

Announcer: Bulletproof Radio: A state of high performance.

Dave: You're listening to Bulletproof Radio with Dave Asprey. Today's cool fact of the day is that blood vessels built from your own cells might someday help you even if you're doing something unusual like dialysis. Right now they're running clinical trials on bioengineered blood vessels they install in the arm of dialysis patients that gets successfully integrated into their circulatory system. That's kind of cool. You could get new blood vessels installed when yours start getting too old. How awesome is that?

Dave: What they did is they created a blood vessel by seeding a biodegradable polymer tube with vascular cells from dead people. In this case I'd want to do it from my own cells, but hey that's just me. They put it inside a bioreactor tank that provides nutrients and the cells multiply, secrete proteins, and form an intercellular network. In eight weeks the polymer scaffolds broke down and what was left was donor cells. They grew the vessel of only six millimeters across, put it in the patient, and the patient's own cells moved into the tube and we're off to the races.

Dave: This has never been done before. Before they would do things like, "We'll just pull this blood vessel from your leg because you probably don't need it that much and we'll just put it in your heart because you need that more than your leg." It seems like a nasty trade-off, but compared to dying it's a pretty good trade-off. I love it when we're now looking at these incredible new abilities to, at a very slow pace, turn on that Wolverine-style kind of healing. Eventually you'll just grow new blood vessels like that and you'll be able to have steel claws too one of these days. Adamantium. But that's just coming. In the meantime, bioreactors, that's all legit. This actually came out of North Carolina. It was published in Science Translational Medicine in March of 2019. That kind of stuff just gets me all excited about the future. Stuff that just seemed like science fiction a little while ago. "We just grew you a new vessel in case you needed it."

Dave: Now, since I'm a master of foreshadowing, you know that I'm probably going to talk about blood vessels with you today. You might be saying to yourself, "Why do I care about blood vessels?" It turns out that one of the big four things that's likely to kill you is probably something having to do with your circulatory system, your cardiovascular system. That's why today's guest is Dr. William Li, who's a really experienced internal medicine physician and a research scientist, something called a vascular biologist, who's been working on something called angiogenesis, that would be growing new blood vessels, for more than 20 years. He's been on Dr. Oz. He's an author. The guy's really looking at what you can do to take control of that one aspect, that what's going on with your blood?

Dave: He wrote a new book that we're going to talk about today called Eat To Beat Disease: The New Science of How Your Body Can Heal Itself. He takes, like me, a systems-based approach to health and prevention and even reversing disease, diseases like cardiovascular, things that aren't supposed to be reversible. We're going to talk in practical terms about what you have to do in order to get your defense systems in order so you just don't have to grow new blood vessels in a bioreactor and stick them wherever your current ones fell apart. Dr. Li, welcome to the show.

- Dr. Li: Thanks, Dave. It's a pleasure to be on. I really appreciate your setup on bioreactors because the body is the best bioreactor we have.
- Dave: It's a great way of looking at it. It's completely true. We'll take anything that we stick in our mouth that can be digested and turn it into electrons and building blocks and poop or breathe the rest out. At least that's my model of it. That's pretty accurate?
- Dr. Li: Pretty much. We are essentially our bodies are like a universe that's a galaxy that's in formation all the time. Our trillions of cells are multiplying. They're actually keeping our organs in good shape. Most of us are fortunate to be healthy and many of us are afraid to get sick. The traditional ways that doctors like me have been taught is to wait until you get sick, diagnose disease, and then write prescriptions to chase down the disease and see if you can cure it. But there's really now a new approach really because the science has advanced to help us get an entirely new view of what health actually means. I think this is where this idea the body is a bioreactor comes back into play because our health is not simply the absence of disease, like most people think. Our health is the result of our hardwired defense systems that protect us through a bioreactor from the day we're born until our very last breath. Guess what? Food can actually activate those health defenses.
- Dave: What are they defending us from? Health defenses. Is this aging? Is this toxins? What's out there that's so scary?
- Dr. Li: Think about the moment we're born. It's like being a windup doll. We are released into a world that is designed to harm the body. Even without pollution and chemicals and secondhand smoke and all that stuff, you got ultraviolet radiation that's beaming in from the sun through the skies causing DNA damage in our skin. You've got radon coming up from beneath the ... We're really assaulted from both atop and below. Then, now that we're in society, we're getting off gasses from furniture and carpets and rugs. We're out there sitting in traffic with our windows down and breathing in exhaust. No matter where we go, basically life is pitted against our health.
- Dr. Li: Our bodies remarkably have evolved a series of self-defense mechanisms, think about aikido or kung fu wired into our bodies, that are set to really neutralize attacks, repair damage, and really try to regenerate and keep our health going at a high level. That's even without the things that we do to ourselves not knowledgeable that actually can take down our health.
- Dave: Pretty much everything out there wants to kill you and eat you. If we're not talking about entropy, just the tendency towards randomness, every life form on earth, bacteria, fungus, higher life forms, plants, eventually the things that make us up, the carbon molecules and whatnot, they will get recycled and eaten by something else. It's your ability to resist that as long as you can determines the quality of your life as well as the length of it, if you want to be dark about it.
- Dr. Li: That's exactly the point, is that the moment we are delivered onto this planet from our moms, our bodies are wound up like these toys and basically they function to allow us

to live as long as we possibly can, defending our healthy organs and tissues, and keeping us ideally optimally functional. That's why when you get started, when we get started, we're still developing and we're not quite optimized yet. It's like a butterfly coming out of a chrysalis. Wings are still wet. Need to dry up before we can fully flush ourselves out. That's like adolescence, young adulthood. Then we wind up being these beautiful pictures of health, most of us. Some people do get sick. But then most of us get to that middle age-ish point where the pluses and minuses of life start to take their toll on us and our defenses start to get overwhelmed. The question is, what can we do to better ourselves?

Dr. Li: The conventional thinking out there is juicing, jogging, and yoga are probably good for us, and they are. But now we have really advanced knowledge. I think this is something that your listeners will love to hear about. What do we know from the frontiers of science that give us that insight onto how our body actually heals itself, repairs itself, keeps us going?

Dave: I'm glad you didn't write yet another book about juicing, yoga, and jogging, because it feels like everyone's been saying that for 30 years. It hasn't really worked that well.

Dr. Li: Totally agree.

Dave: If you look at death rates from cardiovascular disease or Alzheimer's or diabetes or anything else. In fact, it seems like crappy advice because we aren't all getting healthier. What's missing?

Dr. Li: I can tell you that what's missing is a more holistic approach that's informed by science. I think that the confusing thing about foods and health that have I think reigned supreme over the last decade, maybe two decades, is that everybody's thinking about the superfood or the super diet that's going to solve everything. As a systems biologist myself, and I know I'm talking to somebody who thinks this way, we have to understand life's not simple. It's very complicated. Our body's not simple. It's very complicated. One system works with the other either to help us or actually to take us down.

