just know there's a correlation?

Elissa Epel: We would love to know that answer. No one's studied that. What we do know is that when we do these intensive, short-term interventions, we can boost our telomerase, this kind of anti-aging hormone that protects telomeres, or possibly even lengthen telomeres - what we call apparent lengthening because on average, they're longer. We don't know if it's all these fresh, naïve cells coming out or not, but we do know these short interventions can appear to improve our immune cell aging. Whether that's going to lead to vitality and resistance and longevity we don't know. Let's just hedge our bets.

Dave Asprey:

I have a small tribe of phenomenally successful entrepreneurs and billionaire types who are doing a lot of the stuff that I do. We talk about it every now and then, because they're willing to spend almost any amount of money, because they have it, to get more youthfulness. Because hey, if you can have more energy or more time, those are things you don't get back. Living a day where you're at half power, or dying a day earlier is something they just don't want to do, and like all right, so some of them are looking at their telomere length. They're looking at what can I do, as one of hundreds of variables, to make myself either more functional or more long-lived. Do you think that maybe we're too far ahead of the curve, because we don't know if this is causal - or is there enough science right now for us to say having these longer is probably worth doing?

Elissa Epel:

Good question. I do have a good answer for that because it is 2017. If you asked me that a few years ago, I would say, "Ah, we don't know if it's causal." When I said that stress resilience and telomeres walk hand in hand, and we don't know what causes what, we do know that chronic stress shortens telomeres early, and we think that having more robust telomeres, it might be bidirectional. We know more about this stress effect on wearing down telomeres.

In terms of health, we used to think they were a marker and maybe a mechanism and now there's all these [Jira] studies that have shown us that if you have an index for long telomeres, you are more likely to be protected from heart disease - and same with dementia, and same with a few other diseases of aging. This is as causal as we can get in humans, right? At this point, we can't create longer telomeres and see if that helps someone live longer, but we can see if root cause of long telomeres, genetics, directly predicts disease - and it does.

Now, there is a twist. There is a double-edged sword. You mentioned it already, which is how long should your telomeres be? Do you want them as long as possible? What do we know about really long telomeres? They now predict a whole family of cancers, so what we're really talking about is, let's just try to be in a really healthy range on the long end, but not too long. It's a balance, just like everything else in life...moderation, balance. Supplements seem to be causing nudges in a healthy range, but you never know. If you're prone to cancer and you're taking a telomerase-activating supplement, how do you know that you're not pushing yourself over that edge, so that you're at increased risk for cancer? I don't know. I'm just saying it's kind of playing with fire.

Dave Asprey:

It's so funny, because almost everything that we know biologically as humans, we sort of go good and bad...so if it's good, I want more. If it's bad, I want less. The reality is that there's a U-shaped curve for almost all these things. Take table salt. The current recommendations for salt intake are so low that it increases heart disease risk or heart attack risk, because we're not getting enough salt, and salt is required for our stress response. Yet, way too much salt, probably maybe more than six times the current RDA, might be bad for you, as

well, so where you need to be same with cholesterol. If you have very low cholesterol, your odds of dying from all causes of mortality go way up.

It's the same it appears now with telomeres, from what you're saying here, that if you have extremely long ones, like an 8-year-old, you might not want the cells in your 50-year-old body growing like those of an 8-year-old because that would tip you towards cancer. Do you think that we know the right length? Do you want telomeres that are 20% longer than average for your age? Is that a good rule? Do we have a rule like that?

Elissa Epel:

We don't have great rules, but I'll tell you how I think about it when I look at the overall big picture of the literature. I don't want genetically long telomeres. Those are pretty reliable predictors of cancer. When I measure my telomeres, I want them to be longer. That's related to lower risk of cancer, the actual telomere length. There's always studies that are exceptions, but in general, it's what this kind of result ... Telomere length is this product of all these different influences, lifestyle, genetics, stress, chemical exposures, and so when you measure it live, you're looking at the result of all these different inputs. That's when you want to see longer telomeres. All of the things that we know lengthen telomeres, all the natural things, are healthy and not going to put us at risk of cancer.

In our book, which is why I thought you would think the book is boring, rather than focusing on the hacking pieces ... We know how to hack telomeres, in a sense, and we can talk about that. But we focus on this set of behaviors that carry no risk, and that we know stabilize telomeres. I'm not a doctor, so it's very easy for me to have a strong opinion about certain psychological, behavioral, and chemical ways to live. I wouldn't be out there saying you should also be doing these extreme things to hack exactly because of the risk, and because of this U-shaped curve. You, as a hacker, how do you deal with that U-shaped curve? How do you know when you are in the healthy range, and not in the high risk range because you have hacked too much?

Dave Asprey:

It's entirely possible. In fact, I can tell you there have been times when I'm certainly at higher risk for some things or another because the experiment doesn't do what you want it to do. All the diseases you mentioned so far, Alzheimer's, cancer, heart disease...they're all tied to inflammation, and inflammation is always tied to mitochondrial dysfunction. That's why Headstrong, really it's about how do you hack your mitochondria. I do feel very safe saying increasing mitochondrial efficiency, having more highly functional mitochondria, makes you a more powerful human being and lowers your risk of all diseases.