Dr. Li: The reality about health defenses is that this is an intertwined system, they're biological systems. They're hardwired inside us and they help our circulation, for example. That's the angiogenesis system. They help us regenerate from the inside out. That's our stem cell system. Our microbiome happens to be an entire ecosystem inside our body that functions on our behalf until it's disturbed or perturbed. Then that system, which is thrown out of whack, needs to be put back into balance. Then our DNA is another system that needs to protect itself against assault or we wind up having mutations and diseases like cancer. Then finally our immunity, which is another core ... a pillar of our health defenses. Every grandmother has said that your immune system keeps you from getting sick. We know it's more powerful, much more powerful than that, that it is so hardwired to protect us it can even protect us against cancer. Even when we have cancer we need to keep that immunity fully functional.

Dr. Li: There's no superfoods. But really there's a super body. Hacking into the systems that make that work well is what's going to give us the clues on how we can use food in the proper way going into the future to live longer.

Dave: I like that perspective a lot. You say something in the first line of your book that caught my attention. It's one of the reasons I wanted to interview you. You come from a place of learning and you've really spent 20 years on this. You say, "We are at a turning point in the fight against disease." Big words from a licensed medical professional that's spent 20 years on the problem. Why is this a turning point versus last year or next year? What's so special? What's happening?

Dr. Li: It seems like every year somebody is talking about a groundbreaking, game-changing breakthrough in medicine. The media does point out things that are really cool, like the artificial blood vessel that you described. There's so many other things. I actually think that the turning point that's happening now is coming from a number of if angles. First, I think that, as citizens of modern societies, we realize that we just can't go along letting things happen to us. We need to actually use the knowledge that's available and turn our lives into our own favor. That's an empowerment that we didn't have before because the science now tells us what we can do to stimulate the healthy parts of our lives, not just what we should stay away from.

Dr. Li: If I told you basically stay away from the electric fence your whole life will be patterned on fear and distance. If I told you, "Look, reach for this or that because it can activate your health defenses," it gives you something positive to do. Really the turning point comes from the positivity that we're able to lean into health in a way that we haven't been before based on the sophistication of science that's actually coming. By the way, from the biopharmaceutical industry, biotech has delivered the billions of dollars have been used, invested in biotech, has really given us the knowledge that it takes to actually not use drugs, ironically enough.

Dave: The metabolic understanding that came about from drug research will ultimately disrupt the drug companies themselves.

Dr. Li: That's completely correct. The other thing that's happening now that's tipping is the unsustainability of what we've always done, which is, "We're healthy. We don't need to worry about it until we get sick. Then somebody's going to be around to write a prescription or get you into hospital or do a fancy procedure and throw a hugely expensive intervention at you." Yeah. Listen. I'm a doctor. I've been behind and involved with the successful development of 32 FDA-approved game-changing medications for cancer, diabetes, complications, and even vision loss. Things that we weren't able to do before we can do with medicines. I know how powerful these medicines can be to treat disease, even in some cases cure it. But, hey, it's a lot more powerful if you could prevent the disease in the first place. I think that's where the tipping point comes, because when we think that we can prevent the disease or reverse the disease we're suddenly in a completely different place than healthcare has been for 150 years.

Dave: The big difference is that we have a sense of control that we have now that we didn't before.

Dr. Li: Informed control.

Dave: It's interesting because the definition of biohacking is that art and science are changing the environment around you and inside of you so that you have full control of your own biology, which includes health. But if your goal is, "I just want to be healthy," I'm like, "Actually, I'd like to be immortal." Healthy is pretty good. It's table stakes. But I think maybe I could do better. You can have control. Maybe you can get there. Maybe not. You might die trying. It's all good. But I do feel like that's liberated a lot of people.

Dr. Li: I totally agree. I think we're at a point, this tipping point allows us to up our own game. All of us who actually make an effort to be healthy, what's really cool is that now we actually can raise the bar even for ourselves, even for the motivated people. The knowledge that allows us to say, "Hey. Listen. I don't have heart disease. I've got good circulation." Now we can say, "How do we get better circulation?" Or, "I'm growing my muscles. I'm working out. I'm in good shape. I'm body sculpted." The question is, that's fine. Now let's supercharge what we're doing inside our bodies. Can we regenerate ourselves? Can we add stem cells not by injecting ourselves but by using our diet to control, to biohack into our bodies to get our stem cells to work even better? All these things are actually starting to come to light and to practical application.

Dave: That makes me really excited. One of the other things I don't think I've ever talked about on the show but you said something earlier. You said, "What we're doing now is not sustainable." Two things come to mind. One is, it was announced earlier today on the day we're recording this episode that the US has the lowest birth rate in 32 years. The birth rate in Japan has been plummeting forever. In fact, in every developed nation it's coming down. I've been forecasting since my first book on fertility that was published in 2011. We don't have a global population problem. Don't even worry about that. That's a 50-year problem because infertility is climbing at such big rates. Even if you want to have kids, you can't. We'll solve that one biologically.

Dave: But, aside from that, the sustainability of the current thing. There's no young people around to take care of you when you're old. The amount of medical waste coming out of hospitals because of sterility requirements, oh my god. You think you're a good person because you recycle? If you really want to reduce your environmental impact, throw trash everywhere for your entire life and then die in a car accident instead of a hospital and you'll still have less plastic burden on the planet. Do you agree with that statement?

Dr. Li: I totally agree. The thing that is frightening is really how much medical waste. It's not just from the hospitals. It's actually even from your own medicine cabinet. People that toss out old pills or other ... discard biohazard waste that gets tossed around. Most of our water supply is actually contaminated. Here's another example of how our environment actually is set up and what we do in our environment is set up to actually force us to work harder to keep our bodies' health defenses up. You talk about infertility. There's birth control in drinking water just from the stuff that leaches out of septic systems and stuff like that. We've got drugs everywhere. The antidepressants, there's Prozac in drinking water as well. Watch out, people. The fancier we get, the more at risk we get. That's why we really need to be able to raise our own bar in some cases just to get to the baseline of what we should be.

- Dave: It's funny. If I'm feeling sad, I just go to New York and drink some tap water and I feel much better. It's probably the Prozac. I'm just kidding.
- Dr. Li: Could be.
- Dave: In your book, Eat To Beat Disease, you talk about 600 studies or so. You came up with a framework that I think listeners would appreciate where you talk about five defense systems that correspond to the sections in your book. Let's just talk through those so that when people are done listening to this they feel like they got a little mini education in how to eat and what these defense systems are. Tell me about angiogenesis.
- Dr. Li: Five defense systems really come out of this idea that when I started to think about health instead of disease and when I started to think about prevention versus intervention, I started to think about food. When it comes to food and health, here's what's really clear. It's not just about the food. It's about how our body handles and responds to what we put inside it. I started to really start to delve into what it is that health is the result of. I identify in my book five core health defense systems of which angiogenesis is one of them. I know we'll go through them.
- Dr. Li: I'll start with angiogenesis. Angiogenesis is how the body grows blood vessels. You talked about the bioreactor. I'll tell you something even more mind-blowing than that. As adults, we have 60,000 miles' worth of blood vessels packed inside our bodies that twist and turn everywhere delivering oxygen and the nutrients that we need to every single cell in the body. 60,000 miles. That is so extensive that if you were to pull out all these vessels and line them up end to end, you would form a line that would encircle the earth twice. This is one of our body's health defense systems in order to keep everything fed and healthy, not overfed.
- Dr. Li: We don't want to actually overfeed systems. That can actually provoke diseases like cancer. If there's too much overage you can actually have bleeding and cause problems like blindness. If you have too few blood vessels you wind up having the opposite problem. You don't have enough grass sprouting in your lawn. You wind up having bare patches. When that happens, you're not feeding your heart, your brain, your nerves for erectile function. You can wind up having all kinds of problems like that. Angiogenesis defends us by feeding all of our cells. Too much or too few actually cause a problem so we want to keep that ... The body is hardwired to keep that circulation in perfect shape.
- Dave: We have these tiny little vessels in the body that are smaller in diameter than what a blood cell is supposed to be able to fit through, yet somehow they do it. How often does the lining of those super tiny vessels versus a big blood vessels or arteries, how often does that lining turn over?
- Dr. Li: Vascular cells line up the blood vessels. They're like the insulation but on the inside of a blood vessel. Those cells are pretty quiescent. They tend not to replicate unless they're damaged or unless they need to grow. The slowest replicating blood vessel in the body is actually in the retina, which is the blood vessels feeding the back of the eye. In fact, they tend to turn over just twice in your entire lifetime. The average lifetime, 80 years