Now, that's not to say having extremely long telomeres wouldn't increase your risk of cancer, but having kick ass mitochondria is anti-cancer, and so all of my hacks eventually roll back to how do I make it so that the power production systems of my body work really, really well? I feel pretty safe from that front, but if I take a high dose of some supplement ... I just bought a kilo of a white

powder from China for \$2000. I'm not going to name what that is yet. I don't want everyone listening to go out and buy that stuff. I'll tell you if it works. I can tell you it's making a difference. When I give it to my dog, he's 12, and I swear he's like he's 7 again. A difference in a week was overwhelming. This is something that directly stimulates mitochondrial function. It's like all right. Am I doing harm? I don't know, but I looked at the preliminary studies and they're incredibly promising, and so I'm like, I got to try that because that's where I live.

That's the kind of the answer to that is you don't know, but if you look in the mirror and you have a muffin top that wasn't there the day before, that's inflammation. If your brain is inflamed, it feels different. That's also inflammation. When you wake up, you're like wow, I look good. I feel really good, like I'm full of energy, and I have more of that than I did before. That's actually an incredible marker that you're less likely to get cancer, unless the energy comes from some stimulant drug like Adderall or something. That's not what I do, and so kind of a short answer.

Elissa Epel: I get it, yeah. I think the paradigm difference between all of this psychological, behavioral, and environmental telomere science and the hacking science is this. The Telomere Effect will summarize it, so the main idea there is if you're kind of, let's just say lazy, or not disciplined enough to do extreme things, and you don't think you could keep those behaviors up anyway - caloric restriction, extreme endurance exercise, so things like that. You actually-

Dave Asprey: Can you talk about extreme endurance exercise for a minute?

Elissa Epel: Yeah. Let me just finish my point.

Dave Asprey: Okay. Go ahead. Yeah. Yeah.

Elissa Epel: Basically, if you're kind of lazy like me, you can live a moderate day and do these, let's say, five nudges that you know you can do most days of your life, and they add up to healthy longevity and a good chance of being, I would say, a centenarian. They're not extreme, and they're doable and most people can do them. If you just look at the diet - like the meat, the soda, most of America is having this phenomenally toxic, low-quality diet. If you just move to the vegetables, food is medicine. What do we know about longevity dose response with vegetables? I know the Bulletproof diet is super-high in vegetables. That's exactly what I say to people, when they're like which expensive pills to buy, etc. It's like eat a lot of this, these vegetables, and that is your most high antioxidant power. We already know from all these studies that follow people until they die, dose response, vegetables, longevity. Yes, telomeres fit in there in some way. They're a dose response related to high antioxidant diet and anti-inflammatory diet. What does that mean? Eat your damn vegetables. It's really not rocket science when it comes to maintaining telomeres. We can talk about more extreme hacking ways, since I know it's phenomenally interesting, but I just want to point out this really moderate stuff. If you do that every day for decades, it adds up and it matters.

Dave Asprey:

You'd be surprised at how common our strategic laziness would be between us. I write substantial books with ... I was blown away that Headstrong hit the New York Times science list for bestsellers, even though it's more of an advice book. That was one of the biggest honors I've ever done, but writing books takes energy. You know because you've written a book. I'm also like, this radio show takes a lot, and I'm a venture-backed CEO, and I'm a dad and a husband and all. I'm not going to spend one minute in any day doing something that doesn't have a high return on these things, so that simple things everyone can do are the things that I'm most interested in, things I talk about most, like get better quality sleep. You're going to spend X amount of time in bed. What if you got a higher return on that? That's really lazy and I love that.

I wanted to ask about endurance exercise. I'm one of the early guys to say, "Look, chronic cardio is bad for you." I know. I used to do it when I weighed 300 pounds. I never lost weight from it. I've only had three knee surgeries. There's a bunch of evidence about that. I had a guy, I think was it Bill Andrews, on years ago on the radio show who's doing these 100K races, like foot races. There's some evidence that extreme endurance sports, which are just not my cup of tea, never will be - but that they may lengthen telomeres dramatically. What's your take on that?

Elissa Epel:

I've read every study there is on this. Exercise, endurance exercise, from sedentary to extreme ultra marathoners, okay, so here's what we know. Sedentary people have shorter telomeres. No surprise, right? It's not just how active you are. It's really how much sitting you do, so people like me are in trouble. I exercise every day, but I sit on my butt for hours the rest of the time. That's not okay. Now we know that we got to get up and move. Sedentariness is one thing. Being moderately active is associated with longer telomeres. It's the vigorous activity that matters. For older people, that's often walking, so brisk walking is enough.

Marathoners have longer telomeres in most of these studies, but when you compare the people who are, let's say, running 10 miles a week, 15 miles a week, to marathoners, with their extreme mileage and wear on the joints and all and extreme time, it's not a dose response benefit. There is such a marginal benefit of being a marathoner, versus being a moderately fit person who's doing endurance jogging. That's where I stand. For most of us, it's not worth it. Most of us can't be marathoners anyway, but the running - let's say three times a week and getting your heart rate up for 30 to 45 minutes - or maybe the intensity, the high intensity walking that also does this, boosts telomerase. We know that from studies. If you're doing that chronically, you're busting stress and stress hormones. You're boosting telomerase. You're maintaining your telomeres. That's enough. There's other, more important things to do than to be exercising for hours a day.