old, they only divide twice. But other blood vessels that need more turnover, like the blood vessels in your gut for example, that's continuously regenerated, renewed. Those can turn over every couple of days. It depends on the location and how active the system actually needs to be in terms of the turnover of cells.

Dave: That's an interesting perspective. I'm still seeing the world through young eyes, most likely, which encourages me. I feel good about that. But is there something we can do to change the rate of angiogenesis? Don't you want some more blood vessels to grow, not less?

Dr. Li: That's a great question. Here's what it is with all of our health defense systems. We want just the right amount. We want just the right amount at the right time in the right location, so more is not always more. This is a typical attitude that, in a time of abundance, we tend to think that more of something is going to make us richer or healthier or wiser or better. But in terms of blood vessels you want just the right amount. Too many blood vessels can't fit physically in a certain space, so they crowd and they wind up actually becoming, because they're fragile, they can bleed and have a problem. A great example is people who are, in aging, when they have too many blood vessels in the back of the eye in an area called the macula, you get macular degeneration. Age-related macular degeneration is the most common cause of blindness over the age of-

Dave: Just too many blood vessels.

Dr. Li: That's too many blood vessels. When too many blood vessels are packed into an area like underneath the carpet of the eye, the most sensitive part, and they are really fragile, that extensive overage of blood vessels tends to leak. When they leak, think about the plumbing leaking underneath a carpet in your bathroom. You wind up soaking up that area and you wind up destroying that carpet. That's what causes blindness mostly in elderly people.

Dr. Li: We now know through some big breakthroughs that have occurred out of my field of angiogenesis that if you can start cutting off the proteins that are actually fueling those blood vessels from growing underneath the eye you can try to halt the process. In some cases, about 30% of cases, you can actually reverse vision loss to some extent. This is an example of good blood flow through most of our lives in an area of the eye that does have a lot of turnover where, when you have too many blood vessels, actually it causes a huge problem that medicine, medical doctors, are trying to revert or reverse that disease by stopping that overage.

Dr. Li: But if we started early ... My father has age-related macular degeneration and he's getting injections to try to stop it. I'm probably destined to follow his fate if I don't actually take control of my own blood vessels to try to keep those vessels in the right place in the right number at the right time for as long as I possibly can. Diet is a great way to do it.

Dave: My father also has AMD. Granted, I'm a weird biohacker and I've been talking with him for a while. He's been running a small micro TENS current across his eyes around the acupuncture points.

Dr. Li: Interesting.

Dave: Actually reversed his disease. It got smaller, which was cool. He also eats a diet that probably mirrors a lot of the compounds that we're going to talk about in a bit here. It's not like you can do just one thing. But I was blown away because you read about stuff with healthy skepticism, but he definitely saw this and his doctor too like, "Oh, it's much better than it was. What did you do?" But it's 10 minutes a day with your eyes closed.

Dr. Li: That's pretty amazing. I will say that using energy for healing has now moved beyond the woo-woo that used to be there. Really serious scientists, like I was at ... I heard a TED Talk literally about using infrared light to be able to image and then be converted to destroy brain tumors, for example. This is the kind of stuff that is ... I would say it's no longer science fiction. It's moving into the realm of science fact. What you just described is super interesting. I'm actually going to look into it myself.

Dave: The interesting thing there ... I have this book. It was like \$800. It was from the highest-ranking executive, probably the president, of the Karolinska Institute, which is where my wife, Dr. Lana, went to school. In 1984 he published this book saying, "Everything that happens in the body is electrical. But I'm publishing this on the day I'm retiring because I know that you'll probably want to take my license after I say this heretical stuff." I couldn't even understand half the book. I'm pretty good at reading medical literature. He went really deep on subcellular things. It was a compelling, shockingly well-researched, heavy-duty medical tome with this entirely different way of thinking about it. It wasn't a chemical problem. It was always electrical.

Dave: That just opened my mind. Something interesting is going on there. We barely know anything about it. But when you talk about it being a tipping point, I'm happy that you're open-minded about such things, because it feels like there are some things we can do even for blood vessels with infrared light. Have you ever played with things like ultraviolet blood irradiation or using lasers for not just ablation but to cause healing in veins and arteries? Is that real?

Dr. Li: It's something that I'm actually actively investigating now is really the power of energy. A project that is not ready for primetime yet but it's something that's actively being explored is how do you use light and then going to the other side of the wavelength how do you use sound to actually influence cellular behavior? It's real. It's there. The real question is, how much more do we need to know about it to understand how to control it and so that we can use the principles of biohacking in order to be able to get things moving in the direction that we want to? I think it's a very exciting future ahead but it's really all the secrets are inside our body. Then we can figure out what to use from the outside to actually guide and manipulate that inside stuff.

Dave: Tell me about a couple foods or supplements that are really good for having not too much and not too little angiogenesis, stuff that people can read about in your new book.

Dr. Li: A really good anti-angiogenic food is really a beverage is green tea. Everybody knows that green tea is good for you. It's an antioxidant and it does all kinds of other things. The research I've done has actually shown through the same type of laboratory assays used for drug development that you can actually stop blood vessels, the same type of blood vessels that would grow into a cancer, you can right size the vascular system, the circulation, by drinking green tea.

Dr. Li: The other thing that's really interesting about green tea, as you know that one of the big problems is obesity. A discovery that was made about 20 years ago was that tumors are abnormal cells that grow to a large size and fat, adipose tissue, are normal cells that behave abnormally and grow to a large size. Guess what? To sustain the growth of both fat and tumors, which normally stay microscopic, you need new blood vessels to bring oxygen and nutrients. This whole idea of anti-angiogenic therapy, which is delivering drugs to cut off the blood supply to tumors, is now being explored for fat. A super interesting area is using anti-angiogenic foods or foods that contain anti-angiogenic activity like tea to actually treat both tumors or to actually prevent tumors but also to lower obesity. There's some interesting work done looking at truncal obesity, which is really the belly fat, and finding that green tea can actually reduce that as well by starving those fat cells.

Dave: I have a hard time looking at angiogenesis, this ability to grow new blood vessels. If you have cardiovascular disease, your body will grow new blood vessels around a blockage. It's necessary. If you're going to put on muscles then you need to have some blood supply to the muscles.

Dr. Li: Right.

Dave: In order to regenerate and to grow and contract and shrink, we definitely need this. I've always been a little scared when someone says, "Oh, we're going to turn off angiogenesis because it might cause cancer." I'm like, what about the rest of the cells that needed blood vessels and repair that weren't cancer cells? Are we going to starve them too?

Dr. Li: You're asking the fundamental question about angiogenesis that has dogged the field from the very beginning. If you're a cardiologist looking at it you're saying, "Hey. We want blood vessels to grow into the starving heart. But we don't want cancer." If you're an oncologist or a tumor biologist you're saying, "Hey. We want to get rid of those bad blood vessels. But hey, how do we actually not cause a problem in the heart and provoke a heart attack?" It turns out that Mother Nature or evolution as the case may be was a lot smarter than we are.

Dr. Li: The trick to angiogenesis that really answers the question you've asked is that our blood vessels are continuously supported by this ecosystem of angiogenesis stimulators to help grow blood vessels where they're needed and inhibitors that naturally stop them

from growing where they're not needed. Whenever you need it in the heart or for example a wound, if you cut yourself or scrape yourself or fall off your bike you're going to see after the scab forms, if your scab ever came off early you'd see this bright red, bubbling red stuff underneath the scab. That's an eagle's eye view of angiogenesis.

Dr. Li: But guess what? When your wound heals over ... Those vessels by the way are bringing oxygen and nutrients to heal that wound. When your skin grows over that, the inhibitors of angiogenesis that are naturally in the skin take over and they shut it right back down to the normal levels. This is actually how you can actually cut off the blood supply to a tumor and prevent a cancer adding more inhibitors and overcoming the effect of the local stimulators but also for the heart how you can grow them when they're needed and when you have just the right amount the inhibitors take over and just shut the whole system back down to baseline. It's a balance.

Dave: That's cool. Now I'm going to ask you a really controversial question. You talked about the oncology view, which you've worked with. You talked about the cardiovascular view, the heart doctor versus cancer doctor. What about oral nicotine? That was one milligram of oral nicotine. It promotes angiogenesis in what seems to be a really beneficial way at low doses and prevents Alzheimer's disease according to Dr. Nicotine from Vanderbilt University who's been on the show. But, my god. You say nicotine, people freak out. We're talking about 5% of what's in a cigarette there. That's about all I'd recommend, I'd recommend for myself anyway. Nicotine. Oral. Not smoking. Good? Bad? Everyone knows smoking sucks for everything. But is there room for this as a drug for angiogenesis or anything else or not?

Dr. Li: Here's the thing that we do know about nicotine. Again, I look at the clues within the body. It turns out that our blood vessel cells have the receptor for nicotine. They've got a nicotinic acid receptor. This has been both studied by people who look at lung cancer who can tell you that if you have high levels of inhaled nicotine and there's a tumor growing ... We've got cancers growing in our body all the time. That is one of the triggers that can actually help pull the trigger on blood vessels growing to feed a lung cancer. That's not good. On the other hand, a-

Dave: Nicotine, just to be really clear for everyone listening, if you have cancer nicotine is the worst thing you could possibly do that I know of other than just jump off a cliff or something. It's really dangerous.

Dr. Li: That's absolutely the case. Now I'll tell you what's interesting is that a cardiologist ... There's a cardiologist named John Cooke at Stanford who ... He was at Stanford when he discovered this. He discovered the nicotinic acid receptor on blood vessels feeding the heart. Exactly to your point, there's been a lot of research looking at how do we actually tickle that nicotinic acid receptor for the cardiac blood vessels in order to be able to actually feed the healthy blood vessels or prompt them to actually do things that that receptor would normally do? It's a very clever way of thinking about how do we hack into this body system and tip off the vessels that are wanting to do good things, that help support the healthy functions that we want, and also to prevent that because that nicotinic acid receptor is also a target to be able to antagonize things that blood vessels that might feed a cancer as well.

Dave: That's a very nuanced view of it. What I took away from that that I want everyone listening to hear: Don't smoke. It's nasty. Vaping is also inhaled nicotine and they put the same addictive stuff in that that isn't nicotine that they also put in cigarettes. It's a bad habit to start. I just want to be super clear. If you're young and you think vaping's cool, it's better than smoking but seriously it's not good. That's not to say there isn't a role for nicotine, but you're probably using too much if you use it. I don't want to be on the record as telling people to go out and start vaping because that's bad news.

Dave: We talked a lot about this blood vessel maintenance thing and green tea is a big recommendation there. I use it in some of the supplements I formulate and I drink green tea. When I'm making a health smoothie, instead of my normal Bulletproof Coffee, I will sometimes take two ounces of brewed black coffee, throw in a bunch of horrible-tasting herbs and two big scoops of matcha with the oil and everything. I'll blend it up, hold my nose, and chug it. Then I'll drink a cup of Bulletproof afterwards to get that horrible taste out of my mouth and for pleasure. But green tea, absolutely. I love that recommendation. You talked about the hundreds of studies in the book.

Dave: Next, talk to me about regeneration. Stem cells.

Dr. Li: I'm sure when you were growing up, just like me, our grade school teachers told us that salamanders regenerate, starfish regenerate, people don't regenerate. The science now tells us that's not true. In fact, we're continuously regenerating at a pretty slow rate in most cases but in some cases, like our gut or even our hair or our skin, we're regenerating at a pretty furious pace. Some organs that we didn't think could regenerate actually do regenerate. We know the liver regenerates. You can cut off two thirds of your liver and the rest of it will grow right back as long as the rest of your body is healthy. Even the lungs, by the way, if you lop off the top of your lung, the apical part of your lung, the cap of the lung at the very tip near where your collarbone is, that part will also grow back. This is the cool thing about science is that as we continue to forge our way forward we're challenging some of these old notions, for example the body doesn't regenerate. It does. Where do stem cells live? They live everywhere.

Dave: In salamanders. Sorry.

Dr. Li: Even in salamanders. The stem cells live everywhere. They come from the inside out in humans anyway. They love to live in our bone marrow. If you've ever seen a bone, a cross-section or a bone cut in half, there's-

Dave: On Facebook there's actually a picture of my bone marrow.

Dr. Li: No kidding.

Dave: I had it taken out for stem cells.

Dr. Li: That's cool.

Dave: It's cool. It looks just like butter.

Dr. Li: You've got the hard core of the bone on the outside, then you've got this open tube, open cavity, on the inside that's filled with this buttery-like stuff. It's a lot of cells, and most of those cells are stem cells. Most of those stem cells, by the way, we were all originally made of stem cells when we were in the womb developing. We were all made out of stem cells. It's only later that those stem cells wound up differentiating or maturing into the different organs, a finger, a toe, a heart, a brain, a limb. What's interesting that we now know is that our body retains the ability to keep these stem cells around to regenerate when we need to behind the scenes in ways that we didn't even know. But you can actually prompt and stimulate this regeneration.