The other piece is that U-shaped curve. We do know that when people are doing ultra endurance sports, that a certain percentage of them are really running this edge of burnout over training. When we look at the telomeres of

people who feel exhausted and fatigued because they've done too much training, they tend to be shorter in the muscle cells and oh, that is not what you want. We don't know how well those recover. Overtraining is serious. I have a friend who just hit overtraining and really wasn't aware of it, but was tired after these long runs. I was like, "That's not totally normal. There can be a little fatigue, but ..."

Dave Asprey:

I see this a lot when I'm working with these Type A CEOs. I used to do a little bit more coaching than I do now, just because things have gotten really busy with Bulletproof. I still do occasional things. You get the Type A entrepreneur who's like, "I'm a hedge fund trader or I'm running my company, and I decided I want to be an ironman triathlete. I'm going to fly to New York and back in 36 hours, but I'm going to get my training run in in the middle." These guys have terrible sleep quality. Their sex drive is gone. Their testosterone's cratered. Look, you have to recover like a professional, if you're going to exercise like a professional.

If you are living that, especially if you're a parent also, and you're living that. I travel a lot. I get circadian disruption. I don't know what time zone I'm in. Maybe you don't want to go lift heavy things and run for five miles, even if it feels good because you got endorphins from doing it. It's coming at a cost. That's that high end of the U-shaped response curve, where you're getting stress and yes, it feels good to get exercise stress - but it might not be the kind of stress that's going to make you live longer, or perform better in the long term. You agree with that?

Elissa Epel:

Absolutely. There's sometimes sudden heart attacks. If you have a slight heart defect, it would never show up in your life. But if you're pushing that edge chronically, it does put you at risk of sudden cardiac events, as well. I absolutely think for some people, it's one of their life goals that they're doing it for other reasons than just helping their health, because it's got costs on health in so many ways.

Dave Asprey:

I like to point out the guy who ran the first marathon, we know what happened to him. He ran, I think it was from Athens to somewhere, Sparta or, I don't know, some Greek city or another one, and delivered the message that the enemy is coming and keeled over from doing the run. We run to celebrate that, and it's like that's not going to be healthy. It's great if a life goal is to do a triathlon or one of those. I think that's really something worthy of respect, so you show yourself you can do it. If you're going to do that every single day, I interview people who just love it. I respect them greatly for doing that, and it's their life's passion, but it isn't necessarily the healthiest thing you could do.

It also doesn't have a high return. Compared to the number of hours of training you get, it doesn't have a high health return, but it might have a high "I feel great about my life" return. Just different variables to acknowledge that. Okay. Maybe this isn't the best anti-aging health strategy, but man, I love my life. I'm going to do it. Hey, more power to you. If you're doing it because you think it's going to have that benefit, maybe going for a half hour brisk walk every day and

lifting heavy things every now and then might. At least, my research shows that. Yeah, okay.

Elissa Epel: I couldn't agree more.

Dave Asprey: Cool. That's what I tend to do. I oftentimes don't even go for a walk every day, because it rains where I live, so I stand on a whole body vibration platform. That also has its different effects, so it's like who knows - but I want the time back that I would've had to spend doing that. If I knew it would double my lifespan, I'd run for an hour every day, even if my legs hurt.

Elissa Epel: What's for the lifespan and ultra longevity? What are you going to do in those extra years?

Dave Asprey: There's a lot of industries that need disrupting still. I played a big role the very first product ever sold on the internet, the first e-commerce before we had the name for e-commerce, was out of my dorm room. It was a T-shirt that said, "Caffeine, my drug of choice." The second product sold was actually wine. The guys who ended up starting wine.com ran Virtual Vineyard, so way back in the early days. Then early, early cloud computing, I played a meaningful role in that, which was around disrupting telecom, so now it's about disrupting big food. We've got to do something about this problem, and I'm doing this neuroscience company, 40 Years of Zen, and I've got solving the world's junk light problem with the TrueDark company, so I'm starting things.

I feel like I could spend a hundred years moving what everyone does, so that we just build the environment around us so that it's self-replicated, so we can make the environment stronger in and of its own self, increasing soil quality. Most importantly, when you build an awesome environment around you, it talks to your genes. It talks to your mitochondria. Then we're all better off. I feel like that's a big enough problem that might take me more than a hundred years, and if I can make myself strong and have a great time doing it and just build a world where people thrive and the world thrives, hey, that's a big problem. I could spend my time doing that. If I'm wrong and all I'm going to do is sit around and meditate, okay, maybe I'll do that. I have no idea.

Elissa Epel: That's a great answer, Dave.

Dave Asprey: What about you, how long you going to live?