Dr. Li: By the way, I've been one of the people in the early days working on stem cell therapy. You take out cells from your bone marrow, or you can immobilize them in your bloodstream, you remove them, you concentrate them or help them grow by giving them some natural fertilizer, usually proteins that stimulate their robustness and their numbers. They're being used to inject back into different tissues, whether it's a joint, whether it's a muscle. There are clinical trials now that are quite amazing to deliver stem cells to the heart. I've also heard of a clinical trial giving stem cells to young kids with autism. The preliminary findings is that you're actually able to get these early undifferentiated cells, that could be anything, and they reboot the brain to reverse even autism.

Dave: There's so much legitimacy there. I've done several episodes on it. I've probably had the most stem cells introduced into my body in a single instance of anyone on the planet. I did a four-hour procedure with three doctors where they took a whole bunch of stem cells, half a liter of bone marrow and fat-derived, and put them in every joint in my body and did them with a, what do they call it, a canula inside the spine along the spinal sheath and into the cerebrospinal fluid. I've had V cells pulled out of my blood and activated, which are pluripotent, and put back in. I got to tell you, there's some stuff that works there.

Dave: Another family member went in for just a fat ... a very basic procedure intravenously, not planning to treat the valve defect or damage that was going to necessitate surgery. He was just doing it for wellness. When he went in for the scan before the surgery they said, "Your problem's gone. What happened?" He said, "I think it was the stem cells." They said, "Nah. It wasn't the stem cells." He said, "Okay. It was a miracle. It was a unicorn that did it." Whatever it is, there's something going on.

Dave: I'm younger. I'm more resilient on all sorts of different ways. I sleep like I would have when I was 20 if I knew how to sleep when I was 20. I'm with you there. But most people, still it's a \$5,000-and-up procedure. What do people do in your book with food or with lifestyle to get more stem cells without having to do that crazy stuff I just did? That was at the Docere Medical Clinic in Park City where I did it. Actually it was some of that. The other stuff was at Bio Reset. Where do I go on my plate to get at even 5% of those benefits for no additional money?

Dr. Li: Listen. This is the remarkable thing. Until recently we were always focused on stem cells that we would remove from our body, inject back in. I'd love to hear more about your experiences because that's fascinating that you did this. It's really amazing to think

about what the positive effects might be in terms of rebooting your system. But I can tell you the other thing that's really amazing is that we were using the same systems that stem cell therapy developers have been using to test the process, the proof of concept, for years. Now we're actually studying the impact of food and diet.

Dr. Li: For example, they probably, Dave, measured your baseline stem cells somewhere just to get an idea of how many were around. Then, after they removed your stem cells, they were able to count them. This is one way to monitor the number of stem cells in our bloodstream. This is classic regenerative medicine therapy stuff that biotech companies are doing. What's really amazing is now dietary interventions are being explored to see what actually happens. The most surprising thing that I found was that foods can actually do much of the same things that stem cells do. A great example is chocolate, specifically dark chocolate, specifically cacao.

Dr. Li: The study was done at UCSF, very credible medical center, looking at older men who had cardiovascular disease. These are people who we know have crappy, worn-out blood vessels. They have the problem and they need to reverse it. They need to improve their blood flow. There was an intervention study where they studied these men over 30 days. They drew their blood at the very beginning on day zero, counted out their stem cells just to figure out how many were floating around. Usually men with cardiovascular disease have smaller numbers of stem cells. We know in fact that the fewer that you have the more likely you're going to wind up having a fatal cardiovascular event a year later as you get older. Then they gave them an intervention. The intervention is hot cocoa, in this case hot chocolate made with really dark, high-flavanol chocolate, 70% or more. Then they drank this just twice a day, so two eight-ounce cups of hot chocolate twice a day.

Dave: Probably with sugar in it too, which is not good for stem cells. But it's okay. It still worked.

Dr. Li: In this case I think the emphasis was on spiking the high-flavanol chocolate. Listen, I don't know if you've ever had really, really dark chocolate, but you can actually put other things into the chocolate that's not sugar to actually make it palatable.

Dave: Bulletproof has a 78% dark single-estate, high-origin with a little bit of Brain Octane in it as well as zero sugar. We use a proprietary xylitol process. It actually tastes like chocolate people would want to eat. Most zero-sugar chocolate is kind of crystalline and weird. But it's powerful. Imminent Mars makes a supplement which is the flavonoids from cocoa which has really good clinical studies behind it. You got to take four fat pills a day, and I like to eat my chocolate. It seems like there's great evidence here. You're saying to improve that stem cell function there you might want to look at eating some chocolate.

Dr. Li: Right. Dark chocolate specifically. What they found in this research is it doubled the number of stem cells in your circulation in a single individual. Basically over time, wherever you started at day zero, you had up to a doubling of the number of stem cells. Then the question is who cares? The skeptics will say, "That's fine. You get more cells in your bloodstream." Then they did this test, a classic medical test called flow-mediated

dilation. I don't know if you know about this but basically it's the equivalent of putting a blood pressure cuff around your arm and pumping it up and so you're cutting off ... You're squeezing the blood flow down. You want to see how resilient your blood vessels are. That's what stem cells do. They make your vessels more resilient. They make your body more resilient. Then they let go the blood pressure cuff and they just measure how fast the blood jets back into the bottom, the lower part of your, the rest of your arm.

Dr. Li: People who ate these high-flavonol chocolate who had a doubling of stem cells also had a doubling of their resiliency of blood flow in their arms as well with this flow-mediated dilation. That's pretty much a proof of concept. That's quite remarkable that the stem cells were the response to eating chocolate.

Dave: Before we go into the next one of these five defenses from your book, I want to ask about hypoxia. In the research for my anti-aging book that's coming out here pretty soon, it turns out the stem cell niches in the body where they're created the most have very low oxygen levels compared to the rest of the body. When we culture stem cells we do it under low-oxygen environments because having the normal amount of oxygen in the blood actually inhibits stem cell growth. Do you think there's any validity to some of these breathing exercises that introduce brief hypoxia or I have a piece of gear from Upgrade Labs. It's a \$100,000 plus thing that intermittently induces hypoxia by changing the air pressure. Essentially it takes you to the top of Everest and back down on a 20-second basis. But they have studies that show stem cells increase as a result. Should we all be holding our breath every now and then to increase our stem cells, or is the jury still out on that?

Dr. Li: I think that the jury may be out on the actual breath holding part. But I'll tell you some research that actually supports exactly what you're saying. If you are a deep sea diver and you wind up actually coming up too quickly to the surface you'll get decompression sickness, the bends, and they stick you into a hyperbaric chamber. It was developed by the Navy in the old days to really try to reset and change the levels of oxygen and carbon dioxide in your bloodstream. Long story short is that these hyperbaric chambers can exist. You can turn up or turn down the level of oxygen. People going into hyperbaric chambers ... I read that Michael Jackson actually slept in a hyperbaric chamber.

Dave: If we were broadcasting video, do you see that back there? That's my hyperbaric chamber.

Dr. Li: Cool.

Dave: I just turned my camera.

Dr. Li: That's amazing you have one. Let me tell you what the research that's been done. People who have terrible wounds that are not healing, chronic wounds, this could be from a burn, it could be from cardiovascular disease, really ischemic, or it could be from diabetes.

Dave: Just post-surgery.

Dr. Li: Or post-surgery. People have trouble healing for whatever reason. We can actually stick them into a hyperbaric chamber. It's called HBO therapy, hyperbaric therapy. It used to be we thought that what we were doing by increasing the oxygen level in the HBO chamber, we're just giving a lot of oxygen back to you. Your body is actually helpful. You've got to do repeat dives, what they call, putting you in the chamber on high oxygen. Then people get better. Their wounds heal. They feel better. Et cetera, et cetera.

Dr. Li: But what the research is now showing is something that's totally counterintuitive. I know you're going to appreciate this. That the high levels of oxygen are important but in fact it's the period between dives that actually is a relative hypoxia. You go into the chamber. The chamber makes your body feel like it's ... It wants to crave that high oxygen level. It loves it. But then what happens is that when you come out of the chamber back to normal sea level your body then suddenly goes, "Oh my god. I'm hypoxic compared to what I was doing in the chamber." In that hypoxic state you're turning on all kinds of signals. Then you get back in the chamber, it goes back up, resets your body, you come back out. It actually gives you relative hypoxia. What's interesting is that the time in the chamber is good for you for that period but the time outside of that chamber is also beneficial from a stem cell perspective.

Dave: That's blowing my mind. Another piece of tech that I use at labs and just here, it's downstairs, it's called intermittent hypoxic training. You're actually on a bicycle breathing air that's had the oxygen scrubbed out until you drop your blood oxygen levels down to about 87, then you breathe 100% pure oxygen. You're getting a wave of strong oxygen followed by hypoxia followed by strong oxygen. It profoundly improves mitochondrial function. But there's something called HIF, hypoxia-inducible factor, that seems to be a magic thing in the body, maybe as important as heat shock protein from saunas. I think the science is just coming out on that. But as someone who studies angiogenesis I imagine you've probably come across this in your research. Is there any food for that other than chocolate?

Dr. Li: The research on angiogenesis has really given us some amazing information about this hypoxia-inducible factor alpha or HIF 1 alpha. It's really a powerful signal for angiogenesis or blood vessel growth because when your organs are starved or need more oxygen HIF is sent out like a distress call to get something to happen to bring better blood flow. HIF is released like a distress. It activates the blood vessel cells that are normally kind of quiet around it. They start to wake up and jump into action. One of the things they say is that, "Hey, let's start dividing and let's start dissolving holes in the blood vessel walls nearby and let's start sending out the troops," and they'll start sprouting blood vessels towards the source of the HIF.

Dr. Li: What's really interesting is that HIF is not only an important way to get blood vessels to grow towards the tissues that need them. We also know that HIF is also one of those tricky signals that cancer cells have figured out how to hijack. It's like getting a terrorist into an airplane cockpit and they can take those same controls. Tumors can actually also use HIF selfishly to grow blood vessels towards themselves.

Dave: They create something called pseudo-hypoxia which oftentimes creates those muscle knots when you get that localized inflammation.

Dr. Li: Exactly.

Dave: But they're using that to tell the body, "There's no oxygen here. I guess you should send more blood vessels." Then they're like, "Ha ha. I got that blood."

Dr. Li: Exactly.

Dave: Good way of looking at it?

Dr. Li: Yeah. Absolutely.

Dave: The non-medical degree way of looking at HIF, in case any of you non-doctors listening, I'm sure there's three of you. That will do it. I'm fascinated by all this stuff and you're encouraging me to, even though we don't have studies yet, to hold my breath more often, but not to be in hypoxia all the time. Maybe tons of oxygen sometimes and no oxygen other times.

Dr. Li: I'll tell you another good dimension of breath holding is that you're actually inviting your lungs to absorb all the oxygen you possibly can. You're getting a more efficient extraction. You're really figuring out how to get all that ... Basically in your lungs your blood cells are loaded with oxygen and ready to absorb carbon dioxide as an exchange. Most people take shallow breaths. You barely give a chance to your blood cells to do that exchange. Your lung is always half working. It's like a stretching exercise. Here when you hold your breath you're forcing your lung to do all it can do. It really keeps your lungs in good shape. That's one way to actually keep your metabolic extraction of oxygen and your metabolic absorption of carbon dioxide really optimized. That's one good reason to be doing what you're doing.

Dave: That's getting me to continue on my practice. We'll put it that way. Next up, another thing in your book. You talk about the immune system and something called innate immunity and controlling inflammation. Long-term listeners understand that inflammation is at the root of almost everything bad that happens, those four big things that will kill you we talked about earlier on. Inflammation underlies them all. What is the role of innate immunity in your book at controlling inflammation and what do we eat or do so our innate immune systems work well?

Dr. Li: Inflammation is in the public's mind a bad thing. In fact, too much inflammation ... Every chronic disease that's out there is associated with inflammation, whether you're talking about obesity, diabetes, Alzheimer's, you name it, you've got inflammation. How do you think about inflammation beyond a term? Think about it as healthy tissues and organs that are in distress and your body's response is to try to help clean it up, help clean it up. Instead, the cells that come in actually set things on fire. One of the problems is that inflammation is like your own body, your own immune system, going in there and

pouring gasoline around the place and setting the whole house on fire. That's really chronic inflammation and it's associated with every chronic disease.

Dr. Li: But I do want to actually give you some counterintuitive way of thinking about inflammation which is why it occurs in the first place. Our body is hardwired again to protect itself. One of the things, if you cut yourself, if you have an injury, if you have a wound, one of the things that the body is expecting is that you're going to get some debris or bacteria or contamination. A slip on a hill when you're doing a hike and you're going to scrape yourself and maybe have a little bleeding and some dirt gets on there. Some bacteria are going to get in there. The body's hardwired defense system, your innate immunity, sends out immune cells to really create a little bit of inflammation to kill those bacteria, and then it's supposed to go away. What happens in the disease state is that it doesn't go away. It just keeps on getting there and it doesn't go away. That's when it is they start ... It's like a frat party where people get drunk and start dousing the whole place with gasoline and setting things on fire.

Dr. Li: Let me tell you one of the things that actually is very important for downturning chronic inflammation which you can see in autoimmune diseases for example. That's a great example where you wind up having super inflammation. Lupus. Rheumatoid arthritis. Psoriasis. There's a whole family of these really, really devastating diseases is you can turn down or calm inflammation using things like vitamin C. Foods that contain vitamin C have been studied in Japan in the Miyagi Prefecture they took a look at women who had lupus and they wanted to figure out, "Okay, if the women actually are those who are actually having more lupus flares versus women that have less lupus." They actually have a lupus center there where it's like a hive of women that are getting medical care all with lupus. They found the ones who actually had fewer flares of lupus and less inflammation in their bodies are the ones who ate foods containing more and more vitamin C.

Dr. Li: This is where it gets tricky. You could take vitamin C as a supplement. You get pure vitamin C. You can get vitamin C from a lot of citrus fruits, but then you got to be careful of the source of the citrus and what part you're eating and how you're getting it into your system. Vitamin C is one of the really powerful anti-inflammatory foods that you can actually have.