Elissa Epel: That's a really good question, and I want to live as long as I'm healthy. That's my answer. Jeanne Calment, the woman who lived to 122, she said she wanted to keep living, because she can still do stuff. She was still riding her bike around that little French town. Anyway, we all know what it's like to be sick and it's no fun. That's a taste of what it's like to be old. It's really no fun to have inflammation, be in chronic pain. Anyway, I really think we're moving toward a phenomenal extension of health span and thriving, exactly what you were

talking about, of people being able to use all those years of life and wisdom and that investment in social capital that we all care about and be doing wonderful things in our older years together. I love that vision.

What we haven't talked about, we don't have to dwell there, is so that is where some people are going. We're having an extension of health span, but it's really specific to people who have privilege. Then we have majority of people low income, low education, minorities, their lifespan is not extending, and they're the ones who are having these prolonged disease spans, as well as shorter life. How are they going to benefit from any of this research?

Dave Asprey:

There's actually a couple things there. When you talk about living as long as you're healthy, when my grandfather was in his 80s, after a couple years of allergy shots, he developed an autoimmune kidney condition. He recovered from it to the point he was going to need dialysis a couple times a week. He sat down and he said, "You know, here's the deal. What am I going to do? I'm going to sit down. I'm going to watch golf for a while on TV, and I'm going to have to do this painful dialysis." He goes, "I think I'm done." He gathered the family around and said, "I'm only drinking wine. No water, nothing else. I'll probably be gone in three days." It was a conscious decision. He goes, "I'm kind of excited about dying because I've never done that before," so scientist until the end.

Elissa Epel:

Yeah.

Dave Asprey:

He passed away with all of his family present and all that. Then I also look at this anti-aging group I run. We had a board member who was 88, who was dating a 35-year-old and genuinely, they cared for each other. It was an unusual situation, sure, but the fact that he had that much energy and vibrance in his life, it's just very different outcomes that can happen. I agree with you. Living way past when you're healthy, and spending all of your money and just being in pain for an extra 10 years of life, is not something that I would do either.

The question about privilege, I spend...and even when I didn't have much money, and I've always spent a meaningful percentage of my income on supporting my biology, partly because I was just old when I was young. I had toxic mold exposure, Lyme disease. They diagnosed me with fibromyalgia and chronic fatigue and all sorts of stuff going on, pre-diabetes and just all the bad stuff. I'm like, I don't know a better investment of my income, so yeah, I'll drive an older car - but I'm going to take my supplements, and I'm going to do the lab testing. I'm going to figure this out.

I did, but when I look at what's happened in the world of technology and just the speed of disruption happening now, you go back to when I had a pager. Yes, I'm in my mid-40s, so I used to carry a pager. This was before anyone could afford a cell phone. You had these investment bankers in LA with their \$40,000 cell phone, that took up the trunk of their car. All right. Now we've got people in Africa with \$1 cellphones who are able to communicate. This happened in my lifetime, so the stuff that I'm doing now where yes, I live ... I'm recording this

episode right now above a million dollar biohacking laboratory. This is stuff that should be accessible to everyone on the planet.

What's happening is at the very cutting edge of innovation, it's always terribly expensive and it's always the privileged people who access it first. By increasing awareness of this and by increasing demand for it, the inevitable thing that will happen is that the cost of it will drop by orders of magnitude. I'm expecting 10 years from now that the stuff that is just not accessible, will become accessible. I'm starting companies to do this. Right next to the Bulletproof Coffee Shop, we have Bulletproof Labs opening, where we have the same stuff I use here available for people to come in and use. Will it be expensive? Not compared to putting it in your house. It'll be more expensive than going for a jog, but you get a much bigger return on the time you spend. By setting an example there, and showing people what's possible, everyone wants it. When everyone wants it, we will find a way to get it for them, and it'll cost pennies when we're done with this.

Longevity is a part of that, and part of this is making the world a better place, reducing overall stress in society...just creating an environment that naturally, without any additional cost, supports human life, reduces chronic stressors, we're all going to live longer. More importantly, we're going to live better. For the people out there who are listening, saying, "I just want this for me," like it's what if everyone could live longer, here's the deal. People who are healthy and have more energy, they're nicer to each other. They won't break into your mansion and kill you. It behooves all of us to build a world like that, because I like it when people are nice to me. You have to have people who are well-fed and healthy to have that happen. That's how the world works.

Elissa Epel:

Yeah. I couldn't agree more. I think that's well said. One of the things that always stumps me, we absolutely need some ways to prevent biological aging. We all need it, right? You and Big Pharma are working toward this. There so far is nothing from animal models that we can use as humans. There's some hints. There's Metformin. There's anti-inflammatories, etc. In general, what we're working against is really complex biology, where there's a lot of different pathways that aging will happen, even if we block one pathway. Here's where rubber hits the road is that most people - not you, Dave - most people are doing things that are speeding up aging that a pill is never going to stop, period. That's where the stress comes in. We reduce toxic stress. We reduce material deprivation. People have their needs met. We have a healthier society and social network. Then we have hope of raising health span and longevity. Then these pills really matter for public health and society. Right now, we're dealing with people dying at half their potential lifespan because of their stress, because of their diet, etc.

Dave Asprey:

The diet's the lowest-hanging fruit. It is unconscionable that you can go to the store and buy foods that are no better than smoking. You go to most restaurants, and you try to order a meal that's a plate of vegetables, and you simply can't do it. You might get a salad, which is mostly air and water - and

you'll never be satisfied with a kale salad, because if you're going to do that, you need a bowl, like, the size of a watermelon in order to get enough energy that way. I have a hard time when I travel just ordering vegetables. We have big problems with the quality of oils.

This is something that is rapidly changing. Sales of some of the processed foods are down 20, 30%. Big Food is quaking right now, because companies like mine and dozens of others, we're disrupting them. They taught me in business school at Wharton look, it's cheaper to spend a dollar telling people that your product is high quality than it is to make your product high quality. I'm like, I just reject that. No, you have to make food that makes people feel good first, and tastes good second, then convenient third, and then is cost effective fourth. What everyone has done throughout the history of food has been, "how do I make it taste good and cheap?" That's all that's mattered. It's like, what the food does for you wasn't part of the equation. If we build that into our awareness as people, we'll stop buying the crap and then they'll stop making it.

I think we're really on the cusp of that. The internet's driving it, because people talk about what works. When you see someone just lost 20 pounds without feeling any hunger, and like oh, yeah, it was kind of a side effect. I just like how I feel. That's the goal. When we do that, I think we're going to see longer telomeres. We're going to see just less chronic stress from hunger, if nothing else.

Let's talk about chronic stress, because one thing that excited me about your work is that you're talking about epigenetics. Epigenetics has been in every one of my books. This is that science about how what's in the environment around you changes your gene expression. You found that people aged more quickly and they had telomere effects if they were socially disadvantaged, people who are caregivers, people who are victims of violence - or really interesting for me is early childhood adversity, people who were bullied. Or I would also say probably people with a traumatic birth are at risk of this, as well, because early childhood adversity starts the moment you come into the world. That was something I dealt with.

Elissa Epel:

Right. All of this, this whole body of work on stress has been building up, and we know that this adversity in childhood - so really child abuse, neglect, material deprivation, serious socioeconomic adversity - those things appear to shorten telomeres. Lifespan stress, what we do when we're older, a lot of that's complicated. If you're a caregiver, your telomeres might be fine, so then we're getting into personality, resilience, resources. There's lots of resilience in adults, but children don't have those options, so what we see is that we get imprinting. We get what we call biological embedding, where when children face adversity, trauma, being orphans, etc., we see changes in the brain. We see changes in the epigenetic patterns and telomere shortness. I put telomere shortening in an epigenetic category. No one knows where to put the telomeres, but they're not the genome. They're kind of the tip of it.

There's another marker that you probably have seen, which is called the epigenetic clock. That's also like telomeres looking like well, this pattern of methylation, we're all getting more methylated over time. This pattern, number one, being more methylated beyond your years predicts aging and death - so like telomeres, it's a way of looking into the cell and saying, even if this person doesn't have disease, there's biological aging that's happened.

Dave Asprey: From over methylation you're talking about?

Elissa Epel: Over methylation. Then, same with now the health behaviors that we have are also possibly shaping the epigenetic clock. This is all kind of new, and there's not that many studies, but the early childhood trauma is, again, looking like it's causing this early epigenetic aging. Really, all these things that we know are causing early disease, if we look really early and we look at the cell, we know we can see these mechanisms. It's not really that much of a mystery. There's so many pathways, and it comes down to our DNA and our epigenome.

Dave Asprey: It's one of my theories, that one of the reasons I dealt with a lot of the stuff that I dealt with in my own health and all as a younger man, is that I was born with the cord wrapped around my neck. So when that happens, it's early birth trauma. It does leave an imprint. I've gone back, and there are ways you can go back and sort of edit that experience in the body, and even reset some of the epigenetic expression. There's neurofeedback. There's holotropic breathing. There's EMDR. I lead executives through this. The number of very successful entrepreneurs today who are successful because they were bullied, or because they had early childhood trauma, it's profound that one of the responses is "I'm going to become hyper successful" more because I'm running away from the bullying, than because I'm moving towards something that's fulfilling. I fundamentally believe that we can go back and change that. When you do it, you see people able to release toxins they couldn't release before, like mercury from the system. Excretion can go up when someone releases an old trauma.

When you I talk about trauma, the average person listening to this who isn't familiar with psychology and all, like, "I don't have any trauma. My parents were just fine." You're like actually, we all have trauma, because kids don't really have a very good, rational way of thinking. We all have traumatic experiences that we don't even know about, that weren't intended to be traumatic. Then some of us have abusive parents, or dysfunctional stuff, or we were orphaned or just all these things. But it's not in the general conversations oh, that affects who you are as an adult in a very meaningful way psychologically, but also biologically. You're coming across that now, right?

Elissa Epel: Yeah. I think there's a huge therapeutic area that hasn't been studied well, somatic therapy. It is all about how we embody trauma and our adverse life experiences. We may not be aware of it, but it is affecting us. It is embodied in different ways. Some of these ways may be these epigenetic patterns, changes in the nervous system calibration, being more vigilant, behavioral patterns, these habits that we have. There are a lot of ways we embody our life

experience that we're not so aware of. The somatic therapies are like this treasure chest. No one understands them well. No one studies them well, but it's working with the body, not necessarily psychotherapy, that appears to have some really profound effects.