Dr. Li: Another approach to lowering inflammation is really the judicious intake of the Mediterranean Diet. There's food patterns that are helpful as well. But in this case it's not more is more. It's really just having a generally healthier diet and trying to stay away from pro-inflammatory foods as being very important.

Dave: Avoiding the bad is more important than eating perfectly.

Dr. Li: Exactly. I think, listen, when you've got a chronic inflammatory condition, the inflammation is really a side effect of the underlying problem itself. What you want to do is to really try to stay away from things that you know will exacerbate it.

Dave: If you had a choice between eating a plate full of French fries made in the worst quality oil that's been used for a while in a fryer, instead of nice polyunsaturated omega-6s, or smoking one organic cigarette, which would you do?

Dr. Li: Wow. That's like would you rather die in a volcano or be eaten by sharks? Honestly, I would say, if you're asking me personally, I would say because I know that I eat foods that boost my health defense systems and I happen to actually have done a ton of work on tumor biology, I would be more fearful of the cigarette, honestly, because I know that one puff of tobacco ... One pack of cigarette smoke can take a decade for your lung to actually regenerate itself enough to overcome the harm from that. Honestly, everybody every now and then eats something crappy. It doesn't have to be French fries fried in bad stuff. It could be a lot of different things and junk foods that are out there. I would say ... Here's how I think about it, Dave. What am I more likely to recover from and not succumb to?

Dave: You're worried about addiction there. In that case that makes sense. I've asked a few other experts in functional nutrition and more often than not they'll actually say, "This sounds ridiculous but the cigarette's going to create inflammation for eight hours and that big plate of fried stuff is a good 24 to 48 hours of inflammation." But if you look at it from a lung biology versus overall systems inflammation either answer is true. They're both pretty poor choices.

Dr. Li: Not only that, but you can then, after your plate of fries, you can then embark on a course of ... If mostly what you're eating are anti-inflammatory foods, you're resetting and trying to rebalance yourself. Whereas once you've actually inhaled that cigarette you're really there's really no going back until that lung lining is turned over.

Dave: You probably inhale some glutathione and whatever else. They're both pretty poor. You might be able to drink a few swigs of fish oil and take some lipid antioxidants and get through it. But the bottom line is, if you want to live a long time and feel really good, really doing either one of those just once a week on your special day is probably not a good strategy.

Dr. Li: You're bringing up something really interesting, which is, you pitched this to me as the volcano or the shark. But there's a hell of a lot of people out there that are actually eating fries and smoking a cigarette every day.

Dave: They've got one leg in the volcano and the other leg in the shark water going, "Look at me. Look at me."

Dr. Li: Exactly. That's a great way to put it.

Dave: In your book you teach people not to do that for sure. This idea of innate immunity is important. Is there anything you recommend in your book around food besides the vitamin C and flavonoids that might be beneficial for reducing plaques or reducing that outcome of innate immunity?

Dr. Li: I'm a systems biology thinker and I work in this area on the research level. You talk about amyloid, which most people associate with Alzheimer's disease. In the Alzheimer's brain you wind up having these god-awful plaques that gum up your brain. People with Alzheimer's have a lot of it and it's very pro-inflammatory, as you point out. In 2003 I published a thought-leading article in the Lancet, which is a British ... a famous British medical journal, pointing out that angiogenesis and inflammation is linked to the amyloid plaque in the Alzheimer's brain. Here's how inflammation and angiogenesis and this gumming up our systems biology are problems that actually work together.

Dr. Li: Now, you would say, "How does that make sense?" In Alzheimer's you don't have good circulation. You've got bad circulation. Right. It turns out that in ... We know that the Alzheimer's brain tends to be hypoxic. We know that there's inflammation that is drawn by this pseudo-injury in the brain. We don't know everything about Alzheimer's. This is what we do know. We know that hypoxia will attract angiogenesis like it will grow blood vessels to try to restore healing. But guess what? For reasons we don't really understand in the Alzheimer's brain those angiogenic blood vessels form but they don't actually deliver oxygen or nutrients. In fact, what they do unfortunately is the endothelial cells, those vascular cells that are forming in the blood vessels in the Alzheimer's brain, they deliver the precursor to the amyloid plaque.

Dr. Li: In fact, what I pointed out in my article is that if you look, go back to the 1904 original article by Dr. Alois Alzheimer, which is written in German so you've got to use Google Translate to get this, you'll find out that the man himself, Dr. Alzheimer, noticed that there was abnormal angiogenesis and inflammation next to the plaques in the woman whose brain he first observed this in.

Dave: Wow.

Dr. Li: Nothing good exists alone. The same point, nothing bad exists alone. This is why systems biology, that you're all over, is really so important to think about.

Dave: What a fantastic reference. I had no idea about that but it makes so much sense. Keeping that blood vessel or the blood vessel lining in the blood vessels themselves healthy is part of avoiding Alzheimer's and all the other plaques too. You talk about people living a long time, which is awesome because my next question for you is, you know more than the average person about death because you're a doctor and you have a license to kill and you've been studying this at a level beyond most humans. How long are you going to live?

Dr. Li: This is a great question. How long am I going to live is partly dependent on genetics. I can tell just I'll give you some facts. My great uncle lived to 104. Independent. Very healthy until the very end.

Dave: Did he smoke?

Dr. Li: He did not smoke. He may have smoked actually when he was much, much, much younger. But definitely didn't smoke later in his life. I know that for a fact. I'll tell you

what he did do every day. He lived outside of Shanghai in a little village at the base of a mountain that grows tea.

Dave: Nice.

Dr. Li: He hiked, so he was physically active, every day. He'd get up at 4:00 in the morning. He would hike up this little stone path up to a tea garden and he would sit there and watch the sunrise drinking tea. He probably had, I don't know, 10 cups of tea a day, green tea. Fresh, organic.

Dave: Circadian biology plus green tea. That's a powerful thing.

Dr. Li: You got it. And he ate a mostly plant-based diet. He ate a lot of good stuff from Asia.

Dave: 104 is your floor. Where are you going to end up?

Dr. Li: If we can actually properly hack into our stem cells, our circulation, our microbiome ... By the way, I think that one of the things that I worry the most about I think in health in general is how we can right size our microbiome because that 39 trillion bacteria that live inside us communicate to our immune system which we know is critical for inflammation. Tipped in the wrong way, our bacteria in our body actually will make us more likely to be pro-inflammatory and lower our immunity against diseases like cancer. Then, on the other hand, we barely know anything about our microbiome. We know that there are just about as many bugs in our body as our human cells. Maybe a few more. But there's 20 times more bacterial DNA that's in there. We don't understand ... Think about how the environment and toxins can influence that.

Dr. Li: I worry about that because if we can really hack into our microbiome ... We know foods for example like that are fermented like kimchi and sauerkraut actually can be very helpful for introducing diversity. I think that's one area that for everybody, myself included, that we can work a little harder on. We need to raise the bar in our microbiome. Our knowledge is still fairly elementary compared to some other areas that we've talked about today. That's something that we should be doing more of, like yogurt, kimchi, sauerkraut, figuring out how to actually leverage natural bacteria, prebiotic foods, fibers from plants. That's probably something that'll help us live longer in ways that we have not yet predicted.