Dave Asprey: What are your favorite somatic therapies that could help people with telomere shortness?

Elissa Epel: That's a really good question. There are a lot out there and they're not well-studied, so I won't comment on my favorites. I know a lot about the mind-body exercises and all the eastern Asian practices, because we study those. I personally have a good, positive addiction to certain types of yoga, so for me, that's like talk about placid, high vagal tone states where I've gotten rid of ... For me, it kills rumination. It's a meditation. Of course, then, it depends on the right teacher and the right type, so it's not just any yoga.

In terms of your question, about how do we get rid of some of these experiences we might not be aware of, one of the things that we know from research today more than we ever have is that our prenatal experience is so profound. We will never know what we inherited, but when we study, let's just say, the big ticket items, we're like, "Did someone die when you were pregnant? Did you get divorced? Did you suddenly, unexpectedly lose your home or your job?" The big things, those predict telomere shortness in the cord blood. They predict worse pregnancy outcomes, smaller babies, worse metabolic health as an adult - so they're imprinting. That pregnancy period is literally a critical period. We don't really think about it that much. We can't do anything about it, but it did partly shape us. What we can do now is, of course, support all of the pregnant women around us, because that is precious moments where they need support and to be protected from toxic stress.

Dave Asprey: My very first book was called The Better Baby Book. It's all about pre and perinatal stuff you can do, because if you want to really have an aggressive anti-aging strategy, it starts three months before you're conceived. Your parents have to do it for you, and the people who really benefit the most are your grandkids because it's multi-generational. I'm grateful that you brought that up, because the stuff that happens in the womb is so impactful - and especially in the US, we've built this really fearful toxic attitude towards pregnancy, as like a medical condition. It's kind of a special time, so if you're listening, anytime you have a chance to be nice to someone who's pregnant, you're really doing a huge favor, because we have the most leverage of any time in a person's life in the womb. The leverage you have to affect how well you live and how long you live, it drops off with time, starting even that early - and so you want to get the most return on what you do, you open the door for someone who's pregnant, or carry her groceries out. That can have a much bigger impact than anyone would ever imagine.

Elissa Epel: Right, and antecedently, because it's not just that you all of a sudden are ready to have a baby. You should have a whole transition period of restorative relaxation and support before that baby's born - not like, the week before.

Dave Asprey: Yeah.

Elissa Epel: Yeah, we're not good at that. Scandinavian countries do this antecedently.

Dave Asprey: It's funny you say that. My wife is Swedish and she runs a fertility coaching practice. She's an MD. That's a big part of what she tells her clients, who are mostly entrepreneurs and celebrity types. It's like look, you need to chill if you want to get pregnant - and while you're pregnant, you can't fly all over the world because it's really rough on you, but it's also rough on the baby. Getting nine months of chill time is really hard to do right now.

Elissa Epel: Yeah, yeah. One of my postdocs had cut her leave to one week before the baby was due, and I was like, "No, you're starting now. You need more time." She just wrote me and said, "I didn't even know how much I needed that extra few weeks." It probably changed a lot of biochemistry, so there's a rat study you would like. No one studied the stress effects on rat mamas, and then the pup effects with telomeres. I'm sorry. They have, so stressing out mama chicks causes shorter telomeres in the birds. I wanted to mention a grandmother effect. This is really cool work by Susan Ozanne in the UK. When these little mice are deprived of protein, there's a grandmother effect, meaning that mice is then having babies where the eggs are affected, and it's the granddaughter that comes out with really short telomeres and ovarian aging, and she can block it, CoQ, so CoQ enzyme is apparently really protective for this epigenetic transmission. We don't know about that in people. I shouldn't have told you that, now you're going to try it! No, just kidding. You can't get pregnant, Dave. We can't do that experiment!

Dave Asprey: I had a chance once to ask Craig Venter, the guy who created the Human Genome Project, the first human to sequence his entire genome. He's on stage at a small conference with Peter Diamandis, one of my favorite conferences, called Abundance 360. I said, "Craig, you've got your 20 years of data and all this stuff and what advice would you have based on all that data right now - or should we all just have pizza and beer and wait for more knowledge?"

Elissa Epel: I love it.

Dave Asprey: He kind of tipped his head at me. He goes, "Let's talk about it over pizza and beer." I was like, "No," because what's going on with these rat studies? We know that what we're doing we're all going to die because apparently, being alive is a life-threatening condition. And so I'm willing to take an animal study and say well, directionally, I didn't have any direction before, so at least I'm going to kind of head north or east or west or whatever knowing that we'll tighten it over time. It's just a different perspective where most of medicine in

particular is all about look, if we don't know with 100% certainty that do no harm thing, it's like well, you're doing harm when you're eating your French fries, and you're doing harm when you're doing all this other stuff. So I know I might be wrong, but I'm probably more right than I was based on the knowledge from the animal study, which is why yeah, I'll take-

Elissa Epel: The reason you can do this is because you're an entrepreneur. If you were sitting where I'm sitting, in a university where everything is regulated, we can't take any of those risks.

Dave Asprey: It's sad, too, the other thing that's affecting the world really negatively right now is it is illegal for food companies to say what foods do for you, because if you say a food has any effect on biology, now it's a drug claim and the food is, at least in the US, is legally regulated as a drug. If I were to say coffee does X in 500 studies, it doesn't matter. You're not allowed to say that. It's like well, wait. What's going on here? Now we have this weird, kind of, lack of free speech around this.

The cool thing is social media and the internet are breaking that, where people will talk about the studies and they'll say, "Well, I tried this and it worked." Then you have 100,000 people who tried it, and then you get their data using something like Viome, that looks at changes in gut bacteria, or using one of the tests you talk about with mitochondria - and all of a sudden, we have enough data to say, you know what? We might not know why it works, but it works and we can say that - and then do a rigorous academic study. We just couldn't do that because we couldn't gather the data before. I'm more excited than I've ever been about the chances to do that.

Elissa Epel: I'm so excited to hear what you find. You're obsessed with mitochondria. I'm going to tell you about what we found recently. It's not published yet.

Dave Asprey: Oh, yes, yes, please do.

Elissa Epel: I've been working with this young mitochondria researcher, Martin Picard, at Columbia. We've been taking blood from people looking at how high and active their mitochondrial enzymes are, like controlling for total mitochondria. We're just like, how potent are they? Here's what we find. First of all, we find that if you are a caregiver, a mom with a child with a chronic condition, you have dampened enzymes. This is depressing, but not too surprising. That's as a group. When you look inside the group and you say wait a minute. We see these caregivers with really good mitochondria. How are they different?

Then we look at their day. We examine their day. What we've done is, we have asked them from the moment they wake up, we say, "How much are you looking forward to the day? How much are you worrying about the day? How happy are you? How stressed or anxious are you?" We're constantly looking at what we call, not just affect and emotion, but appraisals of what's going to

happen, good or bad. When it really comes down to it, it's like threat or challenge? Are you really threatened and concerned that you are going to do badly or something bad's going to happen, or are you kind of seizing the moment, and you're seeing opportunities and hope and gain? Those are what we call threat and challenge.

We examine this when they wake up. We examine this when the most stressful thing happens to them that day. Maybe a child has a tantrum. When you think about what's your most stressful thing, it might just be that you're late for work, but there are a lot of events that happen to people that they carry with them for the rest of the day, they're ruminating, etc. At night, mood is really important because it's the residue. It's the recovery. How positive is your mood when you get home from work in the evening and before bed? How positive is it?

We checked all the times of the day - morning, after stress, evening - and here's what we find. The women with the best mitochondria have higher positive affect when they wake up and when they go to bed, but especially bedtime. Really, it's that recovery mood, that residue from everything that happened to us. How much can we still feel content and positive and hopeful? That matters, even if you're a caregiver. That is tied to mitochondria activity. We're going to go after that and look at it on a daily basis, and really see can we move around mitochondria? Can we boost positive affect and boost those enzymes?

Dave Asprey: Well, I would love to talk with Martin also, so if you make the introduction, I'd be grateful. It reminds me one of the things that's in most of my books, and certainly a practice that I do regularly and that I recommend for people is that when you go to bed at night, and I just every night with my kids, it's like, "Tell me three things you're grateful for," because if you can turn on a sense of gratitude right before you go to sleep, it shifts your nervous system. What this new, unpublished study you're talking about, it sounds like it might also shift your telomere enzymes, which is ridiculously cool.

Elissa Epel: Yeah. That's kind of our intervention. What you just described is like, that's something we know that works with research is this recalling something you're grateful for. Isn't it amazing, it's so powerful?

Dave Asprey: This is actually the intervention you're using in the study?

Elissa Epel: It's one of them. There's a couple with-

Dave Asprey: Oh, my God. That's so cool.

Elissa Epel: You didn't know that?

Dave Asprey: No.

Elissa Epel: Oh, yes. It's huge, the recalling gratitude, either when you go to bed or when you wake up doing that, you change your affect balance. Yes. You didn't know that that's the original idea.

Dave Asprey: Yeah.

Elissa Epel: I hear it was that you came up with that on your own, yet one more wisdom thing.

Dave Asprey: I'm blown away to find out that there's changes in telomeres. My understand-

Elissa Epel: Yeah. This was the mitochondria.

Dave Asprey: Oh, okay. I can see the mitochondria thing. Okay.

Elissa Epel: Yeah, the telomere enzyme we also are finding is related to that threat challenge I was talking about, so the feeling more of the positive stress is associated more of that telomerase enzyme, the enzyme that protects telomeres and in one study, the longer telomeres, so maybe both, but it's the mitochondria we think that are responsive on a daily basis.

Dave Asprey: My theory on this is that mitochondria are individually and as a network sensing the environment around you, and if you believe some of the researchers out there, I believe that they're the sensors that control epigenetics. Something is telling the cells whether to turn genes on or off, and when you just look at the biology and biochemistry, it's the mitochondria. They're sensing everything, including their individual bacteria threat posture analysis, and then the network one and that kind of rolls up into our body.