Dave: We're in super alignment there. I'm an advisor and investor in a company called Viome that's really helping to crack the code on the activity of what's in the gut. I've managed to take my gut species from 48 to 196 by changing some of the things that I do in my diet. One of the new supplements or prebiotics that we're coming out with at Bulletproof, I've been testing it for a while. I think we got there, because I poop like a superhero.

Dr. Li: I'll tell you how powerful we know the microbiome can be. A couple years ago there was a cancer conference that I helped to convene in Paris. It was called Rethinking Cancer. The premise was very simple: What happens if you have a state-of-the-art cancer

research conference but you remove any mention of chemotherapy and surgery and radiation, but you still have the top people there? What topics do you have on your agenda? You have diet. You've got microbiome. You got inflammation. You got sleep. You got all kinds of the important things that people actually contend with that the medical community generally ignores.

Dr. Li: One area that we did talk about is the intersection of how the immune system works, because we know that immunotherapy can be a life-saving, game-changer in people who are given new treatments for cancer that don't kill cancer cells but really rip off the camouflage that cancer cells use to hide from your immune system, because our immune system is always conducting surveillance and they're like our strike force if there was a cancer in there normally. But cancers do grow in people, and so now immune therapies help the immune system to go after the cancers. However, some people don't respond. In fact, really most people don't respond. Only about 20% of the people have a good response, a curative response to immune therapy, maybe even less than 20%. We don't know why.

Dr. Li: At this meeting there was this embargoed presentation because it was about to be presented and published in the journal Science, which you cited earlier. It turns out that they looked at 200 patients with various cancers that were treated with immune therapy and they divided them into the people who responded well to immune therapy, meaning their cancers got smaller and some of them got cured, versus people that actually didn't respond, meaning that the drug didn't work, the cancer didn't respond, the immune system was a dud in that case. They didn't do well and most of them died. Life. Death. Respond. Non-responder. We don't know the difference.

Dr. Li: They hacked into the stool and found that one of the big differences, maybe one of the only differences, was whether or not there was one bacteria that stood out as being present in the responders and absent in the non-responders. That's a profound thing that one bacteria could actually be not a smoking gun but in this case like a brilliant ray of light. You need this bacteria. It's called Akkermansia muciniphila. It's a bacteria that was only discovered in the 1990s, so it's not like the old microbiologists going back into the 1900s didn't know about this. This is called Akkermansia. It grows in the gut. It loves to live in the mucus lining that we naturally have in our gut. By the way, it is easily killed by antibiotics. Cancer patients are getting antibiotics all the time. You cannot eat a probiotic that will grow this bacteria back right now. There's no Akkermansia probiotic.

Dr. Li: The only way you can actually grow it back, and I write about this in my book, is pomegranate juice has been shown to grow it, help the gut grow it, because it helps to restore the mucus lining. Cranberries seem to do it as well.

Dave: Is it the mannose. Is it the sugars in there? Or is it the polyphenols? I use pomegranate polyphenols.

Dr. Li: We think it's the polyphenols actually.

Dave: They're in my Polyphenomenal formula because there's all kinds of reasons to take pomegranate polyphenols. But the sugar in there is a bit ... It's just super sweet.

Dr. Li: That's what we need to know is figuring out what is the mechanism within the pomegranate, for example? Because we can actually regrow that gut lining and have that healthy gut bacteria grow back. That could make the difference between life and death. Here's another way that this type of research that shows that the microbiome activated by polyphenols could actually help to activate the immune system in such a way that if you were facing the precipice of death and getting an immune therapy it could make the difference between whether you make it or not.

Dave: I love it. It's really cutting-edge that you mention that in your book. The only other guy who's on top of that is Dr. Gundry also mentions the same species as just being so important. It's why polyphenols in general are really important. They're a big part of my Headstrong recommendations even more so than Bulletproof Diet. We know now broad spectrum is important. Getting lots of different ones. Like you said, green tea is a great source. Chocolate. Of course you and I both know what my favorite one would be, which would be coffee. But there's every vegetable, every weird thing that grows that doesn't make you have GI disturbances probably have probably has polyphenols. You want them.

Dave: You did however very successfully dodge naming a number. 104 was your floor, Dr. Li.

Dr. Li: I would say, if 104 is my floor, I would at this time that we're recording this I would give maybe 120 I would say.

Dave: 120.

Dr. Li: That would be my goal.

Dave: You think you might get some advantage over ... This was your grandfather?

Dr. Li: My great uncle.

Dave: Your great uncle. You're going to get some advantage over him from all the science that you're doing and all of your colleagues and all that. It's going to give you an advantage.

Dr. Li: I certainly hope so. I think that I'm somebody who navigates my life biohacking with the knowledge that I have. Wherever I go, when I shop in the market, when I prepare my food, when I go out to eat, when I look at the menu, literally it's like what the Terminator showed on the screen, this computer screen that goes up and lights up. I literally use the knowledge I have to try to make the most intelligent choices, and actually those choices change over time. I want to have diversity in my diet but I want to make sure I'm avoiding bad things and eating more good things. Then I follow the science. I follow what's coming out. I try to figure out what I can do. Of course it's not just diet. You got to get enough sleep. You have to stay physically active. You got to have good social networks. All those things are important.

Dr. Li: I think it'll be really hard to replicate the relative ... the small village, small town feel in rural China at the base of a tea mountain. We all should be aspiring to that. That's really this empowerment, using the knowledge to give us the power to be able to help ourselves.

Dave: Beautiful. Dr. William Li, thank you for writing your book, Eat To Beat Disease. It's got new stuff in there that's worth people's time to read. Your website is drwilliamli, D-R-W-I-L-L-I-A-M-L-I, dot com. I know you're giving away a bunch of stuff because you just wrote your book, so if people go to your website they'll get all sorts of free downloads and all the good stuff that authors do these days, unless you're lazy like me in which case you probably just had a PDF or something. You did a great job on that. Thanks for sharing this knowledge and just going out there as a researcher. I understand that any time you go out there and say, "Food makes a difference," you're taking some professional risks there. But the science is behind you and I think you're doing the right thing, so thank you.

Dr. Li: Thanks, Dave. Thanks for having me on. It's always a pleasure to speak to a fellow systems biology thinker.

Dave: Have a beautiful day.

Dr. Li: You too. Bye-bye now.

Dave: Bye.

Dave: If you liked today's show, you know what to do. Head on over to your favorite book seller and pick up a copy of Eat To Beat Disease. If that's something that you'd like to do, there is new learning for you in there. If you like the book and if you liked any of the things like game-changers based on the show or Headstrong or anything and you haven't had a chance to review it, if you go to the trouble of buying a book and reading it and you think it was a good book, tell us authors just by leaving a quick review. You'd be amazed what a difference it makes. Take the extra 20 seconds to express gratitude. It is clinically shown that expressing gratitude makes your life longer, so we're offering you the opportunity to be grateful for great books to help you live longer. How's that for twisting things around? Have a beautiful day.