One thing they listen to is magnetic fields. Your heart's making a giant magnetic field. When you go into state of gratitude, it changes heart rate variability, which they can and do sense, which I think that's one of the primary ways that your distributed network of sensors is picking up what's going on in your brain, to figure out this emotional stress. That's one of the reasons I think heart rate variability work is so important, and if you're not going to do that - just the things like gratitude, forgiveness, and just realizing how amazing the world is, even if there's problems, for me, it's made me a more functional human being. Whether or not it's affecting your mitochondria, or it just affects the quality of your life, I'm willing to do it. And maybe 20 years from now, we'll also find out it affects the invisible leprechauns that control us all. I have no idea. There's all kinds of stuff we don't know.

Elissa Epel: Right, but the big effects, things like that, the gratitude, stick with that. You're safe. You're probably changing mitochondria and telomerase and a thousand other good things.

Dave Asprey: I had no idea we would get there in this interview, which is really cool. How long does it take for a gratitude practice or meditation or yoga or any of those in order to affect your molecular dynamics, to affect your biology?

Elissa Epel: That's a fabulous question. The study that we're about to publish is mind blowing, and we probably won't get to publish it for years, until it gets through a lot of skeptical reviewers. We basically found that within three weeks of an intensive meditation retreat - beautiful place, you're eating vegetarian food - there was telomere lengthening in this group. That's a very short period for a change, but it was an intense change. We're changing sleep and stress and diet, and they're meditating, so they're also turning on restorative activities. We don't know what happens in a day and to me, it's all about the moment and the day, and those are the units that add up and make it a three week effect and then make it a year, a longitudinal effect, etc. that's all we can control anyway. It comes down to this very moment.

Dave Asprey: I'm really excited to see that study when it comes out. In the meantime, I know that there's long-term effects. I've done lots of personal growth retreats. You've inspired me. Now I'm going to ... I'll chat with you offline about the right types of telomere testing, but for the 40 Years of Zen program where it's 5-day, really intense neurofeedback, I will, at least for a few guinea pig people, I will get some data on that, because that'd be really fun.

Elissa Epel: Awesome. I'd love to see the data. All right. Wonderful to talk with you, Dave.

Dave Asprey: It's a deal. I have one more question for you before we go. If someone came to you tomorrow and they said, "Elissa, I want to perform better at everything I do as a human being," what are the three most important pieces of advice you have for me? What would you offer them?

Elissa Epel: There this pill. No, I'm just kidding.

Dave Asprey: Best answer ever.

Elissa Epel: You know my answer is going to be it's actually things we've already talked about. One of them is let's just say, two psychological and one behavioral. One is these two forces in our life, fundamental forces, love and fear, so love, the social connection. We need our tribe. We need to be feeling like we belong. We're helping people. They're helping us. We have support. The opposite of that is feeling unsafe. We don't feel safe when we're isolated, and we die earlier when we are feeling socially isolated, etc. We need to boost up social connection, and that also means our connection with ourselves, so then that gets into being able to know our mind and live with our ridiculous ruminative processes, where we pay attention to negative more and do some corrections on that, and so that we can be equanimous in the moment.

That's whatever it is for each person. Meditation's a great way, but there are other ways to get there. Then that will reduce the fear and the feeling unsafe, because that's what it's all about. For pro-aging, environmental, psychological effects of pro-aging, it's about safety and becoming able to be in a restorative mode most of the time, instead of a threat mode. Then the behavioral one is exercise - so not too much, but it's got to be vigorous. It's going to clean out the cells and help our brain, let us be in our very best state, our true essence, and not our threatened, overwhelmed, cognitively-overloaded self.

Dave Asprey: Absolutely love it. Elissa, where can people find out more about your work and your book?

Elissa Epel: I've got a website called AME, which is aging, metabolism, emotion, so they just type in AMEUCSF they'll find me or my name. On my lab website and our aging, metabolism, emotions website, we have a link for The Telomere Effect, where we say if you want to understand where to get your telomeres tested, and what the pros and cons are, this is our bottom line as of today. It always changes. There's always new work, but Liz Blackburn and I wrote up our thoughts on telomere testing, as well as the different tests. Also, of course, the book is called The Telomere Effect. It's easy to get. It came out in January, also made it to the New York Times bestseller list under science. I agree with you. That was an important path for it.

Dave Asprey: It's so cool. It feels so good, right?

Elissa Epel: Yeah. I have events on the website. We always have conferences and retreats, and fun things for boosts of science and contemplative practice.

Dave Asprey: Well, thank you so much for being on Bulletproof Radio. I absolutely appreciate it and what a fun interview.

Elissa Epel: Thank you so much. This was great fun. I learned a lot.

Dave Asprey: If you liked today's episode, you know what to do. Go out and pick up a copy of The Telomere Effect and while you're at it, go to Amazon and leave a review for Liz Blackburn and Elissa Epel, the authors of that. Maybe do one for Headstrong, as well, because as authors, we totally look at those reviews on Amazon. It's one of the simplest things you can do to show some gratitude. It'll take you literally 30 seconds, but we notice. Thanks for listening and I'll see you on the next episode.